BLACK GEOTECHNICAL

Consulting Geotechnical Engineers

ACN 005 777 060

GIPPSLAND PORTS

PROPOSED BOAT RAMP & PONTOON JETTY

LAKE TYERS ABORIGINAL TRUST

RULES ROAD, TOORLOO ARM

LAKE TYERS

INTERPRETIVE GEOTECHNICAL INVESTIGATION

REPORT NO V2367R1, APRIL 2025

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CONSULT AUSTRALIA

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CONTENTS

1.0 GENERAL

1.1 Purpose of investigation

This report presents the results of a geotechnical investigation performed at the site of a proposed boat ramp and replacement jetty, within the Lake Tyers Aboriginal Trust (LTAT) property in Lake Tyers.

The approximate decimal coordinates of the site are -37.8375, 148.1038.

A locality plan is shown below in Image 1.

Image 1. Satellite image of site location (Source: Nearmap).

The purpose of the investigation was to:

- Determine the sub-surface conditions at the site.
- Provide an earthquake sub-soil class in accordance with AS 1170.4 – 2024.
- Provide exposure classifications for steel and concrete piles in accordance with AS 2159 – 2009.
- Provide recommendations on pile type, depth, capacity (axial & lateral) and testing.
- Provide estimates of pile settlement and deflection.
- Discuss construction.

1.2 Proposed development

It is understood that Gippsland Ports is managing a project for construction of a new boat ramp and floating pontoon for the Lake Tyers Aboriginal Trust, Lake Tyers, funded by the Victorian Government. To inform the boat ramp and pontoon design, a geotechnical investigation was required to describe the ground conditions and provide recommendations for pile design.

Crossco Consulting's engineering drawing (Drawing No. 2587/100-A, issued for discussion only), supplied by Gippsland Ports shows the proposed boat ramp and a hand drawn sketch of the proposed jetty (Image 2).

No further details of the design including the required axial and lateral design loads have been provided.

