

23 November 2021  
Our ref: KA/C12356

Southern Region Land Engineering  
Via email: gregtodd.srle@gmail.com

**Attention: Greg Todd**

**PROPOSED RURAL SUBDIVISION  
407 CROOKWELL ROAD, KINGSDALE, NSW  
EFFLUENT DISPOSAL – SITE AND SOIL EVALUATION**

**1 Introduction**

At the request of Southern Region Land Engineering, ACT Geotechnical Engineers Pty. Ltd carried out an effluent disposal assessment to AS1547 "On-Site domestic wastewater management", for the proposed rural subdivision at 407 Crookwell Road, in Kingsdale, NSW.

The project comprises a new residential subdivision. However, Lots 22 to 30 cannot be connected to the town sewer and must have on-site wastewater disposal, so a NorBE assessment is required.

This Site and Soil Evaluation was conducted in general accordance with AS 1547:2012 - "On-site domestic wastewater management", "Designing and Installing On-Site Wastewater Systems: A WaterNSW Current Recommended Practice: 2019", and "The Environment & Protection Guidelines 1998 – On-Site Sewage Management for Single Households" (Silver Book).

The site details and assumptions made to assess the requirements of the effluent disposal system are outlined in Table 1 below.

The details of the site and proposed works are summarized in Table 1 below.

**TABLE 1 – SITE DETAILS**

<b>Area of Lots</b>	4000m <sup>2</sup> to 1.43 ha.
<b>Rainfall Station</b>	070263 – Goulburn Tafe NSW
<b>Evaporation Station</b>	070351 – Canberra Airport

**2 Effluent Disposal Site and Soil Assessment**

The proposed locations were assessed and the site limitations are addressed below.

The 1:100,000 Goulburn Geology Map documents the area to be covered by Silurian Age Mount Fairy group and Bishopthorpe Suite bedrock, comprising bishopthorpe dolerite and gabbro, rhyolitic volcanic sandstone, siltstone and mudstone.

## 2.1 Site Limitation Assessment

Table 2 below is a site assessment of the proposed lot locations, and have been assessed using Table 1 from "On-site Sewage Management for Single Households". The table used for this assessment is attached to this report.

**TABLE 2 – SITE ASSESSMENT**

Borehole/ Location	Slope/ Direction	Exposure to sun/wind	Landform/Slope	Erosion Potential	Presence of Fill	Rock Outcrops (%)	Groundwater
1A	~5° E	High	Waxing Divergent/Planar	Low/Not evident	Not found	<10%	Not encountered
2A	5-10° N/NW	High	Waxing Divergent/Planar	Low/Not evident	Not found	<10%	Not encountered
3A	<5° N/W	High	Linear Planar	Low/Not evident	Not found	<10%	Not encountered
4A	5-10° NW	High	Linear Planar	Low/Not evident	Not found	<10%	Not encountered

## 2.2 Sub-surface Conditions

To establish the subsurface conditions, four (4) test holes were drilled at client-provided locations around the proposed subdivision. Figure 1 shows the site locality, while Figures 2 and 3 are aerial photographs showing the location of the investigation boreholes. The subsurface profiles were logged in terms of the Unified Soil Classification System (USCS). The borehole logs can be found in Appendix B.

### 2.2.1 Site Soil Properties

Based on the soil encountered and in accordance with AS1547:2012 – "Disposal Systems for Effluent From Domestic Premises" (Reference 2), the properties of the most limiting material are summarised in Table 3 below.

