ACT Geotechnical Engineers Pty Ltd
ACN 063 673 530

5/9 Beaconsfield Street, Fyshwick, ACT,2609
PO Box 9225, Deakin, ACT, 2600
Ph: (02) 6285 1547
Fax: (02) 6285 1861

23 August 2023
Our ref: SW/C14423

Kirana Bathurst Pty Ltd
c/- Allera
Via email: Stuart Allen

Attention: Stuart@Allera.com.au

PROPOSED MIXED-USE DEVELOPMENT - 50 BUSBY STREET, SOUTH BATHURST, NSW

GEOTECHNICAL INVESTIGATION REPORT

We are pleased to present our geotechnical investigation for the proposed mixed-use development at 50 Busby St in South Bathurst, NSW.

The report outlines the methods and results of exploration, describes site subsurface conditions and provides recommendations for building footing design, excavation conditions, preparation of subgrades, stability of cut and fill batters, provides indicative design CBR values, and site drainage advice.

Should you require any further information regarding this report, please do not hesitate to contact our office.

Yours faithfully,
ACT Geotechnical Engineers Pty Ltd

Stephanie Wilson
Geotechnical Engineer
B.Eng (Hons) (Civil)

Reviewed by:

Jeremy Murray
Senior Geotechnical Engineer | Director
FIEAust CPEng Eng Exec NER RPEQ APEC Engineer IntPE(Aust)
Registered Professional Engineer of Queensland (RPEQ) #19719
NSW Professional Engineer Registration #PRE0001487

ROPOSED MIXED-USE DEVELOPMENT - 50 BUSBY STREET, SOUTH BATHURST, NSW

GEOTECHNICAL INVESTIGATION REPORT

AUGUST 2023

ROPOSED MIXED-USE DEVELOPMENT - 50 BUSBY STREET, SOUTH BATHURST, NSW

GEOTECHNICAL INVESTIGATION REPORT

TABLE OF CONTENTS

ROPOSED MIXED-USE DEVELOPMENT - 50 BUSBY STREET,
SOUTH BATHURST, NSW

GEOTECHNICAL INVESTIGATION REPORT

1 INTRODUCTION

At the request of the client, ACT Geotechnical Engineers Pty Ltd carried out a geotechnical for the proposed mixed-use development at 50 Busby Street, South Bathurst, NSW. It is understood that the project involves could comprise of medium density townhouses and apartments.

The aim of the investigation was to:

(i) Identify subsurface conditions including the extent and nature of any fill materials, soil strata, bedrock type and depth, and groundwater presence.

(ii) Advise on excavation conditions and suitability of excavated material for use as structural fill.

(iii) Provide site classification to AS2870 "Residential Slabs & Footings".

(iv) Advise on suitable footings systems, founding depths, allowable bearing pressures and design parameters for ground slabs.

(v) Provide guidelines for construction of controlled fill platforms.

(vi) Advise on stable batter slopes and retaining wall design parameters.

(vii) Provide subgrade CBR value(s) for pavement design.

(viii) Drainage and other geotechnical advice.

2 SITE DESCRIPTION & GEOLOGY

The 11,726m^2 site is located at the top of a hill and the ground surface dips moderately north, south, and west. Cut to fill works could be required. Figure 1 shows the site locality while, Figure 2 is a recent aerial photograph showing the present site layout and shows the locations of the boreholes.

Local geology maps indicate the site to be underlain by Carboniferous age Bathurst Granite bedrock, which includes coarse-grained porphyritic biotite granite.

3 INVESTIGATION METHODS

To establish the subsurface conditions, an Isuzu drill rig was used to drill boreholes, designated BH1 to BH5, on 19 July 2023. The boreholes were terminated in weathered bedrock at the target depth of 5m. The subsurface profiles were logged in general accordance with AS1726-2017. The locations of the boreholes are shown on Figure 2, and the detailed logs are included in Appendix A.

Definitions of geotechnical engineering terms used in the report on the borehole logs, including a copy of the USCS chart, are provided in Appendix C.

.

4 INVESTIGATION RESULTS

4.1 Subsurface Conditions

The subsurface conditions of the proposed development were investigated by five (5) Boreholes designated BH01 to BH5. The excavation logs in Appendix A can be referred to for more detail. The investigation boreholes found the subsurface profile to comprise:

Table 1: Subsurface Conditions

Geological Profile	Typical Depth Interval	Description
TOPSOIL/FILL	0m-0.3/1m	Sandy gravelly CLAY; brown, low - medium plasticity clay, fine to coarse sands, angular gravels, moist Silty SAND; dark brown/black, fine to coarse sands, some angular gravels, loose moist
RESIDUAL SOILS	0.6/1.3m-0.9/2.5m	Sandy gravelly CLAY; Medium to high plasticity clay, pl=w, fine to coarse sands, angular gravels
BEDROCK	Below 0.8/2.5m	Extremely Weathered GRANITE: excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry, very dense

Table 2 – Depths of Fill, Bedrock and Auger Refusal in Boreholes

Borehole No.	Depth of Topsoil/Fill (m)	Depth to HW Bedrock (m)	Depth to Refusal (m)
BH1	0.3m	2.5m	No refusal, target depth reached
BH2	0.8m	0.8m	No refusal, target depth reached
BH3	1m	1m	No refusal, target depth reached
BH4	0.6m	0.9m	No refusal, target depth reached
BH5	1m	1.3m	No refusal, target depth reached

4 Groundwater

Groundwater was not encountered in the investigation boreholes, and the permanent groundwater table is not expected to be present within 5m depth of existing surface levels. However, perched groundwater may be present at shallower depth within the more pervious soils, but seepage flows rates are expected to be relatively low.

