Consulting Geotechnical Engineering
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GAVIN MORRIS

PROPOSED MEDICAL CONSULTATION ROOMS

LOT 5 DP 23987,
No.5 VIDLER AVENUE,
WOY WOY

GEOTECHNICAL ASSESSMENT

REPORT CKG 1021-1 NOVEMBER 2022

CKGeotech Pty Ltd

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CKG 1021-1 GP: gp
7th November 2022

Gavin Morris
5 Vidler Avenue
WOY WOY NSW 2256

Dear Sir

Re: Proposed Medical Consultation Rooms, Lot 5 DP 23987, No.5 Vidler Avenue, Woy Woy: Geotechnical Assessment.

Find enclosed our report on geotechnical studies at the above site.

The report presents the results of field and laboratory testing and describes surface, subsurface and geotechnical conditions. Report assessment and recommendations cover site classification in accordance with *AS2870-2011 "Residential Slabs and Footings"*, and related advice on footings; and acid sulphate soils.

Please contact the undersigned if you require further assistance.

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1.0 INTRODUCTION

As requested, C K Geotech Pty Ltd has carried out geotechnical studies associated with proposed medical consultation rooms at No.5 Vidler Avenue, Woy Woy. A plan of the site, derived from *Existing Site Plan (Page 2/9)* by RaP Drawing, is shown on the attached Drawing CKG 1021-01.

The site occupies about 671m^2 on the western side of Vidler Avenue. Existing development comprises a single storey clad dwelling within the front to central portion and a remaining concrete slab of a former shed to the rear.

Design plans indicate replacement of existing structures with a double storey building with suspended first floor slab, ground floor parking and a lift well.

The aims of the study were to provide a *Geotechnical Report* comprising an assessment of site classification in accordance with *AS2870-2011 "Residential Slabs and Footings"* and related geotechnical advice on footings; and acid sulphate soils assessment including a management plan. This report should be read in conjunction with the attached General Notes.

2.0 FIELDWORK

Fieldwork carried out on 28th October 2022 comprised a walkover site inspection and Boreholes BH1 and BH2 drilled to depths of 6.9m and 7.9m within the front and rear portions of the site with our skid steer drilling rig. At BH1, percussive window sampling was carried out to 5.0m depth and Dynamic Probe Heavy (DPH) testing was extended to 6.9m depth. At BH2, DPH testing was extended to 7.9m depth to aid assessment of subsurface conditions. Torque readings were measured at regular depth intervals at BH1 and BH2 to allow correction for any drill rod skin friction effects.

The fieldwork was carried out by our Senior Geotechnical Engineer who selected the borehole locations, performed in-situ testing, obtained soil samples for laboratory analysis and prepared field logs of the profiles encountered.

Borehole Logs including a description sheet of terms and symbols used (General Notes) are provided in Appendix A. Approximate locations of the boreholes are shown on Drawing CKG 1021-01.

3.0 LABORATORY TESTING

Soil samples were forwarded to Environmental Analysis Laboratory (E.A.L) at Southern Cross University in Lismore who performed the following testing:

- pH Screening to provide indication of Actual Acid Sulphate Soil (AASS) and Potential Acid Sulphate Soil (PASS) risks; and

- Titratable Actual Acidity (TAA) and Reduced Inorganic Sulphur (Scr) to assess neutralising lime dosing requirement.

The laboratory test results are presented in Appendix B and discussed in Section 5.0.

4.0 SITE CONDITIONS

4.1 Surface

The site is situated within regionally flat to gently undulating low lying terrain and is situated about 640m east of the shoreline of Woy Woy Inlet and about 780m west from Brisbane Water.

The *Plan* indicates surface levels at No.5 ranging from about RL 4.6m to 5.3m AHD, decreasing to the north-west. The site is bound by existing development. Vidler Avenue which fronts the property is sealed and with kerb and gutter drainage.

Surface soils comprise generally aeolian SAND. Vegetation comprises a sparse cover of lawn and some bushes.

4.2 Subsurface

The *Gosford – Lake Macquarie Soil Landscape Series Sheet 91301-9231 by Department of Conservation and Land Management* indicates the site lies within the *Tuggerah (tg) Aeolian Landscape*.