**TABLE 3 – SOIL ASSESSMENT**

Borehole / Location	Depth of Borehole (m)	Depth of Topsoil (m)	Depth of Bedrock (m)	Soil Texture	Soil Structure	Approx. Bulk Density (g/cm <sup>3</sup> )	Indicative Permeability (m/day)
1A	0.8	0.1	0.8	Light Clays	Moderately Structured	1.28	0.06 – 0.12
2A	0.3	0.2	0.3	Medium to Heavy Clays / Bedrock	Massive	1.4	<0.06
3A	1.0	0.1	>1.0	Light Clays	Moderately Structured	1.25	0.06 – 0.12
4A	1.2	0.1	>1.2	Light Clays	Weakly Structured	1.25	<0.06

### 2.2.3 Laboratory Results

Three (3) representative samples were sent to a NATA accredited environmental testing laboratory for Phosphorous Sorption Capacity and bulk density. The results of these tests are summarized in Table 4. The Laboratory Certificates of Analysis are included in Appendix C.

**TABLE 4 – LABORATORY TEST RESULTS ON SOIL PROPERTIES**

Soil Test	Borehole / Sample Depth		
	1A (0.0m – 0.2m)	1A (0.3m – 0.5m)	3A (0.4m – 0.6m)
Phosphorous Sorption Capacity (mg/kg)	4,000	11,000	13,400
Bulk Density (g/cm <sup>3</sup> )	1.16	1.28	1.25