4.3 Laboratory Testing

Subgrade materials were tested for Emerson dispersion testing, salinity testing, Spocas and Asbestos. Results are summarized in the tables below. Certificates of Analysis are included in Appendix C.

4.3.1 Asbestos Testing Results

Asbestos	
Sample No.	**BH03**
Asbestos Detected	Nil defected
Asbestos (Trace)	Nil defected
Asbestos Type	
Synthetic Mineral Fibre	Nil defected
Organic Fibre	Nil defected

No Asbestos was detected.

4.3.2 Emerson Class Results

Emerson Class Number	
Sample No.	**BH03**
Emerson Class	2

Class 2 indicates showed signs of dispersion, so the soils are assessed as dispersive.

4.3.3 Salinity & Electrical Conductivity Results

Salinity & Electrical Conductivity Analysis	
Sample No.	**BH03**
Electrical Conductivity	0.02 dS/m

Soils with dS/m less than 0.2 are considered non saline.

4.3.4 Sulphate Content Results

sPOCAS Analysis	
Sample No. & Depth	**BH03**
pH_{KCl} (before oxidation)	6.6
pH_{OX} (after oxidation)	8.0
Total Actual Acidity (mol H^+/tonne)	<2
Total Potential Acidity (mol H^+/tonne)	<2
Total Sulphuric Acidity (mol H^+/tonne)	<2
Sulphar Trail S_{pos} (%w/w)	<0.02
a-Net Acidity (mol H^+/tonne)	<10
Limiting Rate (kg $CaCO_3$/tonne)	<1

The Spocas test results show that there is no presence of sulphidic material, and acid sulphate soils are not present.

5 DISCUSSION & RECOMMENDATIONS

5.1 Site Classification

Due to the presence of uncontrolled fill materials exceeding 0.4m depth, the site is designated as a Class "P" (problem) site in accordance with AS2870. If the fill is removed, or if footings are founded in the residual soil below the fill, a moderately reactive in terms of potential shrink-swell movements that may occur due to seasonal ground moisture changes. The characteristic ground surface movement "Ys", as defined by AS2870 for the range of extreme dry to extreme wet moisture conditions is estimated to be between 30mm and 40mm. The site would be a Class "M" (moderately reactive).

Should earthworks (cut or fill) be undertaken on the site, or other activities which may cause abnormal moisture conditions to impact the soils within or near the building envelope beyond those addressed herein, the site classification shall be reassessed.

5.2 Building Footings

As the site has been classified as Class P, footing design shall be undertaken in accordance with engineering principles, based upon the requirements on AS2870 (Reference 2) and the characteristic ground surface movement estimate of 20mm to 40mm.

For structures founded at existing grade, footings, including thickened sections of slabs forming footings should be founded below any topsoil or uncontrolled fill soils. A suitable founding depth of ~0.6m/1.0m is expected. Shallow footings could be founded in newly placed controlled fill following removal of any uncontrolled fill material (see Section 5.6). Alternatively, footings could be founded on piles (bored piers, screw piles, driven piles, etc.) extending to alluvial/residual soil or weathered bedrock.

If designing footings based on engineering principles, recommended allowable end-bearing pressures for various footing systems and likely foundation materials are provided in Table 3.

TABLE 3
Recommended Allowable End-Bearing Pressures for Footings

Foundation Material Type	Depth Below Existing Surface Level	Allowable End-Bearing Pressure			Allowable Shaft Adhesion on Bored Piers	
		Strips	Pads	Piles	Downward Loading	Uplift
Existing uncontrolled fill	~0.3m/1.0m	50kPa	60kPa	N.A	N.A	N.A
Newly placed controlled fill (Section 5.6)	-	100kPa	125kPa	N.A	N.A	N.A
Stiff to Very Stiff & Dense to Medium Dense Residual Soils	Below 0.6m/1.3m (See Table 2)	125kPa	150kPa	200kPa	20kPa	10kPa
XW Bedrock	Below 0.8/2.5m (See Table 2)	500kPa	750kPa	1000kPa	100kPa	50kPa

Ground slabs can be constructed on the natural soils or newly placed controlled fill, following the removal of any topsoil and uncontrolled fill material. Following excavation to required level, slab areas on soil should be proof-rolled by a pad foot roller to check for any weak, wet or deforming soils that may require replacement. Suitable replacement fill should be compacted in not thicker than 150mm layers to not less than 95%ModMDD.

If required for design of ground slabs, a modulus of subgrade reaction of 50kPa/mm can be assumed for a natural soil or controlled fill foundation.

5.3 Excavation Conditions & Use of Excavated Material

The existing fill, soils and XW bedrock are readily diggable by backhoe and medium sized excavator to at least 5m depth; however, hard digging conditions due to rock fragments or core stones within the weathered bedrock ("floaters") could be encountered.

The medium plasticity existing fill, residual soils, and weathered bedrock can be used in controlled fill construction of building platforms, although rock particles should be broken down to <75mm size. Any medium to high plasticity soil, and silty topsoil/alluvial material are not typically used in controlled fill construction but the topsoil could be used in non-structural applications such as landscaping, while high plasticity clays could be used as a clay capping/lining material.

If imported fill is required, a suitable select fill material would include a low or medium plasticity soil such as clayey sand or gravelly clayey sand, containing between 25% and 50% fines less than 0.075mm size (silt and clay), and no particles greater than 75mm size.