The *Tuggerah Landscape* is characterised by gently undulating to rolling coastal dunefields. Geology comprises Quaternary sands, consisting of marine quartz sand, coarse with shell fragments, interdune (swale) silt and fine sand. Soils of this landscape typically comprise moderately deep (>2m) *Siliceous Sands* on younger dunes and disturbed areas *and Humus Podzols* in swampy swales.

Development limitations are reported to include wind erosion hazard, localised waterlogging and flooding and localised foundation hazard.

Subsurface conditions encountered at BH1 are generalised as follows:

Layer	Description	Depth to Base of Layer (m)
		BH1
AEOLIAN:	SAND, fine to medium grained, grey to pale grey becoming dark brown below 0.7m depth and yellow-brown below 1.2m depth, some non-low plasticity fines, moist, very loose / loose	2.5
	SAND, fine grained, pale brown, moist to wet, loose	3.0
	SAND, fine to medium grained, pale brown becoming pale brown mottled brown / dark grey, wet, loose / medium dense	4.4
	SAND, fine to medium grained, pale brown mottled brown / dark grey, wet, very loose	>5.0

The results of in-situ DPH testing continued below the 5.0m depth of percussive window sampling at BH1 and carried out at BH2 indicate / infer the presence of very loose and loose

/ medium dense sediments becoming medium dense below depths of about 6.1-7.5m, and dense below 6.5m depth at BH1, to the 6.9-7.9m depths of testing.

Groundwater was encountered below depths of about 2.7-3.2m at the borehole locations at the time of investigation.

5.0 DISCUSSION & RECOMMENDATIONS

5.1 General

The investigation has indicated subsurface conditions to comprise fine to medium grained grey to pale grey and dark brown and yellow-brown and pale brown and pale brown mottled brown / dark grey aeolian SAND to the 5.0m depth of percussive window sampling (PWS).

The results of in-situ Dynamic Probe Heavy (DPH) testing indicate the aeolian SAND to be very loose / loose becoming loose / medium dense below about 3m depth and very loose below about 4.4m depth to the 5.0m depth of PWS, and infer the presence of very loose and loose / medium dense sediments becoming medium dense below depths of about 6.1-7.5m, and locally dense below 6.5m depth, to the 6.9-7.9m depths of testing.

Groundwater was encountered below depths of about 2.7-3.2m at the borehole locations at the time of investigation. However, it is pointed out that groundwater levels and seepages may fluctuate with variations in rainfall, site drainage and other factors.

5.2 Site Classification & Geotechnical Recommendations

The aeolian SAND soils encountered at this site are considered to be non-reactive. In view of the above, classification based on site reactivity is considered to be in the *Class A* (Most sand and rock sites with little or no ground movement from moisture changes) range of *AS2870-2011 "Residential Slabs and Footings".*

Notwithstanding the above, **Lot 5 DP 23987, No.5 Vidler Avenue, Woy Woy is assessed as *Class P (Problem)* in accordance with *AS2870-2011 Section 2.1.3*** due to the presence of very loose and loose sands of low bearing capacity which may experience foundation settlement due to structural loading.

Standard footing systems presented in *AS2870-2011* are for certain residential type structures and do not cover Class P sites' therefore the footing system for the proposed new building at this site should be designed by a Civil / Structural Engineer. It is recommended that footings be piered within medium dense / dense SAND's, encountered below depths of about 6.1-7.5m.

Bored piers are not recommended due to the presence of loose SAND's and groundwater above the required depth of piering. Driven timber piles are not recommended as their installation may cause vibration related damages to buildings on adjacent properties. Proprietary steel screw piles may be considered.

As a guide, screw piles of typically 90mm diameter with a 350mm helix or 140mm diameter with a 550mm helix have allowable load capacities of about 50kN to 75kN or 130kN to 200kN respectively when founded within medium dense to dense SAND. It is our experience that piling contractors will quote to install piles of a given minimum capacity when supplied with geotechnical information such as this report together with a Structural Engineering footing design and pile layout for the project. Consideration should be given to use of increased pile

gauge thickness and concrete filling of the hollow piles to reduce the effects of possible corrosion activity in a wet marine environment.