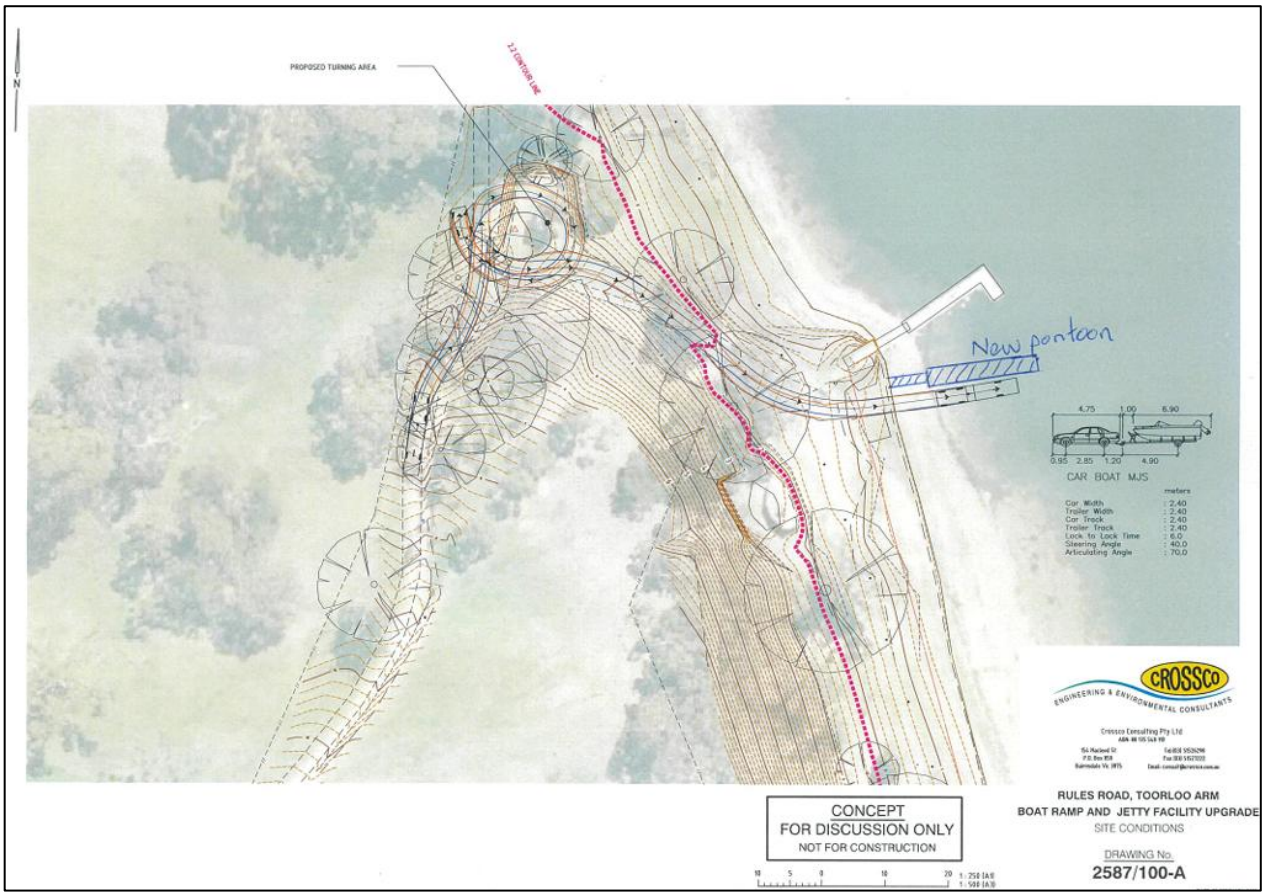

Image 2. Proposed boat ramp & pontoon jetty engineering drawings and sketch (Drawing No. 2587/100-A) (Source: Gippsland Ports).

1.3 Existing conditions

The existing pontoon jetty has a plastic plank deck, supported on timber piles that are tilting considerably. The condition of the piles below the water are assumed to be in poor condition, and the whole jetty is structurally dilapidated. A photo of the existing pontoon is shown below in Image 3.

Image 3. The existing jetty at LTAT shown in the foreground.

2.0 SUB-SURFACE CONDITIONS

2.1 Reported geology

The GeoVic3 online, 1: 250,000 series, Seamless Geology (2007-2014), indicates the site surface geology is Quaternary period Coastal Lagoon deposits (Qg) described as '*silt, clay: dark grey to black; variably consolidated*'.

Onshore, immediately west of the site, the online database shows older Neogene/Quaternary period unconsolidated deposits of the Haunted Hills Formation (Nlh) described as '*sand, silt, gravel: various shades of brown, yellow, red, white, variably sorted, commonly oxidised with ironstone near the top and also within the formation*'. Despite this description, Black Geotechnical's experience with the material is that it is predominantly stiff to very stiff clay with interbedded sand layers and lenses. The sand layers and lenses can be cemented.

An extract from the GeoVic3 database is shown in Image 4.

The GeoVic3 boreholes and wells database shows a significant number of old groundwater boreholes (blue dots in Image 4) in the vicinity of the site. Three of these boreholes are described in Table 1 and are consistent with soil from the Haunted Hills Formation. The borehole locations are shown on Image 4 as B1, B2, and B3.