5.4 Stable Excavation Batters

Temporary site excavations to 1.5m depth can be formed near vertical, although loose topsoil, fill, and moisture-affected soils should be cut back at 1(H):1(V). If required and space allows, deeper temporary cuts can be formed at 1(H):1(V) or benched at 1.5m intervals in soils, and 0.5(H):1(V) in HW and less weathered bedrock. A geotechnical engineer should inspect all cut batters during construction to confirm stability. Exposed temporary batters should be protected from the weather by black plastic pinned to the face with link-wire mesh, or similar.

Permanent cut & fill batter slopes should be formed at no steeper than 2(H):1(V) in soil. Permanent cuts in HW and less weathered bedrock could be formed at 1(H):1(V). All soil cut and fill surfaces should be protected against erosion by topsoiling and grassing, or other suitable means. Steeper permanent cuts should be supported by structural retaining walls.

5.5 Low Retaining Walls Culvert walls

Retaining walls constructed in open excavation, with the gap between the excavation face and the wall backfilled later, can be designed for an earth pressure distribution given by:

$$\sigma_h = (K\gamma' h) + Kq$$

where,

- σ_h is the horizontal earth pressure acting on the back of the wall, in kPa
- K is the dimensionless coefficient of earth pressure; this can be assumed to be 0.4 when the top of the wall is unrestrained horizontally, and 0.6 when the top of the wall is restrained (i.e. by building slabs etc.)
- γ' is the effective unit weight of the backfill, and can be assumed to be 20kN/m^3 for a lightly compacted soil backfill
- h is the height of the backfill, in metres
- q is any uniform distributed vertical surcharge acting on the top of the backfill, in kPa

Apart from structural restraints such as floor slabs, resistance to overturning and sliding of retaining walls is provided by frictional and adhesive resistance on the base, and by passive resistance at the toe of the wall. For a natural soil or controlled fill foundation, an ultimate base friction factor (tanδ) of 0.4, base adhesion (c) of 15kPa, and allowable passive earth pressure coefficient Kp=2.5 can be used for calculation of sliding resistance.

Free-draining granular backfill or synthetic fabric drains should be installed behind all walls. These should connect to weep holes and/or a collector drain, and ultimately to the stormwater system. Granular backfill should be wrapped in a suitable filter fabric to minimise infiltration of silt/clay fines

5.6 Controlled Fill Construction

For construction of any new fill foundation platforms and road subgrades, it is recommended that:

- Areas be fully stripped of all topsoil, silty soils, moisture-affected soils, and uncontrolled fill material. A stripping depth of up to 0.3m/1m may be required (see Table 2). Stripped foundations should be proof-rolled by a vibratory pad-foot roller of not less than 9 tonne static mass to check for any weak or wet areas that would require replacement. No fill should be placed until a geotechnical engineer has confirmed the suitability of the foundation.

- Controlled fill comprising suitable site excavated or imported materials of not greater than 75mm maximum particle size, be compacted in not greater than 150mm layers to not less than 95%ModMDD at about OMC.

- Fill placement and control testing be overviewed and certified by a geotechnical engineer at Level 1 involvement of AS3798 – 2007 "Guidelines on Earthworks for Commercial & Residential Developments" (Reference 3).

5.7 Design CBR Values

On-grade carpark, and access ramp subgrades should be stripped of all topsoil, silty soils, moisture-affected soils, and uncontrolled fill, and soil subgrades then proof-rolled by a pad-foot roller to check for any wet or otherwise weak spots which may require additional removal. Suitable replacement fill can be compacted in not thicker than 150mm layers, to not less than 95%ModMDD.

On-grade pavements are expected to comprise newly placed controlled fill or natural soils, and pavements can be designed for a subgrade CBR value of 5%, when compacted to 95%ModMDD. A geotechnical engineer should inspect prepared subgrades to confirm design values, and preferably view a proof-roll to identify any soft spots or other weaknesses.

5.8 Earthquake Site Factor

Table 2.3 of AS1170.4 "Minimum Design Loads on Structures - Part 4: Earthquake Loads" (Reference 4) lists the earthquake acceleration coefficients for major centres to be considered in structural design. The Canberra area has an acceleration coefficient of 0.08 (the minimum value allowed by the standard).

Section 4.2 of AS1170.4 "Minimum Design Loads on Structures – Part 4: Earthquake Loads" lists the site sub-soil classes to be considered in structural design. The site is classified as a "Class C_e – Shallow Soil Site".

5.9 Site Drainage

Permanent groundwater was not encountered within the investigation depths, and the permanent groundwater table is not expected within at least 5m depth of natural ground surface levels. However, temporary, perched seepages will be present following rain, particularly close to the creek alignment, but should be readily controllable through the use of pumps during construction.

Suitable surface drainage should be provided to ensure rainfall run-off or other surface water cannot pond against buildings or pavements. Drainage should be provided behind all retaining walls, and subsoil drains should be installed along the upslope sides of access roads and carparks. Consideration could be given to installing a deep subsoil cut-off drain along the upslope boundary of the site.