It is recommended that screw pile compression testing be initially carried out at this site in order to verify the depths of required medium dense / dense strata. It is recommended that pile installation be carried out during inspection by a Geotechnical or Structural Engineering Consultant in order to verify that the piles are founded in strata of suitable relative density. Driven depths, location and final capacity of the piles should be recorded and the Structural Engineer consulted where these vary from design assumptions.

Collected water should be discharged in a controlled manner remote from structures.

5.3 Acid Sulphate Soils

Three soil samples of pale grey, dark brown and yellow-brown aeolian SAND were obtained from BH1 for acid sulfate soil screening tests including pH in H_2O (water) and H_2O_2 (peroxide) and reaction to assess for existing acidity and the potential for acid sulfate generation. Sampling depths were 0.4-0.6m, 0.8-1.0m and 1.8-2.0m below existing surface level.

Current guidelines from the *National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual (Water Quality Australia, June 2018)* list indicators of pH in H_2O of less than 4 for actual acidity and pH in H_2O_2 of less than 3 for potential acidity. All three soil samples indicated pH values in H_2O greater than 4 (pH 5.69 to 8.25). All three soil samples indicated pH values in H_2O_2 greater than 3 (pH 4.21 to 5.12). All three samples had reported 'low' reactions. Based on the results of the screening analysis, laboratory TAA and Scr tests were carried out on the coarse textured upper two aeolian SAND samples.

For projects such as this which disturb less than 1000 tonnes of acid sulfate soil, an acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion of Chromium Reducible Sulphur (Scr) $\geq$0.03% S or net acidity 18 mole H^+/t for coarse textured soils, $\geq$0.06% S or 36 mole H^+/t for medium textured soils, and $\geq$0.1% S or 62 mole H^+/t for fine textured soils. For projects which disturb >1000 tonnes of soil, the coarse trigger of $\geq$0.03% S or 18 mole H^+/t would apply.

The test results indicate that the coarse textured aeolian SAND samples had Scr <0.03% S (<0.005 each) and net acidity <18 mole H^+/t (2,11). Therefore, these samples are assessed to have net acidity values below the intervention levels for acid sulfate soil management.

In view of the above, it is assessed that the layers of aeolian SAND encountered to the 2.0m depth of testing are **not** acid sulfate soils in accordance with the *National Acid Sulfate Soils Guidance*. It is therefore considered that an Acid Sulfate Soil Management Plan is not required during earthworks associated with the proposed medical consultation rooms at No.5 Vidler Avenue, Woy Woy.

For and on behalf of

[redacted]

APPENDIX A

Borehole Logs BH1 & BH2

General Notes Terms and Symbols Sheet

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BOREHOLE LOG

Job No:	CKG 1021
Hole No:	BH1
Sheet:	1/2
Started:	28/10/2022
Finished:	28/10/2022
Logged:	G.P.
Checked:	G.P.
R.L. surface:	5.2m approx
Datum:	AHD

Client: Gavin Morris

Project: Proposed Medical Consultation Rooms

Location: No.5 Vidler Avenue, Woy Woy (refer to Drawing CKG 1021-01)

GPS Co-ordinates: easting: northing:

Equipment Type: Massenza MI1 Skid Steer Drilling Rig

Borehole Diameter: 50mm

method	water	samples	DPH (Blows/100mm)	depth (m)	graphic log	USCS symbol	Material Description soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	Comments notes, structure and additional observations
Dynamic Probe Heavy (DPH) & Percussive Window Sampling (PWS)	3.2m ▽	D	1 2 2 2 2	0.5		SP	SAND, fine to medium grained, grey to pale grey becoming dark brown below 0.7m depth and yellow-brown below 1.2m depth and pale brown below 2.5m depth, some non-low plasticity silt fines	M	VL/L	AEOLIAN some organics to about 0.05m depth
		D	2 3 2 2	1.0						T@0.9m=0NM
		D	2 2 3 2 2	1.5						
		D	2 2 3 2 2 2	2.0						T@1.9m=0NM
			3 2 3 3 3 3	2.5				M-W	L	
			3 4 4 3 4 3	3.0				W	L/MD	T@2.9m=5NM
				3.5			BH1 continued below 3.5m depth on Sheet 2/2			