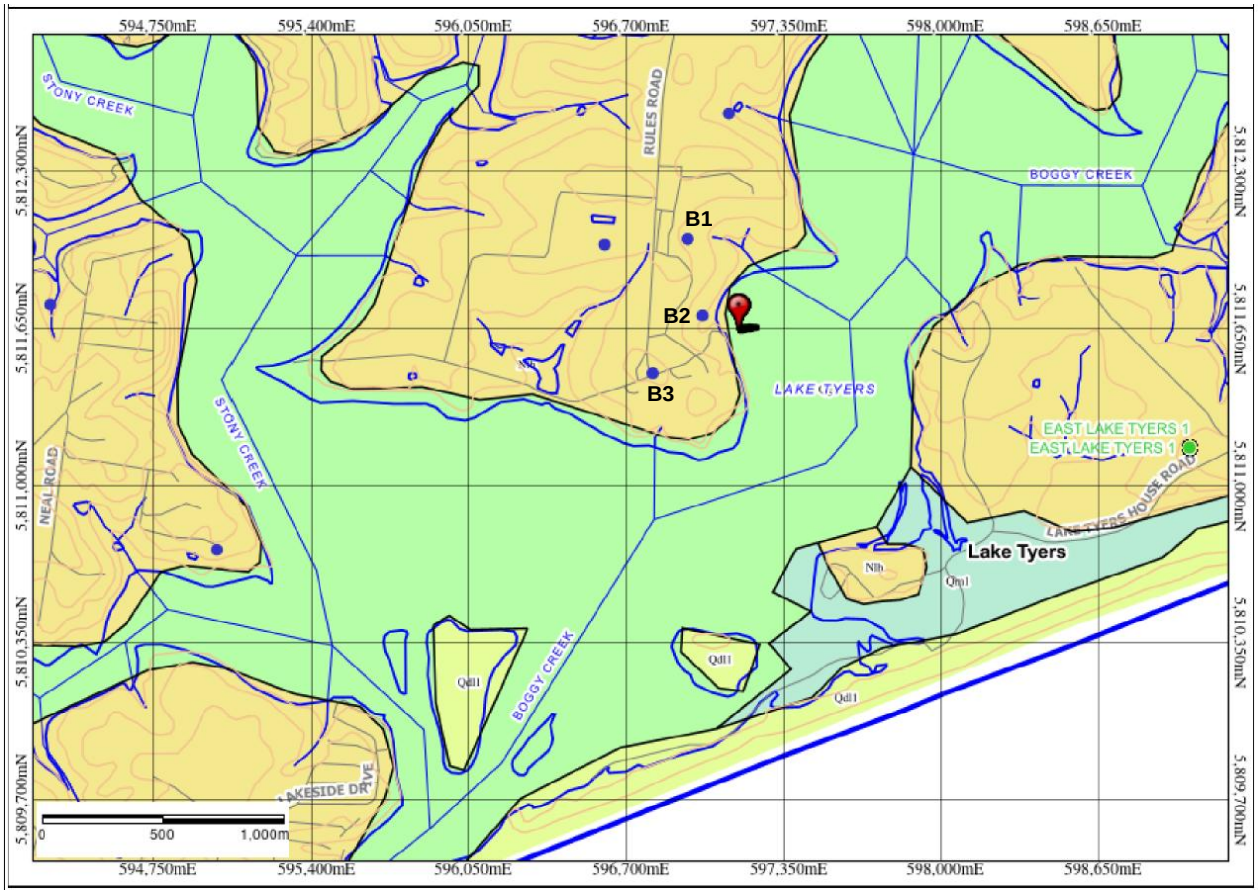

Image 4. GeoVic extract. Site is near the red marker

Table 1. Summary of historical boreholes near the site

BH no.	distance from site	geology	reported lithology
B1	≈ 300 m north-northwest	Nlh	0 - 1.5 m CLAY, 1.5 - 2.75 m SAND, 2.75 - 3 m GRAVEL, 3 - 5.8 m SAND, 5.8 - 13.5 m CLAY, 13.5 - >15.3 m SILT
B2	≈ 125 m west	Nlh	0 - 3 m CLAY, 3 - 6 m GRAVEL, 6 - 14.6 m CLAY, 14.6 - >15.2 m SAND
B3[1]	≈ 400 m southwest	Nlh	0 - 8.8 m CLAY, 8.8-9.5 m LIMESTONE[1], 9.5-19.0 m CLAY, 19.0 ->37 m SAND

[1]*the limestone reported in B3 from 8.8-9.5 m is probably cemented sand within the Haunted Hills Formation*.

