MACQUARIE GEOTECH

27 March, 2023

Rodney & Mel Moore

6580 Sofala Road
Ilford NSW 2795

Attn: Rodney Moore

Geotechnical Investigation –Effluent Disposal Investigation for 6580 Sofala Road, Ilford, NSW

Assessment for On-site Effluent Disposal

Introduction

Macquarie Geotechnical Pty Ltd has undertaken a geotechnical investigation at the above site. This work was completed to evaluate the site for on-site disposal of domestic effluent in accordance with AS1547 - 2012 "Disposal Systems for Effluent from Domestic Premises", and the combined NSW government departments Environmental Health Protection Guidelines (EHPG); "On-site Sewage Management for Single Households" (1998).

Method

Three test boreholes were drilled and logged on the 15th February 2023 by an Engineering Geologist from our Bathurst office. The boreholes were drilled using a 4wd mounted Innovative Sampla 24LT with solid 125mm augers.

Results

The boreholes drilled at the site were used to determine the indicative permeability of the site soils. The assessment was based on the observed soil texture and structure and the indicative information in AS1547:2012 – Table 5.2.

The assessment is summarised in Table 3 below:

Table 3: Permeability Assessment

Test No.	Soil Category	Soil Texture	Soil Structure	Indicative Permeability (m/day)	Average Permeability (m/day)
BH01	2	SANDY LOAM	Weakly Structured	1.6	1.6
BH02	2	SANDY LOAM	Weakly Structured	1.6	
BH03	2	SANDY LOAM	Weakly Structured	1.6	

Based on the foregoing, a permeability of 1.6 m/day was adopted for design.

Discussion & Recommendations

The design effluent flow is based on the number of bedrooms in the house and assumes occupancy of one person per bedroom plus additional two persons.

With reference to Table H1 of AS1547:2012 and assuming a non-reticulated water supply and water reduction facilities are installed the flow allowance would be 140 L/person/day.

Water reduction facilities must include combined use of reduced flush 6/3 litre water closets, shower flow restrictors, aerator faucets, front load washing machines and flow control valves on all water-use outlets.

Based on the foregoing, the total design wastewater flow for this site is based on a three bedroom house.

This gives a total flow calculated as follows:

No. of Bedrooms = *3*

Wastewater Flow = *3x140 (1 person per bedroom) + 2 x 140 (2 additional persons)*

= *700L/day*

Therefore a total flow of 700 L/day was used to calculate wastewater disposal requirements.

We note that the effluent flow rates have been based on a three bedroom house. If a larger sized dwelling is to be constructed on this site please contact Macquarie Geotechnical for additional geotechnical advice.

Disposal Systems

We advise that the disposal of domestic effluent on-site is feasible for the subject site within the recommended disposal envelope indicated on the attached site plan using an absorption bed system with standard septic tank for primary treatment.

Permeability and Design Effluent Loading

As noted previously the permeability of the site soils is **1.6 m/day**.
With reference to Table L1 of AS1547:2012 a Design Loading Rate (DLR) of **6 mm/day** was adopted for design of the **Absorption Bed System**.

Absorption Bed System

Bed dimensions were determined from the following relationship:

$$L = \frac{Q}{DLR \times W}$$

Where:

L	=	length in m
Q	=	design daily flow in L/day
DLR	=	Design Loading Rate in mm/day
W	=	Width in m (3.0m for absorption bed)

Therefore:

$$L = \frac{700}{6 \times 3}$$

$$L = 38$$

Total bed length required is 38m which should be constructed as two of 19m beds, or three 13m beds, running parallel to a land contour, and effluent should be distributed evenly using a splitter box or sequencing valve.

Wet Weather Storage and Septic Tank

The water balance calculations are attached and indicate that wet weather storage would not be required.

Minimum septic tank sizes are prescribed in Table J1 of AS1547:2012. Based on the average daily flow rate, a septic tank with a minimum capacity of **3,500L** shall be used.

Installation and General Requirements

The following paragraphs outline installation and general requirements for the effluent disposal system.