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BOREHOLE LOG

Job No:	CKG 1021
Hole No:	BH1
Sheet:	2/2
Client:	Gavin Morris
Started:	28/10/2022
Project:	Proposed Medical Consultation Rooms
Finished:	28/10/2022
Location:	No.5 Vidler Avenue, Woy Woy (refer to Drawing CKG 1021-01)
Logged:	G.P.
GPS Co-ordinates:	easting: northing:
Checked:	G.P.
Equipment Type:	Massenza MI1 Skid Steer Drilling Rig
R.L. surface:	5.2m approx
Borehole Diameter:	50mm
Datum:	AHD

method	water	samples	DPH (Blows/100mm)	depth (m)	graphic log	USCS symbol	Material Description soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	Comments notes, structure and additional observations
DPH & PWS			3 4 3 3 4 4 3 4 3 2 1 2 2 1 1	4.0 4.5 5.0		SP	SAND, fine to medium grained, pale brown mottled brown / dark grey	W	L/ MD VL	AEOLIAN T@3.9m=10NM T@4.9m=5NM
DPH			1 2 1 2 1 1 0 0 0 1 2 4 7 7 10 12 12 14 18	5.5 6.0 6.5			BH1 (PWS) terminated at 5.0m depth		(VL) (MD) (D)	T@5.9m=5NM T@6.9m=40NM
				7.0			BH1 (DPH) terminated at 6.9m depth			

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BOREHOLE LOG

Job No:	CKG 1021
Hole No:	BH2
Sheet:	1/3
Started:	28/10/2022
Finished:	28/10/2022
Logged:	G.P.
Checked:	G.P.
R.L. surface:	4.9m approx
Datum:	AHD

Client: Gavin Morris

Project: Proposed Medical Consultation Rooms

Location: No.5 Vidler Avenue, Woy Woy (refer to Drawing CKG 1021-01)

GPS Co-ordinates: easting: northing:

Equipment Type: Massenza MI1 Skid Steer Drilling Rig

Borehole Diameter: 50mm

method	water	samples	DPH (Blows/100mm)	depth (m)	graphic log	USCS symbol	Material Description soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	Comments notes, structure and additional observations
Dynamic Probe Heavy (DPH)	collapse below 2.7m depth		1 2 2 2 2 2 2 2 2 2 3 2 3 2 1 2 1 2 1 2 3 3 3 4 4 5 5 5 5 5 7	0.5 1.0 1.5 2.0 2.5 3.0 3.5					(VL/ L) (L) (MD)	T@0.9m=0NM T@1.9m=0NM T@2.9m=5NM
							BH2 continued below 3.5m depth on Sheet 2/3			

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BOREHOLE LOG

Job No:	CKG 1021
Hole No:	BH2
Sheet:	2/2
Started:	28/10/2022
Finished:	28/10/2022
Logged:	G.P.
Checked:	G.P.
R.L. surface:	4.9m approx
Datum:	AHD

Client: Gavin Morris

Project: Proposed Medical Consultation Rooms

Location: No.5 Vidler Avenue, Woy Woy (refer to Drawing CKG 1021-01)

GPS Co-ordinates: easting: northing:

Equipment Type: Massenza MI1 Skid Steer Drilling Rig

Borehole Diameter: 50mm

method	water	samples	DPH (Blows/100mm)	depth (m)	graphic log	USCS symbol	Material Description soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	Comments notes, structure and additional observations
DPH			7						(MD)	
			8							
			8							
			6							
			6	4.0						T@3.9m=25NM
			6							
			6							
			4							
			5							
			5	4.5						
			4						(L/ MD)	
			4							
			3							
			4							
			3	5.0						T@4.9m=10NM
			4							
			4							
			5							
			3							
			6	5.5					(MD)	
			8							
			8							
			6							
			7							
			6	6.0						T@5.9m=25NM
			6							
			4							
			5							
			5							
			4	6.5						
			5							
			4							
			3							
			3						(L)	
			3	7.0						T@6.9m=20NM
							BH2 (DPH) continued below 7.0m depth on Sheet 3/3			