2.2 Fieldwork

To assess the site sub-surface conditions, two rotary drill wash-bore boreholes were drilled from the lake surface on a floating barge to a maximum depth of 17.4 m below lake surface level. The drill rig was provided by Star Drilling and the barge was provided by Carter Marine.

The borehole locations were recorded using a high-accuracy RTK GPS.

An aerial photo with the approximate borehole locations is shown in Image 5.

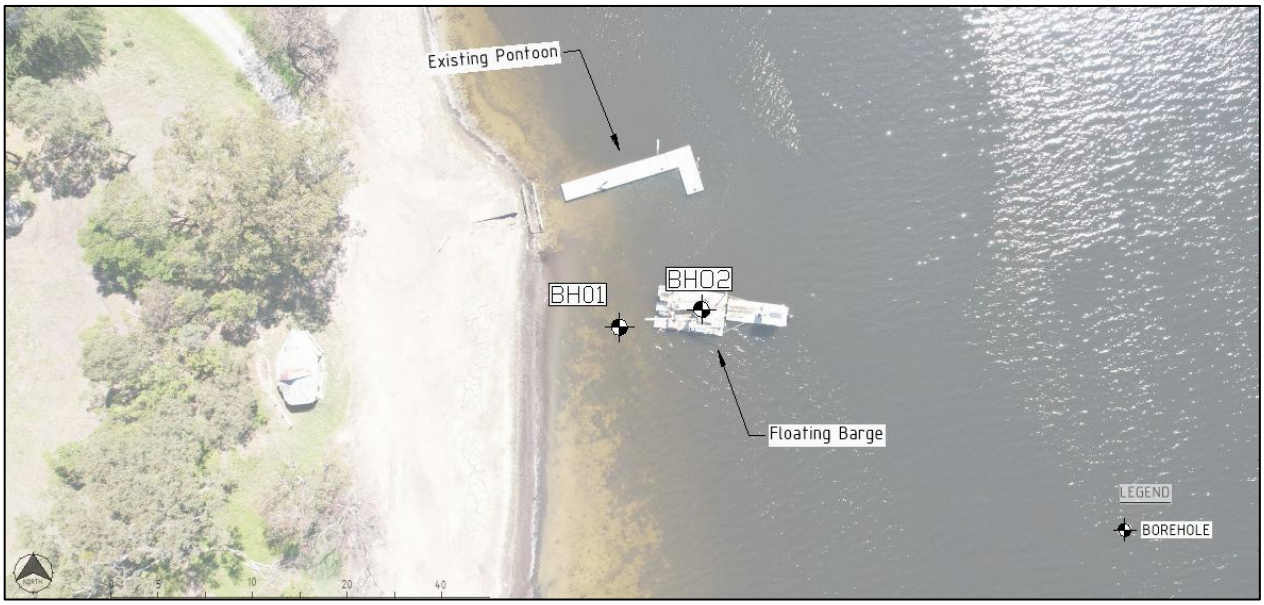

Image 5. Aerial image illustrating the borehole locations at Lake Tyers.

Engineering logs of the boreholes together with a summary of the descriptive terms used in logging are included in Appendix A (Figure 1A).

Standard Penetration Tests (SPTs) were conducted in the boreholes. An SPT was conducted initially at 1 m depth below the lakebed with subsequent SPTs conducted every 1.5 m in each borehole.

Disturbed soil samples were collected from the SPTs. As expected, no rock was encountered. The recovered soil samples may be inspected by prior arrangement at Black Geotechnical's office, 258 Hyde Street, Yarraville. The recovered soil samples will be disposed of six months after the fieldwork.

Photos taken during the fieldwork are shown below in Image 6 to Image 8.

Image 6. Looking west at the work platform.

Image 7. Looking north at the work platform.

Image 8. Looking down at the work platform whilst drilling BH02.

2.3 Sub-surface profile

The boreholes encountered differing sub-surface conditions of uncertain origin, but most likely all Coastal Lagoon Deposits. The sub-surface profile encountered in the boreholes is summarised below in Table 2.