- The area be sited within the recommended area indicated on the site plan (Figure 1 attached) in a location receiving good sunlight and exposure to prevailing breezes and where possible away from general access and play areas;
- A suitable diversion drain should be installed on the high side of the disposal area to minimise run on surface storm water flows.
- A storm water diversion berm should be constructed on the uphill perimeter of the tank top to prevent the infill of surface runoff into the tank.
- The area be located so that the following minimum horizontal set back distances are complied with:
- 3m from any property boundary or residence if higher than the disposal area; or 6m from any property boundary or residence if lower than the disposal area;
- 3m from any pathway or walkway;
- 6m from the edges of a swimming pool.
- 40m from any dams or water courses.
- Planting of suitable vegetation shall be carried out prior to commissioning of the system. The design assumes that a perennial pasture will be planted over the area; if alternative vegetation is contemplated then further geotechnical advice should be obtained.

Conclusion

The findings of our report were based on our fieldwork, in-situ testing, laboratory testing, technical assessment and local knowledge for this site.

We trust the foregoing is sufficient for your present purposes, and if you have any questions please contact the undersigned.

Yours sincerely
Yours sincerely

[redacted]

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Attached: Limitations of Geotechnical Site Investigation
Reactive Soils Notes

References: Australian Standard 1726 – 2017 Geotechnical Site Investigations
Australian Standard 2870 – 2011 *Residential Slabs and Footings*
Australian Standard 1547 – 2012 On-Site Effluent Disposal

LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

Scope of Services

This report has been prepared for the Client in accordance with the Services Engagement Form (SEF), between the Client and Macquarie Geotechnical.

Reliance on Data

Macquarie Geotechnical has relied upon data and other information provided by the Client and other individuals. Macquarie Geotechnical has not verified the accuracy or completeness of the data, except as otherwise stated in the report. Recommendations in the report are based on the data.

Macquarie Geotechnical will not be liable in relation to incorrect recommendations should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

Geotechnical Investigation

Findings of Geotechnical Investigations are based extensively on judgment and experience. Geotechnical reports are prepared to meet the specific needs of individual clients. This report was prepared expressly for the Client and expressly for the Clients purposes.

This report is based on a subsurface investigation, which was designed for project-specific factors. Unless further geotechnical advice is obtained this report cannot be applied to an adjacent site nor can it be used when the nature of any proposed development is changed.

Limitations of Site investigation

As a result of the limited number of sub-surface excavations or boreholes there is the possibility that variations may occur between test locations. The investigation undertaken is an estimate of the general profile of the subsurface conditions. The data derived from the investigation and laboratory testing are extrapolated across the site to form a geological model. This geological model infers the subsurface conditions and their likely behavior with regard to the proposed development.

The actual conditions at the site might differ from those inferred to exist.

No subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

Time Dependence

This report is based on conditions, which existed at the time of subsurface exploration. Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report.

Macquarie Geotechnical should be kept appraised of any such events, and should be consulted for further geotechnical advice if any changes are noted.

Avoid Misinterpretation

A geotechnical engineer or engineering geologist should be retained to work with other design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

No part of this report should be separated from the Final Report.

Sub-surface Logs

Sub-surface logs are developed by geoscientific professionals based upon their interpretation of field logs and laboratory evaluation of field samples. These logs should not under any circumstances be redrawn for inclusion in any drawings.

Geotechnical Involvement During Construction

During construction, excavation frequently exposes subsurface conditions. Geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendations and should make their own enquiries and obtain independent advice in relation to such matters

Macquarie Geotechnical assumes no responsibility and will not be liable to any other person or organisations for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisations arising from matters dealt with or conclusions expressed in the report.

Other limitations

Macquarie Geotechnical will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Other Information

For further information reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, 1987.

DESIGN & MAINTENANCE PRECAUTIONS FOR REACTIVE SOILS

These precautions apply to residential masonry buildings founded on reactive clay soils. Such soils are prone to shrink/swell movements due to moisture variations caused by natural or artificial causes.

The owner should appreciate that on reactive clays it is virtually impossible to design an economic foundation system that will totally prevent movement. Some minor aesthetic cracking, while undesirable, is likely to occur in a significant proportion of houses. The basic design philosophy is to minimise any cracking and provide a serviceable structure. It is thus a compromise between economy and performance.