ACT Geotechnical Engineers Pty Ltd

REFERENCES

1 Abell, R.S., 1992, Canberra (1:100 000 scale geology map), Bureau of Mineral Resources, Commonwealth of Australia.

2 Standards Australia, "AS2870 – Residential Slabs & Footings", 2011.

3 AS3798, "Guidelines on earthworks for commercial and residential developments".

4 Standards Australia, "AS1170.4 – 2007 – Minimum Design Loads on Structures – Part 4 Earthquake Loads".

PROPOSED MIXED-USE DEVELOPMENT - 50 BUSBY STREET,
SOUTH BATHURST, NSW
SITE LOCALITY

ACT Geotechnical Engineers Pty Ltd	C14423	FIGURE 1

Legend:

• - Boreholes Location

PROPOSED MIXED-USE DEVELOPMENT - 50 BUSBY STREET,
SOUTH BATHURST, NSW
SITE PLAN & BOREHOLES LOCATIONS

ACT Geotechnical Engineers Pty Ltd	**C14423**	**FIGURE 2**

APPENDIX A
Borehole Logs BH01 to BH05

Borehole Log

Borehole No.	BH1
Sheet	1 of 1
Job No.	C14423

CLIENT: Kirana Bathurst Pty Ltd c/- Allera

PROJECT: Proposed Mixed-use Development
50 Busby Street, South Bathurst, NSW

Location : See report

Collar Level : Not Known
Angle From Vertical : 0°
Bearing : N.A.

Equipment Type :
Hole Diameter : 100mm

Samples		Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure	Consistency or Relative Density	Field Test Results	Geological Profile
			0.3		SM	Silty SAND; dark brown/black, fine to coarse sands, some angualr gravels, loose moist	Medium Dense		Topsoil
			1.0 1.3		CL	Sandy gravelly CLAY; brown Medium to high plasticity clay, pl=w, fine to coarse sands, angular gravels	Stiff		Residual
			2.0 2.5		CL	Sandy gravelly CLAY; dark brown, Medium to high plasticity clay, w>Pl, fine to coarse sands, angular gravels	Stiff		
			3.0 4.0 5.0		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		Bedrock
			6.0			BOREHOLE TERMINATED AT 5m			

Logged By : SW Date : Checked By : JM Date :

ACT Geotechnical Engineers

Act Geotechnical Engineers

Borehole Log

Borehole No.	BH2
Sheet	1 of 1
Job No.	C14423

CLIENT: Kirana Bathurst Pty Ltd c/- Allera

PROJECT Proposed Mixed-use Development
50 Busby Street, South Bathurst, NSW

Location : See report

Collar Level : Not Known
Angle From Vertical : 0°
Bearing : N.A.

Equipment Type :
Hole Diameter : 100mm

Samples		Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure	Consistency or Relative Density	Field Test Results	Geological Profile
			0.8		SM	Silty gravelly SAND; dark brown/black, fine to coarse sands, fine angualr gravels, loose moist	Loose		Topsoil
			1.0		SWG	XW Granite bedrock excavates as Gravelly SAND; brown, fine to coarse sands, fine angular gravels, dry - moist dense	Dense		Bedrock
			1.7		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
			1.9		SWG	XW Granite bedrock excavates as Gravelly SAND; red brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
			2.0 3.0 4.0 5.0		SWG	XW Granite bedrock excavates as Gravelly SAND; light red brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
			6.0			BOREHOLE TERMINATED AT 5m			

Logged By : SW	Date :	Checked By : JM	Date :

Borehole Log

Borehole No.	BH3
Sheet	1 of 1
Job No.	C14423

CLIENT: Kirana Bathurst Pty Ltd c/- Allera

PROJECT: Proposed Mixed-use Development
50 Busby Street, South Bathurst, NSW

Equipment Type :
Hole Diameter : 100mm

Location : See report

Collar Level : Not Known
Angle From Vertical : 0°
Bearing : N.A.

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure (Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure)	Consistency or Relative Density	Field Test Results	Geological Profile
		0.8		CL	Sandy gravelly CLAY; brown, low - medium plasticity clay, fine to coarse sands, angular gravels, moist	Loose		Fill
		1.0		SM	Silty SAND; dark brown/black, fine to coarse sands, some angualr gravels, loose moist	Medium Dense		Original Topsoil
		1.2		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry - moist dense	Dense		Bedrock
		2.0 3.0 3.3		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
		4.0 4.1		SWG	XW Granite bedrock excavates as Gravelly SAND; light red brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
		5.0		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
		6.0			BOREHOLE TERMINATED AT 5m			

Logged By : SW Date : Checked By : JM Date :

BOREHOLE/EXCAVATION LOG LOGS.GPJ ACT GEO.GDT 21/8/23

Borehole Log

Borehole No.	BH4
Sheet	1 of 1
Job No.	C14423

CLIENT: Kirana Bathurst Pty Ltd c/- Allera

PROJECT: Proposed Mixed-use Development
50 Busby Street, South Bathurst, NSW

Location : See report
Collar Level : Not Known
Angle From Vertical : 0°
Bearing : N.A.

Equipment Type :
Hole Diameter : 100mm

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure (Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure)	Consistency or Relative Density	Field Test Results	Geological Profile
		0.4		CL	Sandy gravelly CLAY; brown, low - medium plasticity clay, fine to coarse sands, angular gravels, moist	Loose		Fill
		0.6		SM	Silty SAND; dark brown/black, fine to coarse sands, some angualr gravels, loose moist	Medium Dense		Original Topsoil
		0.9		CL	Sandy gravelly CLAY; Medium to high plasticity clay, pl=w, fine to coarse sands, angular gravels	Stiff		Residual
		1.0, 1.8		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry dense	Dense		Bedrock
		2.0, 2.5		SWG	XW Granite bedrock excavates as Gravelly SAND; brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
		3.0, 4.0, 5		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		
		5.0, 6.0			BOREHOLE TERMINATED AT 5m			

Logged By : SW Date :
Checked By : JM Date :

ACT Geotechnical Engineers

Act Geotechnical Engineers

Borehole Log

Borehole No.	**BH5**
Sheet	1 of 1
Job No.	C14423

CLIENT: Kirana Bathurst Pty Ltd c/- Allera

PROJECT Proposed Mixed-use Development
50 Busby Street, South Bathurst, NSW

Location : See report

Collar Level : Not Known
Angle From Vertical : 0°
Bearing : N.A.