### 3 Effluent Disposal Recommendations

The local council should be consulted regarding its on-site sewage management policy and required minimum buffer distances (depending on the proposed effluent disposal system).

A fence should be placed around the effluent disposal areas if there is a risk of children, animals or vehicles coming into the area. Signage, complying with AS1319 shall be placed in at least two places at the boundary of the application area, clearly visible to property uses, with wording such as "Recycled Water – Avoid Contact – DO NOT DRINK".

The treated effluent is not suitable for vegetable gardens or areas where people can come in contact with the effluent.

The areas should not be used for any purposes that compromise the effectiveness of the system or access for future maintenance purposes.

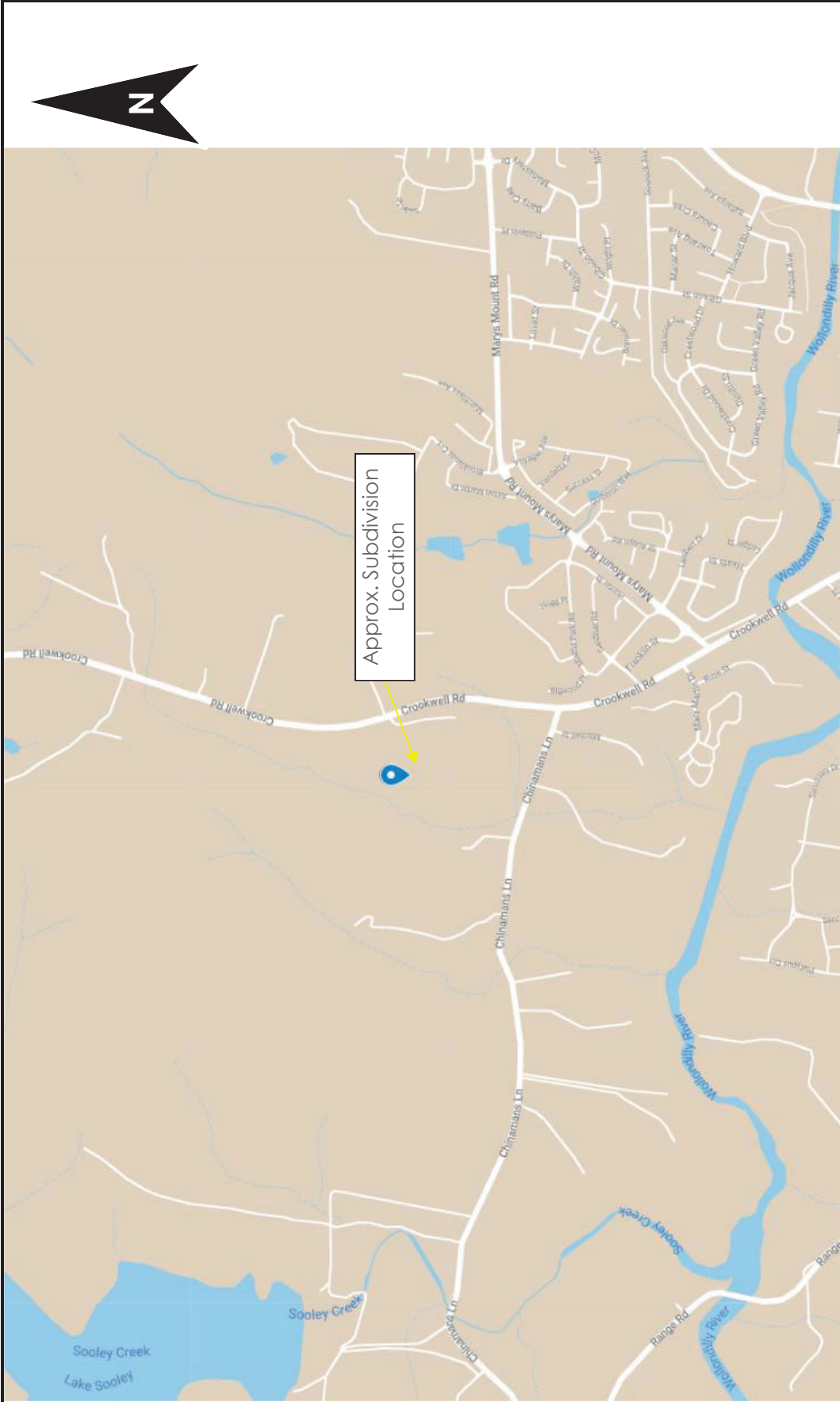
Should you require any further information regarding this report, please do not hesitate to contact our office.