Table 2. Summary of sub-surface conditions for BH01 & BH02

unit	type	description	depth to top (m)	depth to base (m)	thickness (m)
1	WATER	Lake Tyers	0.0	0.8, 2.6	0.8, 2.6
2a	PROBABLY ALL COASTAL LAGOON DEPOSITS	Clayey SAND: very loose to loose; fine grained; black; wet with shells	0.8, 2.6	3.3, 5.1	2.5, 2.5
2b		Clayey SAND: loose becoming medium dense at 4.8 m; fine grained; blue-grey; wet (BH01 only)	3.3	5.1	1.8
3		Sandy CLAY: stiff; medium to high plasticity; blue-grey mottled brown; W>Wp, becoming very stiff in BH01 at 6.3 m	5.1	7.8, 7.0	2.7, 1.9
4a		Clayey SAND: medium dense; fine to medium grained, grey-brown; wet ▪ Sandy CLAY layer encountered in BH02 from 9.6-11.1 m	7.8. 7.0	13.8, 11.1	6.0, 4.2
4b		Clayey SAND: loose/very loose; fine to medium grained, grey-brown; wet	13.8, 11.1	15.3, 12.6	1.5, 1.5
5		Sandy/Silty CLAY: very stiff in BH01, firm becoming stiff in BH02 ▪ variable plasticity from low to high; ▪ variable colour from pale brown, mottled blue grey-brown, mottled orange-brown, both becoming dark grey at 17.1 m ▪ Shells and rootlets encountered in BH01; ▪ Sudden SPT refusal at 17.2 m in BH01 and 17.4 m in BH02 in hard clay	15.3, 12.6	>17.18, >17.4	>1.88, >4.8

The SPT results are listed in Table 3. The elevation datum referenced in this report is Australian Height Datum (AHD).

Table 3. Summary of SPT results

log ID	depth (m)	top elevation (m AHD)	SPT 'N' value	soil type	density/shear strength
BH01	1.8-2.25	-1.4	1	clayey sand	very loose
	3.3-3.75	-2.9	8	clayey sand	loose
	4.8-5.25	-4.4	14	sand/clay	medium dense/≈ 95 kPa
	6.3-6.75	-5.9	17	sandy clay	≈ 115 kPa
	7.8-8.25	-7.4	23	clayey sand	medium dense
	9.3-9.75	-8.9	28	clayey sand	medium dense
	10-10.45	-9.6	28	clayey sand	medium dense
	12-12.75	-11.6	35	clayey sand	dense
	13.8-14.25	-13.4	10	clayey sand	loose
	15.3-15.75	-14.9	18	sandy clay	≈ 120 kPa
	16.8-17.18	-16.4	refusal[1]	sandy clay	>200 kPa
BH02	3.6-4.05	-3.3	0	clayey sand	very loose
	5.1-5.55	-4.8	11	sandy clay	≈ 75 kPa
	6.6-7.05	-6.3	11	sandy clay	≈ 75 kPa
	8.1-8.55	-7.8	13	sandy clay	≈ 85 kPa
	9.6-10.05	-9.3	5	sandy clay	≈ 35 kPa
	11.1-11.55	-10.8	3	clayey sand	very loose
	12.6-13.10	-12.3	7	silty/sandy clay	≈ 45 kPa
	14.1-14.55	-13.8	10	sandy clay	≈ 65 kPa
	15.6-16.05	-15.3	10	sandy clay	≈ 65 kPa
	17.1-17.42	-16.8	refusal[1]	sandy clay	>200 kPa

[1]*SPT refusal was sudden towards the end of the SPT test depth in both boreholes*

Unusual conditions from Table 2 and Table 3 are listed below and are discussed in Section 3.3.

- The Unit 4b loose clayey sand layer in BH01 from 13.8-14.9 m and the very loose clayey sand layer in BH02 from 11.1-12.6 m.
- The sudden SPT refusal at 17.2 m in BH01 and 17.4 m in BH02, with hard clay in the tip of the SPT sampler.