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BOREHOLE LOG

Job No:	CKG 1021
Hole No:	BH2
Sheet:	3/3
Client:	Gavin Morris
Started:	28/10/2022
Project:	Proposed Medical Consultation Rooms
Finished:	28/10/2022
Location:	No.5 Vidler Avenue, Woy Woy (refer to Drawing CKG 1021-01)
Logged:	G.P.
GPS Co-ordinates:	easting: northing:
Checked:	G.P.
Equipment Type:	Massenza MI1 Skid Steer Drilling Rig
R.L. surface:	4.9m approx
Borehole Diameter:	50mm
Datum:	AHD

method	water	samples	DPH (Blows/100mm)	depth (m)	graphic log	USCS symbol	Material Description soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	Comments notes, structure and additional observations7
DPH			3						(L)	
			3							
			2							
			3							
			4	7.5						
			5						(MD)	
			7							
			7							
			8							T@7.9m=20NM
				8.0			BH2 (DPH) terminated at 7.9m depth			
				8.5						
				9.0						
				9.5						
				10.0						
				10.5						

General Notes
Terms and Symbols

GENERAL
Geotechnical reports present the results of investigations carried out for a specific project and usually for a specific phase of the project (e.g. preliminary design). The report may not be relevant for other phases of the project (e.g. construction), or where projects details change.

SOIL AND ROCK DESCRIPTIONS
Soil and rock descriptions are based on AS 1726-1993, using visual and tactile assessment except at discrete locations where field and/or laboratory tests have been carried out. Refer opposite for term and symbol definitions.

GROUNDWATER
The water levels indicated on the logs are taken at the time of measurement and depending on material permeability may not reflect the actual groundwater level at those specific locations. Also, groundwater levels can vary with time due to seasonal or tidal fluctuations and construction activities.

INTERPRETATION OF RESULTS
The discussion and recommendations in the accompanying report are based on extrapolation / interpolation from data obtained at discrete locations. The actual interface between the materials maybe far more gradual or abrupt than indicated. Also, actual conditions in areas not sampled may differ from those predicted.

CHANGE IN CONDITIONS
Subsurface conditions can change with time and can vary between test locations. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions.

REPRODUCTION OF REPORTS
 Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimise the likelihood of misinterpretation from logs.

FURTHER ADVICE
We would be pleased to further discuss how any of the above issues could affect your specific project. We would also be pleased to provide further advice or assistance including:

- Assessment of suitability of design and construction techniques;
- Contract specification;
- Construction advice (foundation assessments, excavation support).

SOIL DESCRIPTIONS

Consistency		Qu (kPa)
VS	Very Soft	<25
S	Soft	25-50
F	Firm	50-100
St	Stiff	100-200
VSt	Very Stiff	200-400
H	Hard	>400
Fb	Friable	

Density Index		I_D (%)
VL	Very Loose	<15
L	Loose	15-35
MD	Medium Density	35-65
D	Dense	65-85
VD	Very Dense	>85

Moisture Condition

D	Dry	M	Moist	W	Wet
W_P	Plastic Limit	W_L	Liquid Limit		

ROCK DESCRIPTIONS

Weathering		Structure	Spacing
RS	Residual Soil	Thinly laminated	<6mm
XW	Extremely Weathered	Laminated	6-20mm
HW	Highly Weathered	Very Thinly bedded	20-60mm
MW	Moderately Weathered	Thinly bedded	60-200mm
DW	Distinctly Weathered*	Medium bedded	0.2-0.6m
SW	Slightly Weathered	Thickly bedded	0.6-2m
FR	Fresh	Very thickly bedded	>2m
	*DW covers HW & MW		

Strength		$I_{s(50)}$ MPa	
EL	Extremely Low	<0.03	
VL	Very Low	0.03 - 0.1	X = diametral testing
L	Low	0.1 – 0.3	
M	Medium	0.3 – 1	
H	High	1 – 3	O = axial testing
VH	Very High	3 – 10	
EH	Extremely High	> 10	