Yours faithfully

**ACT Geotechnical Engineers Pty. Ltd.**



Jeremy Murray  
Director  
Senior Geotechnical Engineer  
Attachments: Figures 1 to 3, Appendix A to D



**SOUTHERN REGION LAND ENGINEERING  
RURAL SUBDIVISION – 407 CROOKWELL ROAD, KINGSDALE, NSW  
SITE LOCALITY**

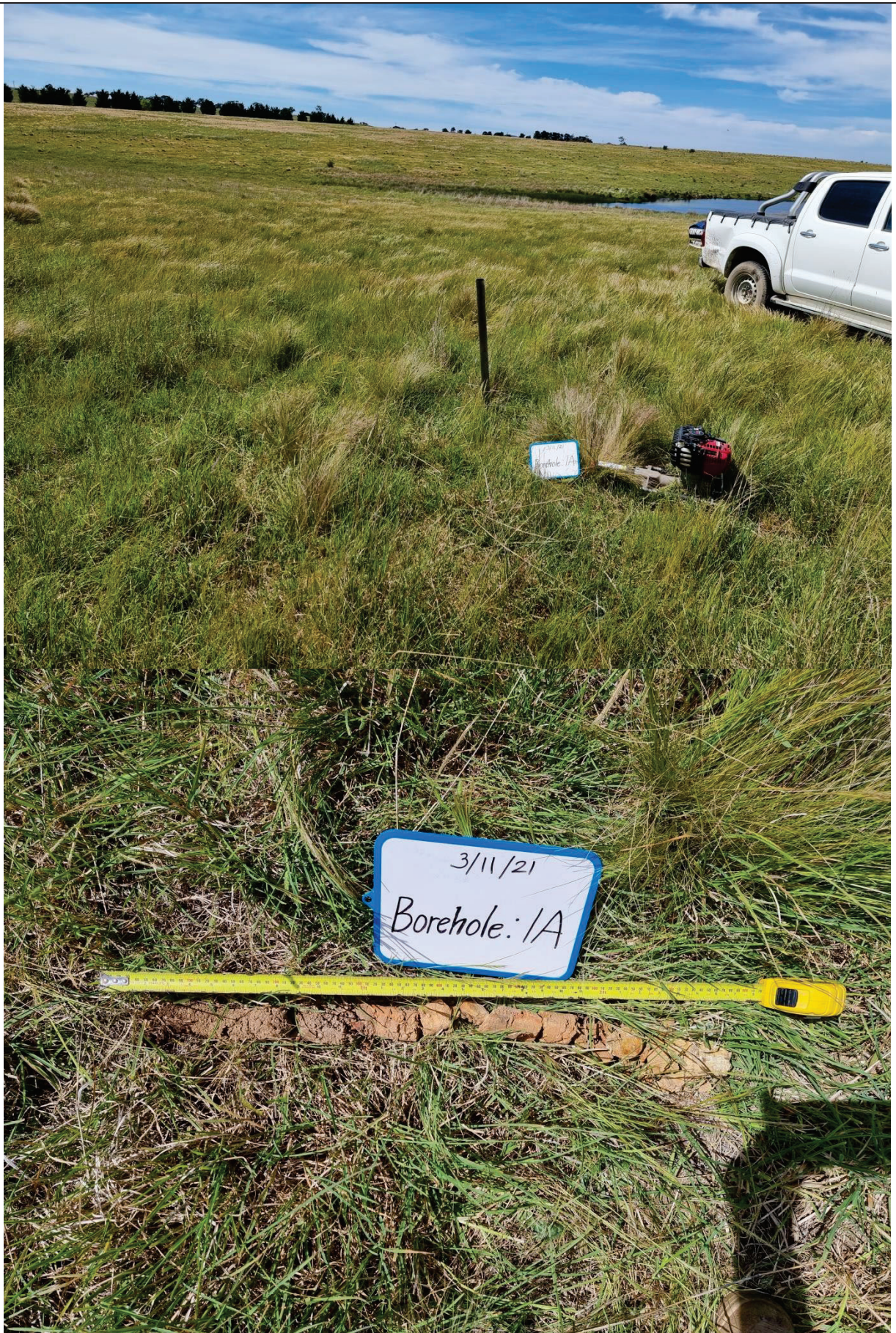




SOUTHERN REGION LAND ENGINEERING  
 RURAL SUBDIVISION – 407 CROOKWELL ROAD, KINGSDALE, NSW  
 AERIAL PHOTOGRAPH AND BOREHOLE LOCATIONS