2.4 Lake water level

The starting depth for the boreholes was the lake surface. The depth from lake surface to lakebed was 0.8 m in BH01 and 2.6 m in BH02. The boreholes were drilled on consecutive days. On day one when BH01 was drilled the lake surface level was RL +0.4 m. On day two when BH02 was drilled the lake surface level was RL +0.3 m.

A week, or so, before the fieldwork was conducted, the lake surface level was about RL +2 m as the entrance to Bass Strait was closed by a sand bar. The lake appeared to be tidally influenced at the time of fieldwork. The tidal variation is unknown. Similar changes in lake water level can be expected in the future.

2.5 Laboratory testing

2.5.1 Geotechnical laboratory testing

Natural moisture content, Atterberg limits determinations, and particle size distributions were performed on two samples recovered from each borehole. The test results are summarised in Table 4. The test certificates are included in Appendix A.

Table 4. Summary of geotechnical laboratory test results

log ID	depth (m)	type	plasticity	W (%)	W_L (%)	W_P (%)	I_P (%)	<75 µm (%)
BH01	3.3-3.6	clayey sand	medium	17.6	36	17	19	33
BH01	5.1-5.25	sandy clay	high	18.9	51	22	29	62
BH02	5.1-5.4	clayey sand	medium	18.8	34	19	15	36
BH02	6.6-6.9	clayey sand	medium	20.9	32	19	13	46

where: W = natural moisture content, W_L = Liquid Limit, W_P = Plastic Limit, I_p = Plasticity Index, <75 µm = silt/clay content.

Note 1: because of the high clay content, all samples are expected to behave as a cohesive soil.
Note 2: the sample depths on the test certificates in Appendix A are from the lakebed, whereas the depths in Table 4 are from the top of lake water level.

2.5.2 Environmental laboratory testing

A suite of environmental laboratory tests, including pH, chloride, sulphate, and conductivity, were conducted on samples of soil and surface water recovered from the site for durability design purposes.

The test results are summarised in Table 5. The test certificates and chain of custody are included in Appendix A.

Table 5. Summary of environmental laboratory test results

log ID	depth, m	soil condition [A]	pH	conductivity (µS/cm)	resistivity (ohm.cm)	chloride [B] (ppm)	sulphate [B] (ppm)
BH01	1.80	A	7.5	1900	530	2400	430
BH02	5.10	B	9.5	1600	630	2100	360
Lake water	N/A	N/A	7.8	-	-	8000	1200

[A] Refer to AS 2159 – 2009, Table 6.4.2(C) and Table 6.5.2(C). Relevant to recovered sample.
[B] Units in parts per million (ppm), or mg/kg for soil samples and mg/L for water sample.

AS 2159 – 2009, Table 6.4.2(C) and Table 6.5.2(C) provide the following classification for soil type:
- Soil condition A – high permeability soils (e.g., sands and gravels) which are in groundwater.
- Soil condition B – low permeability soils (e.g., silts and clays) or all soils above groundwater.

The soil at the site is both Soil Conditions A and Soil Condition B'. Soil Condition A is the more extreme condition of the two and should be adopted for the site.

Based on AS 2159 – 2009, Table 6.4.2(C), Table 6.5.2(A) and Table 6.5.2(C), and the above laboratory test results, the following exposure classifications are applicable:

- Concrete piles in soil – 'moderate' for soil condition A.
- Steel piles in tidal/splash zone – 'Severe' for submerged piles, and 'Severe' for above water piles.
- Steel piles in soil – 'Severe' for soil condition A.

continued…

3.0 DISCUSSION & RECOMMENDATIONS

3.1 Soil reactivity

The Atterberg Limits determinations indicate a variable plasticity, however, the four test results plot well below the montmorillonite zone on the Holtz & Kovacs '*location of common minerals on the Casagrande plasticity chart (1981)'*. Montmorillonite is a type of clay mineral that causes significant volume change with variation in moisture content.

Soil reactivity will have no effect on the ramp and jetties foundation performance and will require no special design, construction or maintenance considerations.