Equipment Type :
Hole Diameter : 100mm

Samples		Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure	Consistency or Relative Density	Field Test Results	Geological Profile
			0.2		CL	Sandy gravelly CLAY; brown, low - medium plasticity clay, fine to coarse sands, angular gravels, moist	Loose		Fill
			1.0		SM	Silty SAND; dark brown/black, fine to coarse sands, some angualr gravels, loose moist	Medium Dense		Original Topsoil
			1.3		CL	Sandy gravelly CLAY; Medium to high plasticity clay, pl=w, fine to coarse sands, angular gravels	Stiff		Residual
			2.0 3.0 4.0 5.0		SWG	XW Granite bedrock excavates as Gravelly SAND; light brown, fine to coarse sands, fine angular gravels, dry dense	Very dense		Bedrock
			6.0			BOREHOLE TERMINATED AT 5m			

Logged By : SW Date : Checked By : JM Date :

ACT Geotechnical Engineers

Act Geotechnical Engineers

Material Test Report

J & A Geotech Testing Pty Ltd
Canberra Laboratory
Unit 2, 25 Dacre Street Mitchell ACT 2911
Phone: (02) 6255 5363
Email: scott.miller@jageotech.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Scott Miller
Lab Manager
NATA Accredited Laboratory Number: 19979

Report Number:	**CP231554-1A**
Issue Number:	1
Date Issued:	01/08/2023
Client:	ACT Geotechnical Engineers Pty Ltd Unit 5/9 Beaconsfield St, Fyshwick ACT 2609
Contact:	Jeremy Murray
Project Number:	CP231554
Project Name:	Busby Street Bathurst
Project Location:	Busby Street, Bathurst, N.S.W
Work Request:	8489
Sample Number:	CS8489A
Date Sampled:	21/07/2023
Dates Tested:	21/07/2023 - 27/07/2023
Sampling Method:	Sampled by Client *The results apply to the sample as received*
Preparation Method:	AS 1289.1.1 - Sampling and preparation of soils
Site Selection:	Selected by Client
Sample Location:	**BH#3, Depth: 2.0 - 3.0m**

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description			
Nature of Water			
Temperature of Water (^{o}C)	15		

Multiple Analysis Profile

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Mailing Address: PO Box 357
Pennant Hills NSW 1715
Em: info@sesl.com.au
Web: www.sesl.com.au

Tests are performed under a quality system certified as complying with ISO 9001: 2008. Results and conclusions assume that sampling is representative. This document shall not be reproduced except in full.

Batch N°: 65682 **Sample N°: 1** **Date Instructions Received: 2/8/23** **Report Status: Final**

Client Name: **J & A Geotech Testing**
Client Contact: **Scott Miller**
Client Order N°: **231554/8489**
Address: **Unit 2, 25 Dacre Street**
MITCHELL ACT 2911

Project Name: **Busby St, Bathurst**
SESL Quote N°:
Sample Name: **BH #3**
Description: **Soil**
Test Type: **sPOCAS_ALS, EC_Sol**

Analysis	Unit	Result
Electrical Conductivity	dS/m	0.02

Recommendations not requested

Analysed by SESL Australia Pty Ltd (NATA #15633).

Consultant: Owen Guy

Authorised Signatory: Samantha Grant-Vest

Date Report Generated
11/08/2023

SESL AUST.

SPOCAS

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Mailing Address: PO Box 357
Pennant Hills NSW 1715
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 65682 **Sample N°: 1** **Date Instructions Received: 2/8/23** **Report Status: Final**

Client Name: **J & A Geotech Testing**
Client Contact: **Scott Miller**
Client Order N°: **231554/8489**
Address: **Unit 2, 25 Dacre Street**
MITCHELL ACT 2911

Project Name: **Busby St, Bathurst**
SESL Quote N°:
Sample Name: **BH #3**
Description: **Soil**
Test Type: **sPOCAS_ALS, EC_Sol**

Analysis	Unit	Result	Comment
pH KCl (23A)	pH units	6.6	
pH OX (23B)	pH units	8.0	
Titratable Actual Acidity (23F)	moles H+/T	<2	
Titratable Peroxide Acidity (23G)	moles H+/T	<2	
Titratable Sulfidic Acidity (23H)	moles H+/T	<2	
sulfidic - Titratable Actual Acidity (s-23F)	% pyrite S	<0.02	
sulfidic - Titratable Peroxide Acidity (s-23G)	% pyrite S	<0.02	
sulfidic - Titratable Sulfidic Acidity (s-23H)	% pyrite S	<0.02	
KCl Extractable Sulfur (23Ce)	% S	<0.02	
Peroxide Sulfur (23De)	% S	<0.02	
Peroxide Oxidisable Sulfur (23E)	% S	<0.02	
acidity - Peroxide Oxidisable Sulfur (a-23E)	moles H+/T	<10	
KCl Extractable Calcium (23Vh)	% Ca	0.096	
Peroxide Calcium (23Wh)	% Ca	0.167	
Acid Reacted Calcium (23X)	% Ca	0.071	
acidity - Acid Reacted Calcium (a-23X)	moles H+/T	35	
sulfidic - Acid Reacted Calcium (s-23X)	% S	0.056	
KCl Extractable Magnesium (23Sm)	% Mg	0.031	
Peroxide Magnesium (23Tm)	% Mg	0.043	
Acid Reacted Magnesium (23U)	% Mg	<0.02	
Acidity - Acid Reacted Magnesium (a-23U)	moles H+/T	<10	
sulfidic - Acid Reacted Magnesium (s-23U)	% S	<0.02	
ANC Fineness Factor	-	1.5	
Net Acidity (sulfur units)	% S	<0.02	
Net Acidity (acidity units)	moles H+/T	<10	
Liming Rate	kg CaCO3/t	<1	
Net Acidity excluding ANC (sulfur units)	% S	<0.02	
Net Acidity excluding ANC (acidity units)	mole H+ / t	<10	
Liming Rate excluding ANC	kg CaCO3/t	<1	