The following design precautions are recommended to minimise cracking from reactive soil movements:

- All surface water runoff must be directed away from the building by appropriate grading in order to prevent ponding near foundations. Site drainage should form part of the building contract. Leaking plumbing or blocked drains should be repaired promptly and site grading maintained to prevent ponding near foundations.
- Peripheral pathways, with impermeable underliner, should be provided around the building to improve site drainage and assist in the stabilisation of moisture conditions near foundations.
- All brickwork should be suitably articulated into discrete units to accommodate the expected movements. Brickwork over doors and windows should be avoided.
- Internal and external walls should be arranged along straight lines, where possible. All house drains and water pipes should be provided with sufficient flexibility to accommodate the expected differential movements (between foundation and uncovered outside area) at the level of the service.
- The extension of services through slabs should be avoided where possible in order to prevent hidden leaks under the slab area. Most plumbing fixtures can be arranged to exit through outside walls.
- Septic systems should be located so as not to influence the house or neighbouring foundations.
- Subgrades beneath elevated and well-ventilated floors should be covered with an impermeable liner (with protective soil blanket) to minimise excessive desiccation.

In addition, certain other site management precautions must be adhered to during the life of the structure. These precautions generally relate to the control of abnormal moisture variations due to the effects of drainage and vegetation. Recommendations on site management precautions are contained in the following section.

- Leaking plumbing or blocked drains should be repaired promptly and site grading maintained to prevent ponding near foundations. Garden watering, particularly by fixed systems, should be controlled to avoid over-watering. Proper garden maintenance should produce year round uniform moisture conditions.
- Trees and some shrubs can cause a substantial drying and shrinking of reactive clays, additional to that experienced in a drought or a long dry spell. This effect is most likely to result in damage when added to the drying effects from a drought or a long dry spell. Trees should be planted at a substantial distance from the house. The distance depends upon the species and soil conditions, but generally a distance equal to 75% of the mature height is a minimum.
- Problems during a drought can be minimised by extensive pruning (thus reducing water demand) and/or providing trees with adequate water. Frequent moderate watering during dry periods should minimise the risk of the tree extracting excessive moisture from beneath the foundation of the house. The owner should also immediately undertake this action if brickwork cracking due to tree drying is noticed. Most reactive clay failures can be minimised by controlling the combined drying effects of trees and drought.

Reference should be made to Appendix A of AS2870.2 "Residential Slabs. and Footings" and CSIRO 10-91 "A Guide to Home Owners on Foundation Maintenance and Footing Performance" for more detailed recommendations regarding Design and Site management precautions.

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Geotechnical Explanatory Notes

Geotechnical Explanatory Notes

Soil Description

In engineering terms soil includes every type of uncemented or partially cemented inorganic material found in the ground. In practice, if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters, with secondary textures in lower case. The dominant feature is assessed from the Unified Soil Classification system and a soil symbol is used to define a soil layer as follows:

UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as, sieve analysis, liquid limit and plasticity index.

USC Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
OL	Organic soil of low plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peaty Soil

MOISTURE CONDITION

Dry – Cohesive soils are friable or powdery
Cohesionless soil grains are free-running

Moist – Soil feels cool, darkened in colour
Cohesive soils can be moulded
Cohesionless soil grains tend to adhere

Wet – Cohesive soils usually weakened
Free water forms on hands when handling

For cohesive soils the following codes may also be used:

MC>PL	Moisture Content greater than the Plastic Limit.
MC~PL	Moisture Content near the Plastic Limit.
MC<PL	Moisture Content less than the Plastic Limit.

PLASTICITY

The potential for soil to undergo change in volume with moisture change is assessed from its degree of plasticity. The classification of the degree of plasticity in terms of the Liquid Limit (LL) is as follows:

Description of Plasticity	LL (%)
Low	<35
Medium	35 to 50
High	>50

COHESIVE SOILS – CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by the pocket penetrometer values and by resistance to deformation to hand moulding.