3.2 Earthquake classification

The Earthquake Site Sub-Soil Class in accordance with AS 1170.4 – 2024, Structural design actions, Part 4: Earthquake actions in Australia, Section 4, is judged to be **Class D_e**. The **D_e** classification is due to deep unconsolidated deposits of the Haunted Hills Formation that are expected to underlie the Coastal Lagoon Deposits at the site.

The Hazard Factor (Z) in accordance with AS 1170.4 – 2024 is **0.09**.

3.3 Relevant levels and depths

Final levels are not known. It is possible the top of the boat ramp will be at about RL +2 m to cater for entrance closures and high lake surface levels. In any event, the pontoon jetty will have to be designed for a lake surface level of at least RL +2 m.

Driven piles are recommended for the boat ramp and the jetty. For the purpose of pile axial capacity computation, the following is assumed:

- The soil in Units 1 and 2 (refer to Section 2.3, Table 2) will not contribute to pile capacity.
- The loose/very loose clayey sand layer in Unit 4b will not contribute to pile capacity.
- The 'hard clay' encountered at the base of both boreholes is not necessarily an end bearing layer.

For the levels and depths in Table 6 we have assumed a top of boat ramp elevation of RL +2.0 m.

Table 6. Relevant levels and depths

location	depth below top of boat ramp (m)	elevation (m AHD)
Top of boat ramp	0	+2.0
Lakebed at BH01	2.4	-0.4
Top Unit 3 (stiff clay) in BH01	6.7	-4.7
Top Unit 4a (medium dense sand) in BH01	9.4	-7.4
Top Unit 4b (loose sand) in BH01	15.4	-13.4
Top Unit 5 (stiff clay) in BH01	16.9	-14.9
Lakebed at BH02	4.3	-2.3
Top Unit 3 (stiff clay) in BH02	6.8	-4.8
Top Unit 4a (medium dense sand) in BH02	8.7	-6.7
Top Unit 4b (very loose sand) in BH02	12.8	-10.8
Top Unit 5 (stiff clay) in BH02	14.3	-12.3

Based on Table 6, the subsurface model shown below in Table 7 has been adopted for design.

Table 7. Design subsurface model (for axial load)

item	description	elevation (m AHD)	thickness (m)	angle of friction, ϕ (degrees)	undrained shear strength, Su (kPa)
Lakebed	-	-2.5	-	-	-
Top Unit 3	stiff clay	-5	2	-	50
Top Unit 4a	medium dense sand	-7	5.5	30	-
Top Unit 4b	loose/very loose sand	-12.5	1.5	25	-
Top Unit 5	stiff clay	-14	>3	-	50

continued…

3.4 Approximate loads and pile types

No design has been conducted at this stage by Gippsland Ports. It is understood that their structural engineer has suggested pile load of about 136 kN. It is assumed that this refers to the ULS axial load in compression and not to a lateral load.

For a similar boat ramp and jetty investigated conducted by Black Geotechnical at Shaving Point, Metung in December 2022, the following indicative ULS pile loads were provided.

Boat ramp. Individual pile axial loads of 120-200 kN depending on the pile spacing. Individual pile lateral loads of 20 kN for vessel impact plus 3.5 kN for wave impact.

Pontoon Jetty. Individual pile axial load 60 kN. Individual pile lateral load as for boat ramp.

Recently advised ULS lateral load for proposed pontoon jetties at Paynesville was about 50 kN/pile for a pile spacing of about 10 m.

The proposed Metung piles were 219 x 6.4 CHS steel piles or 230 x 9.7 CHS FRP piles. It is not known what pile type was finally adopted.

The proposed Paynesville pontoon jetty piles are 405 x 12.7 CHS piles with a 450 mm PN4 HDPE sleeve. It is assumed the HDPE is only above the lowest permanent lake level and will not affect shaft adhesion capacity.

3.5 Pile recommendations – axial loads

3.5.1 Pile lengths

Based on the soil properties in Table 7, the design geotechnical strength shaft adhesion, f_{sdgs}, and end bearing, f_{bdgs}, shown in Table 8 may be adopted.