Consultant
Owen Guy

Authorised Signatory
Samantha Grant-Vest

Date Report Generated
11/08/2023

Method References:
SESL Method PM0011: Analysis of acid sulphate soils - sPOCAS derived from Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

SESL AUST.

SPOCAS

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120
Mailing Address: PO Box 357
Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 65682 **Sample N°: 1** **Date Instructions Received: 2/8/23** **Report Status:** ○ **Draft** ◉ **Final**

Client Name: **J & A Geotech Testing**
Client Contact: **Scott Miller**
Client Order N°: **231554/8489**
Address: **Unit 2, 25 Dacre Street**
MITCHELL ACT 2911

Project Name: **Busby St, Bathurst**
SESL Quote N°:
Sample Name: **BH #3**
Description: **Soil**
Test Type: **sPOCAS_ALS, EC_Sol**

Recommendations not requested

Analysed by ALS Laboratory Group, NATA # 825, Report # EB2324006

Consultant
Owen Guy

Authorised Signatory
Samantha Grant-Vest

Date Report Generated
11/08/2023

Method References:
SESL Method PM0011: Analysis of acid sulphate soils - sPOCAS derived from Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

DESCRIPTION AND CLASSIFICATION OF SOILS

The methods of description and classification of soils used in this report are based on the Australian Standard 1726 – 1993, Geotechnical site investigations. In general, descriptions cover the following properties – soil type, colour, secondary grain size, structure, inclusions, strength or density and geological description.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy clay) on the following basis:

Classification	**Particle Size**
Clay	Less than 0.002mm
Silt	0.002mm to 0.06mm
Sand	0.06mm to 2.00mm
Gravel	2.00mm to 60.00mm
Cobbles	60mm (63mm) to 200mm
Boulders	>200mm

Soils are also classified according to the Unified Soil Classifications System which is included in this Appendix. Rock types are classified by their geological names.

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

Consistency	**Shear Strength su(kPa) (Representative Undrained Shear)**	
Very soft	< 12	<2 (~SPT "N")
Soft	12 - 25	2-4
Firm	25 - 50	4-8
Stiff	50 – 100	8-15
Very Stiff	100 – 200	15-30
Hard	> 200	>30

Non-cohesive soils are classified on the basis of relative density, generally from the results of in-situ standard penetration tests as below:

Term	**Relative Density (%)**	**SPT Blows/300mm 'N'**
Very loose	< 15	<4
Loose	15-35	4-10
Medium dense	35-65	10-30
Dense	65-85	30-50
Very Dense	>85	>50

SAMPLING

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

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

Undisturbed samples are generally taken by one of two methods:

1. Driving or pushing a thin walled sample tube into the soil and withdrawing with a sample of soil in a relatively undisturbed state.

2. Core drilling using a retractable inner tube (R.I.T.) core barrel.

Such samples yield information on structure and strength in additions to that obtained from disturbed samples and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

PENETRATION TESTING

The relative density of non-cohesive soils is generally assessed by in-situ penetration tests, the most common of which is the standard penetration test. The test procedure is described in Australian Standard 1289 "Testing Soils for Engineering Purposes" Testing Soils for Engineering Purposes" – Test No. F3.1.

The standard penetration test is carried out by driving a 50mm diameter split tube penetrometer of standard dimensions under the impact of a 63 kg hammer having a free fall of 750mm.

The "N" value is determined as the number of blows to achieve 300mm of penetration (generally after disregarding the first 150mm penetration through possibly disturbed material). The results of these tests can be related empirically to the engineering properties of the soil.

The test is also used to provide useful information in cohesive soils under certain conditions, a good quality disturbed sample being recovered with each test. Other forms of in situ testing are used under certain conditions and where this occurs, details are given in the report.

DEFINITIONS OF ROCK, SOIL, AND DEGREES OF CHEMICAL WEATHERING

GENERAL DEFINITIONS – ROCK AND SOIL

ROCK In engineering usage, rock is a natural aggregate of minerals connected by strong and permanent cohesive forces.

Note: Since "strong" and "permanent" are subject to different interpretations, the boundary between rock and soil is necessarily an arbitrary one.

SOIL In engineering usage, soil is a natural aggregate of mineral grains which can be separated by such gentle mechanical means as agitation in water, can be remoulded and can be classified according to the Unified Soil Classification System. Three principal classes of soil recognized are:

Residual soils: soils which have been formed in-situ by the chemical weathering of parent rock. Residual soil may retain evidence of the original rock texture or fabric or, when mature, the original rock texture may be destroyed.

Transported soils: soils which have been moved from their places of origin and deposited elsewhere. The principal agents of erosion, transport and deposition are water, wind and gravity. Two important types of transported soil in engineering geology and materials investigations are:

Colluvium – a soil, often including angular rock fragments and boulders, which has been transported downslope predominantly under the action of gravity assisted by water. The principle forming process is that of soil creep in which the soil moves after it has been weakened by saturation. It may be water borne for short distances.