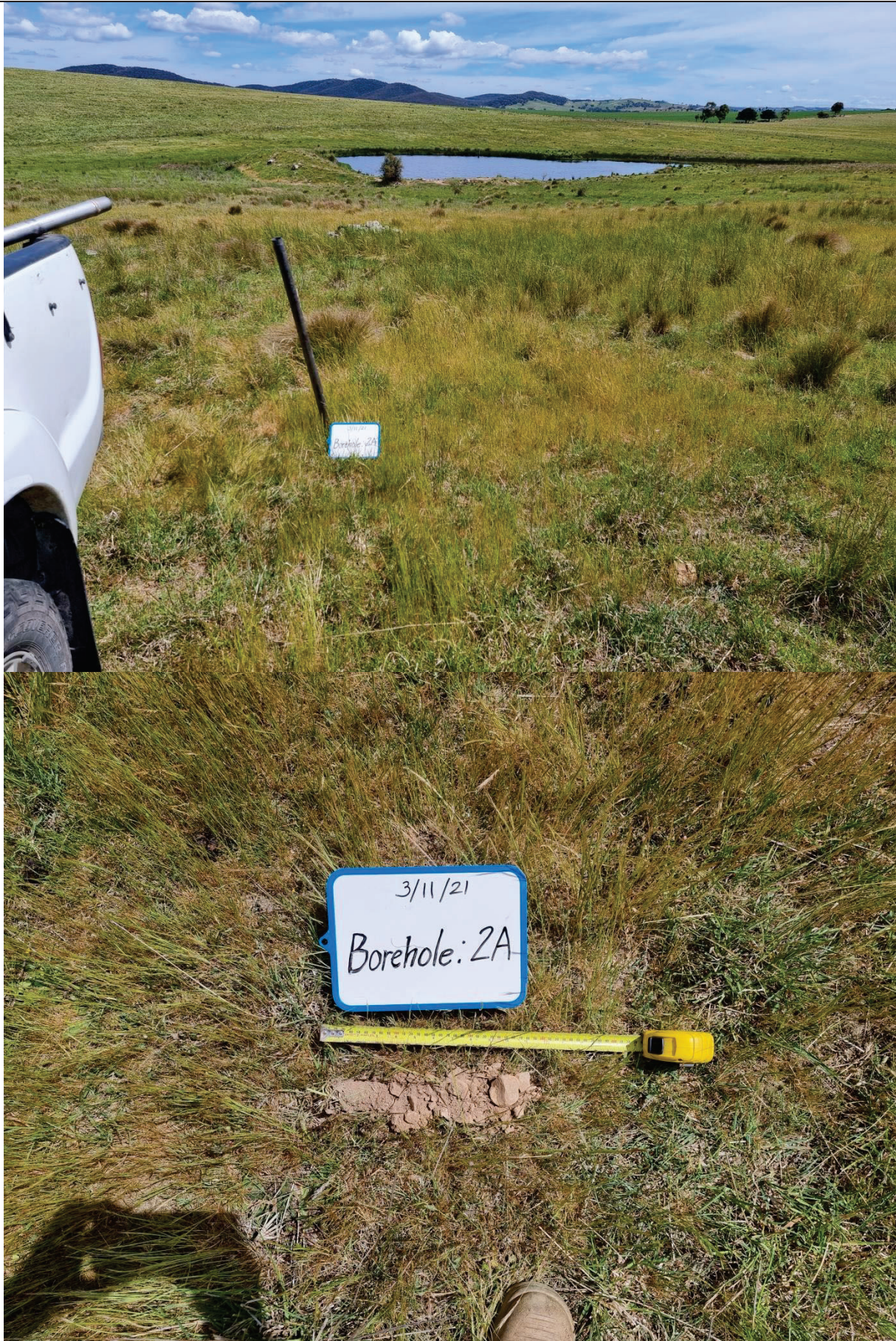
**APPENDIX A**  
**Location and Soil Core Photos**





**SOUTHERN REGION LAND ENGINEERING  
RURAL SUBDIVISION – 407 CROOKWELL ROAD, KINGSDALE, NSW  
LOCATION AND SOIL CORE PHOTOS (1A)**