Natural Fractures

Type		Shape		Infill / Coating		Roughness	
JT	Joint	pl	planar	cn	clean	pol	polished
BP	Bedding plane	cu	curved	cl	clay	slk	slicken-sided
SM	Seam	un	undulose	ca	calcite		
FZ	Fractured zone	st	stepped	cb	carbonaceous	smo	smooth
SZ	Shear zone	ir	irregular	fe	iron oxide	rou	rough
VN	Vein	dis	discontin-uous	mi	micaceous	vro	very - rough
				qz	quartz		

Note: Soil and rock descriptions are based on AS 1726-1993

EXCAVATION / DRILLING METHOD & CASING		SAMPLES / TESTS & WATER MEASUREMENTS	
BH	Backhoe / excavator bucket	B	Bulk sample
NE	Natural exposure	D	Disturbed sample
EX	Existing excavation	U50	Undisturbed sample 50mm ϕ
HE	Hand excavation	PP	Pocket penetrometer (kPa)
AS	Auger screwing*	SV	Shear vane test (kPa)
AD	Auger drilling*	SPT	Standard penetration test
	*bit type shown by suffix	N*	SPT value (blows/300mm)
	V = "V" shaped Bit		*Denotes sample taken
	T = Tungsten carbide Bit	Nc	SPT value with solid cone
	B = Blank Bit	DCP	Dynamic cone penetrometer (blows/150mm)
R	Roller / Tricone	R	Refusal of SPT or DCP
W	Washbore	▼	Water Level during drilling
NMLC	NMLC size core drilling	▲-	Water Inflow
NQ/HQ	Wireline core drilling	-▲	Water Outflow
C	Casing		
M	Mud		

APPENDIX B

Laboratory Test Results

RESULTS OF ACID SULFATE SOIL ANALYSIS

3 samples supplied by C K Geotech on 31/10/2022. Lab Job No. N4100.
Analysis requested by Gary Peake. Your Job: CKG 1021.

PO Box 7020 KARIONG NSW 2250

Sample identification	EAL Lab Code	Texture	Moisture Content		pH_F and pH_{FOX}				Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS)		pH_{KCl}	Actual Acidity (Titratable Actual Acidity - TAA)	Retained Acidity		Non-treated soil: Acid Neutralising Capacity (ANC_{BT})		Non-treated soil: Net Acidity	Lime Calculation
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	pH_F	pH_{FOX}	pH change	Reaction	(% S_{Cr})	(mol H^+/t)		(mol H^+/t)	($\%S_{KAS}$)	(mol H^+/t)	(% $CaCO_3$)	(mol H^+/t)	(mol H^+/t)	(kg $CaCO_3$/t DW)
Method Info.		**	**		*(In-house method S21)*				*(In-house method S20)*		*(In-house method 16b)*		**		*(In-house method S14)*		**	**
BH1 0.4-0.6m	*N4100/1*	Coarse	3.6	0.04	8.25	4.91	-3.34	Low	< 0.005	0	5.99	2	..	..	..	..	2	0
BH1 0.8-1.0m	*N4100/2*	Coarse	3.8	0.04	5.69	4.21	-1.48	Low	< 0.005	0	5.24	11	..	..	..	..	11	1
BH1 1.8-2.0m	*N4100/3*	Coarse	3.5	0.04	6.11	5.12	-0.99	Low	..	..	..	..	..	..	..	..	..	..

NOTES:

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity) (Eq. 3.3; Sullivan et al. 2018 - full reference above).
   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an initial Acid Neutralising Capacity if verification testing is planned post-liming.
   The initial Acid Neutralising Capacity must be provided by the client to enable EAL to produce Verification Net Acidity and Liming calculations for post-limed soil materials.
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the pHKCl < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during initial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the initial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the initial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol H+/t; medium texture ≥ 0.06% S or 35 mol H+/t; fine texture ≥ 0.1% S or 62 mol H+/t) (Table 1.1; Sullivan et al. 2018 - full reference above)**
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol H+/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where pHKCl is < 4.5 or > 6.5, zero is reported for SNAS and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal/t&cs or on request).
21. Results relate to the samples tested.
22. This report was issued on 3/11/2022.