Alluvium – a soil which has been transported and deposited by running water. The larger particles (sand and gravel size) are water worn.

Lateritic soils: soils which have formed in situ under the effects of tropical weathering include all reddish residual and non residual soils which genetically form a chain of material ranging from decomposed rock through clay to sesqui-oxide rich crusts. The term does not necessarily imply any compositional, textural or morphological definition; all distinctions useful for engineering purposes are based on the differences in geotechnical characteristics.

ROCK WEATHERING DEFINITIONS

Extremely Weathered (EW)	Rock substance affected by weathering to the extent that the rock exhibits soil properties, i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered (HW)	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of the chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered (MW)	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Slightly Weathered (SW)	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance, usually by limonite, has taken place. The colour and texture of the fresh rock is recognisable.
Fresh (Fr)	Rock substance unaffected by weathering.

The degrees of rock weathering may be gradational. Intermediate stages are described by dual symbols with the prominent degree of weathering first (e.g. EW-HW).

The various degrees of weathering do not necessarily define strength parameters as some rocks are weak, even when fresh, to the extent that they can be broken by hand across the fabric, and some rocks may increase in strength during the weathering process.

Fresh drill cores of some rock types, such as basalt and shale may disintegrate after exposure to the atmosphere due to slaking, desiccation, expansion or contraction, stress relief or a combination of any of these factors.

AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS

This classification system provides a standardised terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable. Where other rock types are encountered, such as in dykes, standard geological descriptions are used for rock types and the same descriptions as below are used for strength, fracturing and weathering.

Under this system rocks are classified by Rock Type, Strength, Stratification Spacing, Degree of Fracturing and Degree of Weathering. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc) where these are relevant.

ROCK TYPE DEFINITIONS

ROCK TYPE	DEFINITION
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2mm) fragments.
Sandstone:	More than 50% of the rock consists of sand sized (0.06 to 2mm) grains.
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06mm) granular particles and the rock is not laminated.
Claystone:	More than 50% of the rock consists of silt or clay sized particles and the rock is not laminated.
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated.

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. clayey sandstone, sandy shale.

STRATIFICATION SPACING

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

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks.

Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20mm, and mostly of width less than the core diameter
Highly Fractured:	Core lengths are generally less than 20mm – 40mm with occasional fragments.
Fractured:	Core lengths are mainly 30mm – 100mm with occasional shorter and longer section.
Slightly Fractured:	Core lengths are generally 300mm – 1000mm with occasional longer sections and occasional sections of 100mm – 300mm.
Unbroken:	The core does not contain any fracture.

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics.

Term	Point Load Index Is(50) MPa	Field Guide	Approx qu MPa*
Extremely Weak:	0.03	Easily remoulded by hand to a material with soil properties.	0.7
Very Weak:	0.1	May be crumbled in the hand. Sandstone is “sugary” and friable.	2.4
Weak:	0.3	A piece of core 150mm long x 50mm dia. May be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	7
Medium Strong:	1	A piece of core 150mm long x 50mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.	24
Strong: (SW)	3	A piece of core 150mm long x 50mm dia. core cannot be broken by unaided hands, can be slightly scratched or scored with knife.	70
Very Strong (SW)	10	A piece of core 150mm long x 50mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	240
Extremely Strong (Fr)	>10	A piece of core 150mm long x 50mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.	>240

The approximate unconfined compressive strength (qu) shown in the table is based on an assumed ration to the point load index of 24:1. This ratio may vary widely.

Unified Soil Classification System (Metricated)
Data for Description Indentification and Classification of Soils

MAJOR DIVISIONS			Group Symbol	TYPICAL NAME	DESCRIPTIVE DATA	GRADATIONS		NATURE OF FINES	DRY STRENGTH	Group Symbol	% [2] < 0.06mm	PLASTICITY OF FINE FRACTION			NOTES
COARSE GRAINED SOILS More than 50% by dry mass, less than 60mm is greater than 0.06mm.	GRAVELS	More than 50% of coarse grains are greater than 2.0mm	GW	Well graded gravels and gravel-sand mixtures, little or no fines	Give typical name, indicate approximate percentages of sand and gravel, maximum size, angularity, surface condition and hardness of the coarse grains, local or geological name and other pertinent descriptive information, symbols in parenthesis. For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics. EXAMPLE: Silty Sand, gravelly, about 20% hard, angular gravel particles, 10mm maximum size, rounded and sub angular sand grains coarse to fine, about 15% non-plastic fines with low dry strength, well compacted and moist in place, light brown alluvial sand, (SM)	GOOD	Wide range in grain size	"Clean" materials (not enough fines to band coarse grains)	None	GW	0-5	-	>4	Between 1 and 3	1. Identify Fines by the method given for fine grained soils. 2. Borderline classifications occur when the percentage of fines (fraction smaller than 0.06mm size) is greater than 5% and less than 12%. Borderline classifications require the use of dual symbols eg SP-SM GW-GC
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		POOR	Predominantly one size or range of sizes			GP	0-5	-	Fails to comply with above		
	GRAVELLY SOILS		GM	Silty gravels, gravel-sand-silt mixtures		GOOD TO FAIR	"Dirty" materials (Excess of fines)	Fines are non-plastic (1)	None to medium	GM	12-50	Below 'A' line and Ip >7	-	-	
			GC	Clayey gravels gravel-sand-clay mixtures				Fines are plastic (1)		GC	12-50	Above 'A' line and Ip > 7	-	-	
	SANDS	More than 50% of coarse grains are greater than 2.0mm	SW	Well graded sands and gravelly sands, little or no fines		GOOD	Wide range in grain size	"Clean" materials (not enough fines to band coarse grains)	None	SW	0-5	-	>6	between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		POOR	Predominantly one size or range of sizes			SP	0-5	-	Fails to comply with above		
	SANDY SOILS		SM	Silty sand, sand-silt mixtures		GOOD TO FAIR	"Dirty" materials (Excess of fines)	Fines are non-plastic (1)	None to medium	SM	12-50	Below 'A' line or Ip < 4	-	-	
			SC	Clayey sands, sand-clay mixtures				Fines are plastic (1)		SC	12-50	Above 'A' line and Ip > 7	-	-	