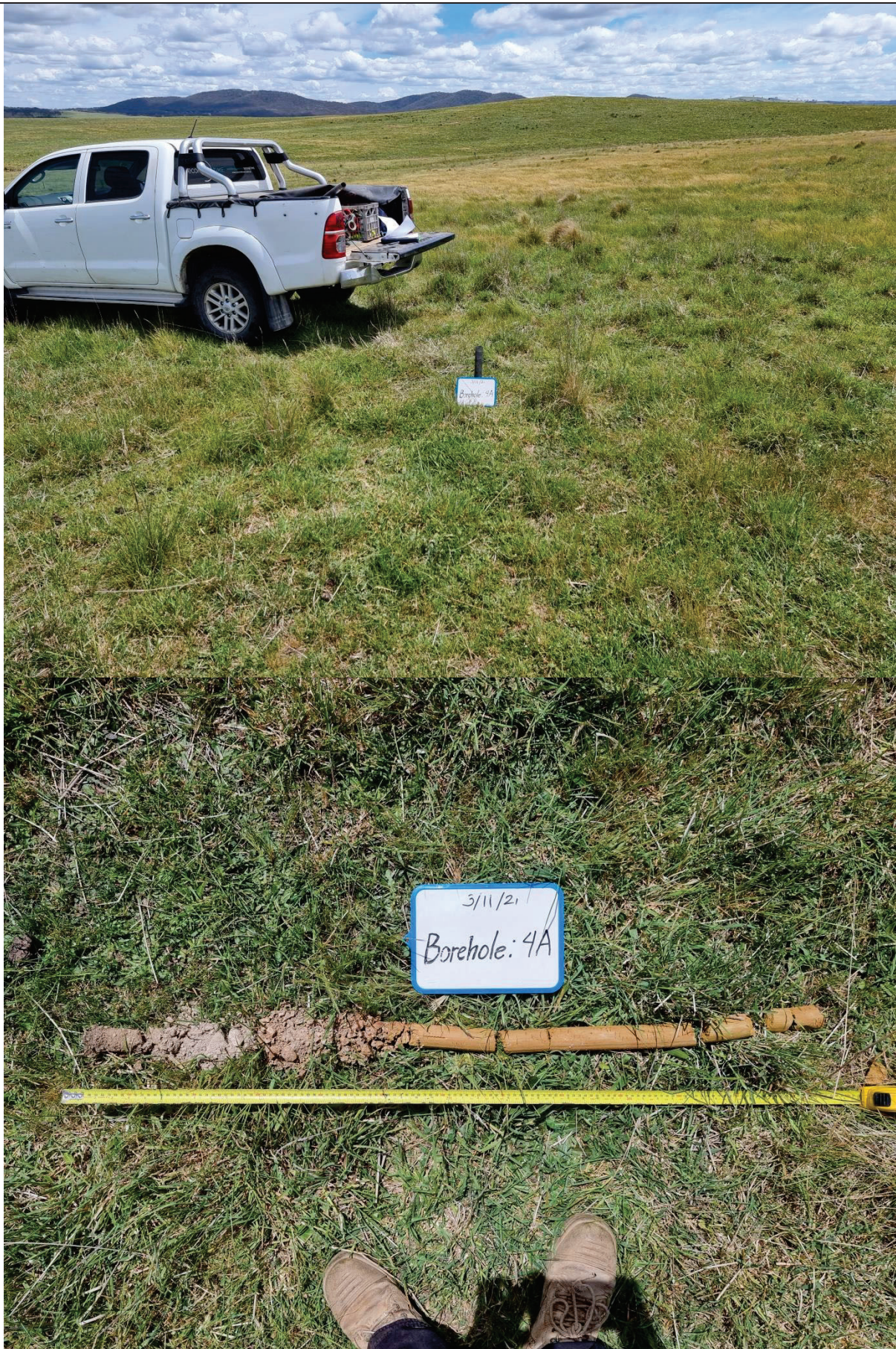
**SOUTHERN REGION LAND ENGINEERING  
RURAL SUBDIVISION – 407 CROOKWELL ROAD, KINGSDALE, NSW  
LOCATION AND SOIL CORE PHOTOS (2A)**





**SOUTHERN REGION LAND ENGINEERING  
RURAL SUBDIVISION – 407 CROOKWELL ROAD, KINGSDALE, NSW  
LOCATION AND SOIL CORE PHOTOS (3A)**





**SOUTHERN REGION LAND ENGINEERING  
RURAL SUBDIVISION – 407 CROOKWELL ROAD, KINGSDALE, NSW  
LOCATION AND SOIL CORE PHOTOS (4A)**



**APPENDIX B**  
**Borehole Logs 1A to 4A**

# Borehole Log

Borehole No.	<b>1A</b>
Sheet	1 of 1
Job No.	<b>C12356</b>
Location :	SEE REPORT
Collar Level :	Not Known
Angle From Vertical :	0°
Bearing :	N.A.