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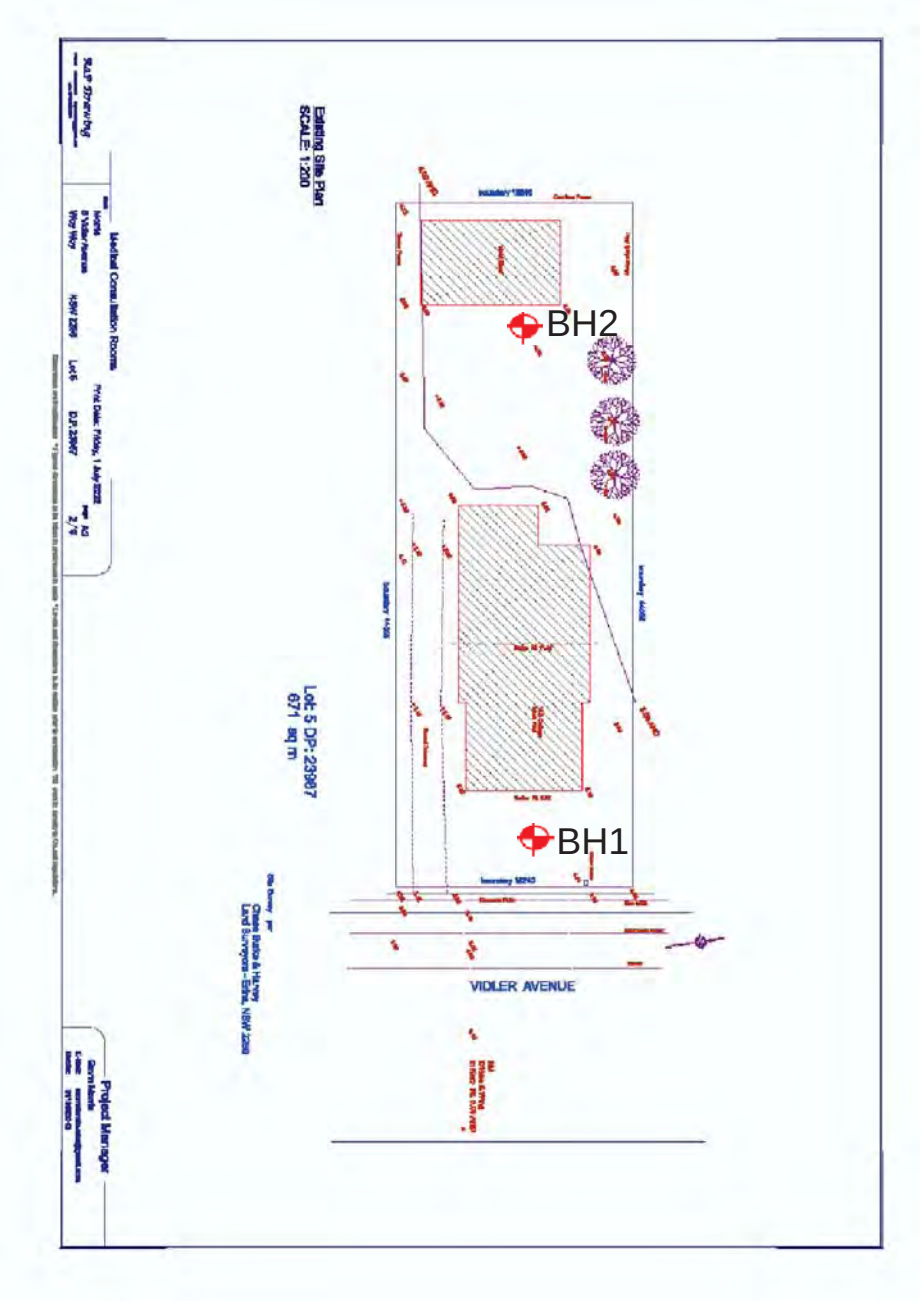
[redacted]



Legend

Approximate Location of Borehole

North

CKGeotech Pty Ltd

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Drawing No:	CKG 1021-01
Scale:	As Shown
Drawn By:	G.P.
Date:	7.11.22

Gavin Morris

Proposed Medical Consultation Rooms

No.5 Vidler Avenue, Woy Woy

SITE PLAN