A Pocket Penetrometer may be used in the field or the laboratory to provide approximate assessment of unconfined compressive strength of cohesive soils. The values are recorded in kPa, as follows:

Strength	Symbol	Pocket Penetrometer Reading (kPa)
Very Soft	VS	< 25
Soft	S	20 to 50
Firm	F	50 to 100
Stiff	St	100 to 200
Very Stiff	VSt	200 to 400
Hard	H	> 400

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COHESIONLESS SOILS – RELATIVE DENSITY

Relative density terms such as very loose, loose, medium, dense and very dense are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values. Other condition terms, such as friable, powdery or crumbly may also be used.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289, 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm are recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded. SPT correlations may be subject to corrections for overburden pressure and equipment type.

Term	Symbol	Density Index	N Value (blows/0.3 m)
Very Loose	VL	0 to 15	0 to 4
Loose	L	15 to 35	4 to 10
Medium Dense	MD	35 to 65	10 to 30
Dense	D	65 to 85	30 to 50
Very Dense	VD	>85	>50

COHESIONLESS (GRANULAR) SOILS PARTICLE SIZE DESCRIPTIVE TERMS

Name	Subdivision	Size
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	19 mm to 63 mm
	medium	6.7 mm to 19 mm
	fine	2.36 mm to 6.7 mm
Sand	coarse	600 μm to 2.36 mm
	medium	210 μm to 600 μm
	fine	75 μm to 210 μm

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Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) or Total Core Recovery (TCR) is given where:

$$\text{RQD (\%)} = \frac{\text{Sum of Axial lengths of core} > \text{100mm long}}{\text{total length considered}}$$

Term	Abbreviation / Symbol	Uniaxial Compressive Strength*	Point Load Strength Index $Is_{(50)}$ MPa
Very Low Strength	VL	0.6 to 2.0	0.03 to 0.1
Low Strength	L	2 to 6	0.1 to 0.3
Medium Strength	M	6 to 20	0.3 to 1
High Strength	H	20 to 60	1 to 3
Very High Strength	VH	60 to 200	3 to 10
Extremely High Strength	EH	More than 200	More than 10

$$\text{TCR (\%)} = \frac{\text{length of core recovered}}{\text{length of core run}}$$

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ROCK STRENGTH

Rock strength is described using AS1726 (2017) and ISRM - Commission on Standardisation of Laboratory and Field Tests, "Suggested method of determining the Uniaxial Compressive Strength of Rock materials and the Point Load Index", as follows:

Term	Symbol	Uniaxial Compressive Strength (MPa)	Point Load Index $Is_{(50)}$ (MPa)
Very Low	VL	0.6 to 2	0.03 to 0.1
Low	L	2 to 6	0.1 to 0.3
Medium	M	6 to 20	0.3 to 1
High	H	20 to 60	1 to 3
Very High	VH	60 to 200	3 to 10
Extremely High	EH	More than 200	>10

ROCK MATERIAL WEATHERING

Rock weathering is described using the following abbreviation and definitions used in AS1726 (2017):

Abbreviation	Term
RS	Residual soil
XW	Extremely weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
FR	Fresh

DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

Term	Defect Spacing	Bedding
Extremely closely spaced	<6 mm	Thinly Laminated
	6 to 20 mm	Laminated
Very closely spaced	20 to 60 mm	Very Thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2 m	Thick
Very widely spaced	>2 m	Very Thick

DEFECT DESCRIPTION

Type:	Description
B	Bedding
F	Fault
C	Cleavage
J	Joint
S	Shear Zone
D	Drill break

Planarity/Roughness:

Class	Description
I	rough or irregular, stepped
II	smooth, stepped
III	slickensided, stepped
IV	rough or irregular, undulating
V	smooth, undulating
VI	slickensided, undulating
VII	rough or irregular, planar
VIII	smooth, planar
IX	slickensided, planar

The inclination if defects are measured from perpendicular to the core axis.

WATER

▽ Water level at date shown ◁ Partial water loss

▷ Water inflow ◀ Complete water loss

Groundwater not observed: The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

Groundwater not encountered: The borehole/test pit was dry soon after excavation, however groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

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Graphic Symbols for Soils and Rocks

Typical symbols for soils and rocks are as follows. Combinations of these symbols may be used to indicated mixed materials such as clayey sand.