CLIENT:	SOUTHERN REGION LAND ENGINEERING
PROJECT	RURAL SUBDIVISION 407 CROOKWELL ROAD, KINGS DALE, NSW
Equipment Type :	PUSH TUBE DRILL
Hole Diameter :	50mm

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure <small>Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure</small>	Consistency or Relative Density	Field Test Results	Geological Profile
		0.1		SM	Silty SAND; fine to medium grained sand, low plasticity silt, brown, dry, with grass rootlets.	LOOSE		TOPSOIL
		0.3		SM	Silty SAND: fine to medium grained sand, low plasticity silt, grey-brown, dry.	LOOSE		SLOPEWASH
		0.6		CL-CH	Sandy Gravelly CLAY; medium plasticity clay, fine to coarse sand, fine to coarse gravel, orange-brown, dry.	VERY STIFF		RESIDUAL SOIL
		0.8			Extremely to Highly Weathered (EW-HW) SILTSTONE; fine to medium grained, light brown, dry.	EXTREMELY WEAK TO VERY WEAK		BEDROCK
		1.0			BOREHOLE TERMINATED AT 0.8m refusal in bedrock			
		1.5						

Logged By :	KA	Date :	23/11/21	Checked By :	JM	Date :	23/11/21
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BOREHOLE/EXCAVATION LOG C12356.GPJ ACT GEO.GDT 23/11/21



# Borehole Log

Borehole No.	<b>2A</b>
Sheet	1 of 1
Job No.	<b>C12356</b>
Location : SEE REPORT	
Collar Level : Not Known Angle From Vertical : 0° Bearing : N.A.	

CLIENT:	<b>SOUTHERN REGION LAND ENGINEERING</b>
PROJECT	<b>RURAL SUBDIVISION 407 CROOKWELL ROAD, KINGS DALE, NSW</b>
Equipment Type : PUSH TUBE DRILL Hole Diameter : 50mm	

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure <small>Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure</small>	Consistency or Relative Density	Field Test Results	Geological Profile
		0.2		SM	Silty SAND; fine to medium grained sand, low plasticity silt, some gravel to 10mm, dry.	LOOSE		TOPSOIL
		0.3			Extremely to Highly Weathered (EW-HW) SILTSTONE; fine to medium grained, light brown, dry.	EXTREMELY WEAK TO VERY WEAK		BEDROCK
		1.0			BOREHOLE TERMINATED AT 0.3m refusal in bedrock			
		1.5						

Logged By : KA	Date : 23/11/21	Checked By : JM	Date : 23/11/21
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BOREHOLE/EXCAVATION LOG C12356.GPJ ACT GEO.GDT 23/11/21

# Borehole Log

Borehole No.	<b>3A</b>
Sheet	1 of 1
Job No.	<b>C12356</b>
Location : SEE REPORT	
Collar Level : Not Known Angle From Vertical : 0° Bearing : N.A.	

CLIENT:	<b>SOUTHERN REGION LAND ENGINEERING</b>
PROJECT	<b>RURAL SUBDIVISION 407 CROOKWELL ROAD, KINGS DALE, NSW</b>
Equipment Type : PUSH TUBE DRILL Hole Diameter : 50mm	

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure <small>Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure</small>	Consistency or Relative Density	Field Test Results	Geological Profile
		0.1		SM	Silty SAND; fine to medium grained sand, low plasticity silt, brown, dry, with grass rootlets.	LOOSE		TOPSOIL
				SM	Silty SAND: fine to medium grained sand, low plasticity silt, grey-brown, dry.	LOOSE		SLOPEWASH
		0.4		CL-CH	Sandy CLAY; medium plasticity clay, fine to coarse sand, orange-brown, dry.	STIFF TO VERY STIFF		RESIDUAL SOIL
		1.0						
		1.5						
					BOREHOLE TERMINATED AT 1m very slow progress			

BOREHOLE/EXCAVATION LOG C12356.GPJ ACT GEO.GDT 23/11/21

Logged By : KA	Date : 23/11/21	Checked By : JM	Date : 23/11/21
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# Borehole Log

Borehole No.	<b>4A</b>
Sheet	1 of 1
Job No.	<b>C12356</b>
Location :	SEE REPORT
Collar Level :	Not Known
Angle From Vertical :	0°
Bearing :	N.A.