FIELD IDENTIFICATION: Determine approximate percentages of material over 60mm size, maximum size, shape, surface texture, hardness of material, geological description. Identify on estimated percentage mass of the various fractions.

COARSE GRAINED SOILS: More than half of the material less than 60mm is larger than 0.06mm

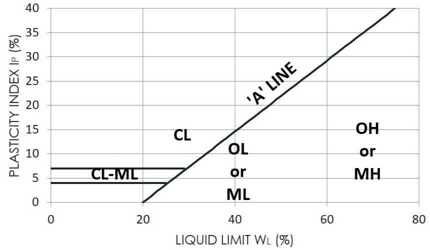
0.05mm is about the smallest particle visible to the naked eye

LABORATORY CLASSIFICATION: Use the gradation curve of material passing 60mm for classification of fractions according to criteria given under "Major Division".

SILT AND CLAY FRACTION
Fraction smaller than 0 20mm AS sieve size

MAJOR DIVISIONS		Group Symbol	TYPICAL NAME	DESCRIPTIVE DATA	DRY STRENGTH	DILATANCY	TOUGHNESS	Group Symbol		PLASTICITY OF FINE FRACTION
FINE GRAINED SOILS More than 50% by dry mass, less than 6mm is less than 0.06mm	Liquid Limit less than 50%	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.	Give typical name, indicate degree and character of plasticity, amount and maximum size of coarse grains, colour in wet condition, odour if any, local or geological name and r pertinent descriptive information, symbols in parenthesis. For undisturbed soil add information on structure, stratification, consistancy in undisturbed and remoulded states, moisture and drainage conditions. EXAMPLE Clayey Silt, brown, low plasticity, small percentage of fine sand, numerous vertical root-holes, firm and dry in place, fill, (ML).	None to low	Quick to slow	None	ML	More than 50% passing 0.06mm	Below 'A' line
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.		Medium to high	None to very slow	Medium	CL		Above 'A' line
		OL	Organic silts and organic silty clays of low plasticity		Low to medium	Slow	Low	OL		Below 'A' line
	Liquid Limit more than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.		Low to medium	Slow to none	Low to medium	MH		Below 'A' line
		CH	Inorganic clays of high plasticity, fat clays.		High to very high	None	High	CH		Above 'A' line
		OH	Organic clays of medium to high plasticity.		Medium to high	None to very slow	Low to medium	OH		Below 'A' line
		Pt	Peat muck and other highly organic soils.		Readily identified by colour, odour, spongy feel and generally by fibrous texture			Pt*	*Effervescence with H2O2	

FIELD IDENTIFICATION: FINE GRAINED SOILS: More than half of the material less than 50mm is less than 0.06mm



PLASTICITY CHART
FOR CLASSIFICATION OF FINE GRAINED SOILS

ACT Geotechnical Engineers

ACT Geotechnical Engineers Pty Lt
ACN 063 673 530

5/9 Beaconsfield Street, Fyshwick ACT 2609
PO Box 9225, Deakin ACT 2600
Ph: (02) 6285 1547

Limitations in the Use and Interpretation of this Geotechnical Report

Our Professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The geotechnical report was prepared for the use of the Owner in the design of the subject development and should be made available to potential contractors and/or the Contractor for information on factual data only. This report should not be used for contractual purposes as a warranty of interpreted subsurface conditions such as those indicated by the interpretive borehole and test pit logs, cross- sections, or discussion of subsurface conditions contained herein.

The analyses, conclusions and recommendations contained in the report are based on site conditions as they presently exist and assume that the exploratory bore holes, test pits, and/or probes are representative of the subsurface conditions of the site. If, during construction, subsurface conditions are found which are significantly different from those observed in the exploratory bore holes and test pits, or assumed to exist in the excavations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between conducting this investigation and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, this report should be reviewed to determine the applicability of the conclusions and the recommendations considering the changed conditions and time lapse.

The summary bore hole and test pit logs are our opinion of the subsurface conditions revealed by periodic sampling of the ground as the test holes progressed. The soil descriptions and interfaces between strata are interpretive and actual changes may be gradual.

The bore hole and test pit logs and related information depict subsurface conditions only at the specific locations and at the particular time designated on the logs. Soil conditions at the other locations may differ from conditions occurring at these bore hole and test pit locations. Also, the passage of time may result in a change in the soil conditions at these test locations.

Groundwater levels often vary seasonally. Groundwater levels reported on the boring logs or in the body of the report are factual data only for the dates shown.

Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples, bore holes or test pits. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. It is recommended that the Owner consider providing a contingency fund to accommodate such potential extra costs.

This firm cannot be responsible for any deviation from the intent of this report including, but not restricted to, any changes to the scheduled time of construction, the nature of the project or the specific construction methods or means indicated in this report: nor can our company be responsible for any construction activity on sites other than the specific site referred to in this report.