Soil Symbols

Main components

- CLAY - CL
- CLAY - CH
- SAND
- GRAVEL
- BOULDERS / COBBLES
- TOPSOIL
- SILT

Minor Components

- Clayey
- Silty
- Sandy
- Gravelly

Other

- FILL
- BITUMEN
- CONCRETE

Rock Symbols

Sedimentary Rocks

- SANDSTONE
- SILTSTONE
- CLAYSTONE, MUDSTONE
- SHALE
- LAMINITE
- ASPHALT
- LIMESTONE
- CONGLOMERATE

Igneous Rocks

- GRANITE
- BASALT
- UNDIFFERENTIATED IGNEOUS

Metamorphic Rocks

- SLATE, PHYLLITE, SCHIST
- GNEISS
- QUARTZITE

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DEFECT SPACING

The terms relate to spacing of natural fractures in NMLC, NQ and HQ diamond drill cores and have the following definitions:

Defect Spacing (mm)	Terms Used to Describe Defect Spacing[1]
>2000	Very widely spaced
600 – 2000	Widely spaced
200 – 600	Moderately spaced
60 – 200	Closely spaced
20 – 60	Very closely spaced
<20	Extremely closely spaced

[1]After ISO/CD14689 and ISRM.

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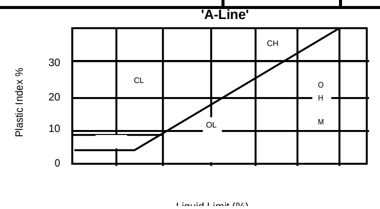
Summary of Soil Logging Procedures

Coarse Material: grain size - colour - particle shape - secondary components - minor constituents - moisture condition - relative density - origin - additional observations.

Fine Material: plasticity - colour - secondary components - minor constituents - moisture w.r.t. plasticity - consistency - origin - additional observations.

Guide to the Description, Identification and Classification of Soils

Major Divisions				SYMBOL	Typical Names
> 200mm	BOULDERS				
60 to 200mm	COBBLES				
COARSE GRAINED SOILS	More than 65% by dry mass less than 63mm is greater than 0.075mm	GRAVEL	More than 50% of coarse fraction > 2.36mm	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
		Gravelly Soils		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures
		SANDS	More than 50% of coarse fraction < 2.36mm	SW	Well-graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
		Sandy Soils		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED	More than 35% by dry mass less than 60mm is less than 0.076mm	Liquid Limit < 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
				OL	Organic silts and organic silty clays of low plasticity.
		Liquid Limit > 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays.
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				Pt	Peat and other highly organic soils.



Grain sizes	
Gravel	Sand
Coarse – 63 to 19mm	Coarse – 2.36 to 0.6mm
Medium – 19 to 6.7 mm	Medium – 0.6 to 0.21mm
Fine – 6.7 to 2.36mm	Fine – 0.21 to 0.075mm

GEOLOGICAL ORIGIN:-

Fill - artificial soils / deposits
Alluvial - soils deposited by the action of water
Aeolian - soils deposited by the action of wind
Topsoil - soils supporting plant life containing significant organic content
Residual - soils derived from in situ weathering of parent rock.
Colluvial - transported debris usually unsorted, loose and deposited

Field Identification of Fine Grained Soils - Silt or Clay?

Dry Strength - Allow the soil to dry completely and then test its strength by breaking and crumbling between the fingers.
High dry strength - Clays; Very slight dry strength - Silts.

Toughness Test - the soil is rolled by hand into a thread about 3mm in diameter. The thread is then folded and re-rolled repeatedly until it has dried sufficiently to break into lumps. In this condition inorganic clays are fairly stiff and tough while inorganic silts produce a weak and often soft thread which may be difficult to form and readily breaks and crumbles.

Dilatancy Test - Add sufficient water to the soil, held in the palm of the hand, to make it soft but not sticky. Shake horizontally, striking vigorously against the other hand several times. Dilatancy is indicated by the appearance of a shiny film on the surface of the soil. If the soil is then squeezed or pressed with the fingers, the surface becomes dull as the soil stiffens and eventually crumbles. These reactions are pronounced only for predominantly silt size material. Plastic clays give no reaction.