CLIENT:	SOUTHERN REGION LAND ENGINEERING
PROJECT	RURAL SUBDIVISION 407 CROOKWELL ROAD, KINGS DALE, NSW
Equipment Type :	PUSH TUBE DRILL
Hole Diameter :	50mm

Samples	Casing	Depth Metres	Graphic Log	U.S.C.S.	Material Description, Structure <small>Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components, Moisture, Structure</small>	Consistency or Relative Density	Field Test Results	Geological Profile
		0.1		SM	Silty SAND; fine to medium grained sand, low plasticity silt, brown, dry, with grass rootlets.	LOOSE		TOPSOIL
		0.3		SM	Silty SAND: fine to medium grained sand, low plasticity silt, grey-brown, dry.	LOOSE		SLOPEWASH
		0.5		SC	Clayey Gravelly SAND; fine to coarse sand, fine to medium grained sedimentary gravel, low plasticity clay, grey/brown, dry.	MEDIUM DENSE		COLLUVIUM
		1.0		CH	Sandy CLAY; medium to high plasticity clay, fine to coarse sand, orange-grey, dry.	VERY STIFF		RESIDUAL SOIL
		1.2			BOREHOLE TERMINATED AT 1.2m			
		1.5						

BOREHOLE/EXCAVATION LOG C12356.GPJ ACT GEO.GDT 23/11/21

Logged By :	KA	Date :	23/11/21	Checked By :	JM	Date :	23/11/21
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**APPENDIX C**  
**Laboratory Test Certificates**



## CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: CA2106828</b>	<b>Page</b>	<b>: 1 of 2</b>
<b>Client</b>	<b>: ACT Geotechnical Engineers Pty Ltd</b>	<b>Laboratory</b>	<b>: ALS Water Resources Group</b>
<b>Contact</b>	<b>: Kris Alipio</b>	<b>Contact</b>	<b>: Client Services</b>
<b>Address</b>	<b>: 5/9 Beaconsfield Street Fyshwick ACT 2609</b>	<b>Address</b>	<b>: 16B Lithgow Street Fyshwick ACT Australia 2609</b>
<b>Telephone</b>	<b>: ----</b>	<b>Telephone</b>	<b>: +61 2 6202 5404</b>
<b>Project</b>	<b>: C12368</b>	<b>Date Samples Received</b>	<b>: 03-Nov-2021 17:05</b>
<b>Order number</b>	<b>: ----</b>	<b>Date Analysis Commenced</b>	<b>: 11-Nov-2021</b>
<b>C-O-C number</b>	<b>: ----</b>	<b>Issue Date</b>	<b>: 12-Nov-2021 16:24</b>
<b>Sampler</b>	<b>: Kris Alipio</b>		
<b>Site</b>	<b>: C12368</b>		
<b>Quote number</b>	<b>: ----</b>		
<b>No. of samples received</b>	<b>: 3</b>		
<b>No. of samples analysed</b>	<b>: 3</b>		



Accreditation No. 992  
Accredited for compliance with  
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Amanda Gonzalez	Laboratory Technician	Inorganics, Fyshwick, ACT



## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key :

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- For samples collected by ALS WRG, sampling was carried out in accordance with Procedure EN67

## Analytical Results

Sub-Matrix: SOLID  
(Matrix: SOLID)

Sub-Matrix: SOLID (Matrix: SOLID)		Sample ID											
Compound	CAS Number	Sampling date / time		LOR	Unit	1A (0-0.2)		1A (0.3-0.5)		3A (0.4-0.6)			
						03-Nov-2021 00:00		03-Nov-2021 00:00		03-Nov-2021 00:00			
						CA2106828-001		CA2106828-002		CA2106828-003			
						Result		Result		Result			
EK072CA: Phosphate Sorption													
ø Phosphate Sorption Capacity		500	Kg/ha 100 cm			4000		11000		13400			
ø Bulk Density		0.01	g/cm3			1.16		1.28		1.25			

**APPENDIX D**  
**Limitations of Geotechnical Report**

## **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.