Descriptive Terms for Material Portions

COARSE GRAINED SOILS		FINE GRAINED SOILS	
% Fines	*Term/Modifier*	*% Coarse*	*Term/Modifier*
≤ 5	Omit, or use "trace"	≤ 15	Omit, or use "trace"
> 5, ≤ 12	"with clay/silt" as applicable	> 15, ≤ 30	"with sand/gravel" as applicable
> 12	Prefix soil as "silty/clayey"	> 30	Prefix as "sandy/gravelly"

Moisture Condition

for non-cohesive soils:

- Dry - runs freely through fingers.
- Moist - does not run freely but no free water visible on soil surface.
- Wet - free water visible on soil surface.

for cohesive soils:

- MC > PL Moisture content estimated to be greater than the plastic limit.
- MC ~ PL Moisture content estimated to be approximately equal to the plastic limit. The soil can be moulded
- MC < PL Moisture content estimated to be less than the plastic limit. The soil is hard and friable, or powdery.

The plastic limit (PL) is defined as the moisture content (percentage) at which the soil crumbles when rolled into threads of 3mm dia.

Consistency - For Clays & Silts

Description	*UCS (kPa)*	*Field guide to consistency*
Very soft	< 25	Exudes between the fingers when squeezed in hand
Soft	25 - 50	Can be moulded by light finger pressure
Firm	50 - 100	Can be moulded by strong finger pressure
Stiff	100 - 200	Cannot be moulded by fingers. Can be indented by thumb.
Very stiff	200 - 400	Can be indented by thumb nail
Hard	> 400	Can be indented with difficulty by thumb nail
Friable	-	Crumbles or powders when scraped by thumbnail

Relative Density for Gravels and Sands

Description	*SPT "N" Value*	*Density Index (ID) Range %*
Very loose	0 - 4	< 15
Loose	4 - 10	15 - 35
Medium dense	10 - 30	35 - 65
Dense	30 - 50	65 - 85
Very dense	> 50	> 85

Summary of Rock Logging Procedures

Description order: constituents - rock name - grain size - colour - weathering - strength - minor constituents - additional observations.
- minor constituents - moisture w.r.t. plasticity - consistency - origin - additional observations.

Definition - Sedimentary Rock

Conglomerate	more than 50% of the rock consists of gravel (>2mm) sized fragments
Sandstone	more than 50% of the rock consists of sand (0.06 to 2mm) sized grains
Siltstone	more than 50% of the rock consists of silt sized granular particles and the rock is not laminated
Claystone	more than 50% of the rock consists of clay or mica material and the rock is not laminated
Shale	more than 50% of the rock consists of clay or silt sized particles and the rock is laminated

Weathering

Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a change in volume but the soil has not significantly transported.
Extremely Weathered	EW	Rock is weathered to such an extent that it has 'soil' properties; ie. it either disintegrates or can be remoulded, in water.
Distinctly Weathered	DW	**Highly Weathered (HW)** - Rock is wholly discoloured and rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals **Moderately Weathered (MW)** - The whole of the rock is discoloured, usually by iron staining and bleaching. Shows little or no change in rock strength.
Slightly Weathered	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition or staining.

Stratification

thinly laminated	<6mm	medium bedded	0.2 - 0.6m
laminated	6 - 20mm	thickly bedded	0.6 - 2m
very thinly bedded	20 - 60mm	very thickly bedded	>2m
thinly bedded	60mm - 0.2m		

Discontinuities

order of description: depth - type - orientation - spacing - roughness / planarity - thickness - coating

	Type	Class	Roughness/Planarity	Class	Roughness/Planarity
B	Bedding	I	rough or irregular, stepped	VI	slickensided, undulating
F	Fault	II	smooth, stepped	VII	rough or irregular, planar
C	Cleavage	III	slickensided, stepped	VIII	smooth, planar
J	Joint	IV	rough or irregular, undulating	IX	slickensided, planar
S	Shear Zone	V	smooth, undulating		
D	Drill break				

Rock Strength

Term		Is (50)	Field Guide
		0.03	
Very low	VL		Material crumbles under firm blows with sharp end of pick; can be peeled with knive. Pieces up to 30mm thick can be broken by finger pressure.
		0.1	
Low	L		A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
		0.3	
Medium	M		A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.
		1	
High	H		A piece of core 150 mm long x 50 mm dia. core cannot be broken by unaided hands, can be slightly scratched or scored with knife.
		3	
Very High	VH		A piece of core 150 mm long x 50 mm dia. May be broken readily with hand held hammer. Cannot be scratched with pen knife.
		10	
Extremely High	EH		A piece of core 150 mm long x 50 mm dia. Is difficult to break with hand held hammer. Rings when struck with a hammer.

* - rock strength defined by point load strength (Is 50) in direction normal to bedding

Degree of fracturing

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 lengths
slightly fractured	Core lengths are generally 300mm - 1000mm with occasional longer sections and shorter sections of 100mm -- 300mm.
unbroken	The core does not contain any fracture.

- spacing of all types of natural fractures, but not artificial breaks, in cored bores.

The fracture spacing is shown where applicable and the Rock Quality Designation is given by: RQD (%) = sum of unbroken core pieces 100 mm or longer

Appendix B – Site Plan & Test Locations

MACQUARIE GEOTECH

3 Watt Drive, Bathurst NSW 2795
P: 02 6332 2011 F: 02 6334 4213 E: macgeo@macgeo.com.au

Client: Rod Moore			
Project: 6580 Sofala Road			
Location: Ilford, NSW			
Drawn: D.O'Donnell	Checked: J.Boyle	27-03-2023	

0 15 30 45

Metres - Scale 1:500

Vertical to Horizontal Scale 1 : 1
Co-ordinate Reference System - EPSG: 4326 WGS: 84

JOB NO	B21755

Macquarie Geotechnical Ltd
Geotechnical Investigation Locality Map

Drawing Number: B21755 - Rev0

Appendix C – Effluent Disposal Information

Absorption Bed Water Balance Calculations								
Month	Evaporation mm	ET =0.75 Evaporation mm	Rainfall mm	Rr=0.75R Rainfall mm	LTAR (DLR*Days) mm	Disposal Rate mm	Application Rate Litres	Area m^2
Jan	211.00	158.25	66.10	49.58	186	294.68	17050	57.86
Feb	165.00	123.75	58.10	43.58	168	248.18	15400	62.05
Mar	140.00	105.00	51.50	38.63	186	252.38	17050	67.56
April	84.00	63.00	42.60	31.95	180	211.05	16500	78.18
May	50.00	37.50	44.20	33.15	186	190.35	17050	89.57
June	33.00	24.75	46.80	35.10	180	169.65	16500	97.26
July	37.00	27.75	44.80	33.60	186	180.15	17050	94.64
August	56.00	42.00	45.70	34.28	186	193.73	17050	88.01
Sept	78.00	58.50	46.10	34.58	180	203.93	16500	80.91
October	121.00	90.75	59.20	44.40	186	232.35	17050	73.38
November	159.00	119.25	56.80	42.60	180	256.65	16500	64.29
December	211.00	158.25	60.00	45.00	186	299.25	17050	56.98
Av Area								**75.89**

Month	Trial	Application Rate mm	Disposal Rate mm	Net Storage (S) mm	Depth Increase S/n mm	Depth at End of Month	Increase mm	Computed Depth mm
December	105.00							
Jan		162.38	294.68	-132.29	-440.98	0	-440.98	0.00
Feb		146.67	248.18	-101.51	-338.36		-338.36	0.00
Mar		162.38	252.38	-89.99	-299.98		-299.98	0.00
April		157.14	211.05	-53.91	-179.69		-179.69	0.00
May		162.38	190.35	-27.97	-93.23		-93.23	0.00
June		162.38	169.65	-7.27	-24.23		-24.23	0.00
July		162.38	180.15	-17.77	-59.23		-59.23	0.00
August		162.38	193.73	-31.34	-104.48		-104.48	0.00
Sept		157.14	203.93	-46.78	-155.94		-155.94	0.00
October		162.38	232.35	-69.97	-233.23		-233.23	0.00
November		157.14	256.65	-99.51	-331.69		-331.69	0.00
December		162.38	299.25	-136.87	-456.23		-456.23	0.00