A geotechnical reduction factor of $\phi g = 0.5$ has been adopted to determine the design geotechnical strength values.

Table 8. Design geotechnical strength shaft adhesion and end bearing values

unit	shaft adhesion, f_{sdgs}, (kPa)	end bearing, f_{bdgs} ,(kPa)
Unit 3 (stiff clay)	22.5	225
Unit 4a (medium dense sand)	12.5	225[1]
Unit 4b (loose to very loose sand)	7.5	225
Unit 4b (stiff clay)	22.5	225

[1]Unit 4a in BH01 contained a 1 m thick layer of clay. Therefore, the typical f_{bdgs} for medium dense sand of >1000 kPa has been reduced to a stiff clay value.

For a 219 CHS and a 405 CHS section, the parameters in Table 8 indicate the following pile lengths below RL +2 m for a 136 kN ULS axial pile load in compression:

- 219 CHS. 19 m. This is a 2 m embedment into the Unit 5 clay, with a toe level of RL -16.5 m.
- 405 CHS. 14 m. This is a 4.5 m embedment into the Unit 4a sand, with a toe level of RL -11.5 m.

For a lower ULS axial load in compression of say 60 kN/pile for the pontoon jetty piles, the following pile lengths below RL +2 m are required:

- 219 CHS. 11.5 m. This is a 2 m embedment into the Unit 4a sand, with a toe level of RL -9 m.
- 405 CHS. 10.5 m. This is a 1 m embedment into the Unit 4a sand, with a toe level of RL -8 m.

3.5.2 Pile settlement

The theoretical maximum post construction vertical settlement of the proposed driven piles under an SLS load of, say, 100 kN (about 75% of the ULS load) due to ground compression is less than 5 mm.

Driven pile settlement estimates are based on the elastic solutions of Poulos, 1972.

3.5.3 Pile testing

It is recommended that high strain dynamic testing with wave matching analysis (PDA testing) is conducted on a minimum of 10% of the total number of driven piles. Dynamic testing should be conducted using a Pile Driving Analyzer® with CAPWAP modelling (or similar).

The pile test load is calculated by dividing the design action effect on the pile (i.e. the pile ULS axial load), E_d, by the geotechnical strength reduction factor, ϕ_g, where $\phi_g = \phi_{gb} + (\phi_{tf} - \phi_{gb}) * K \geq \phi_g$.

ϕ_g = geotechnical strength reduction factor
ϕ_{gb} = basic geotechnical strength reduction factor
ϕ_{tf} = intrinsic geotechnical strength reduction factor = 0.8 for dynamic load testing of preformed piles
K = testing benefit factor = $1.13p/(p+3.3) \leq 1$
P = percentage of the total piles that are tested and meet the specified acceptance criteria

For this site, it is estimated that $\phi_{gb} = 0.48$. If 10% of piles are dynamically load tested, a ϕ_g of 0.75 is appropriate. For a ULS axial load of 136 kN, this results in a pile test load of about 180 kN.

The capacities of untested piles can be confirmed by driving to a minimum set and energy determined by CAPWAP modelling.

PDA testing of piles requires sensors to be attached to the sides of the test piles at least 1.5 pile diameters below the top of the pile. For high strain dynamic testing to be conducted on the piles, contractors must ensure there is sufficient and safe access to the sides of the test piles for sensor attachment.

Black Geotechnical can provide a fee to perform PDA testing at the site.

If no piles are tested or if the piles are tested based on a driving formula (e.g., Hiley), $\phi_g = \phi_{gb} = 0.48$. For a ULS axial load of 136 kN, this results in a pile test load of about 283 kN.

3.6 Pile recommendations – lateral loads (preliminary)

For lateral load analyses, Table 7 has been altered to include Unit 2. This is shown in Table 9.

Table 9. Design subsurface model for lateral loads

item	description	elevation (m AHD)	thickness (m)	friction angle, ϕ (degrees)	undrained shear strength, Su (kPa)
Lakebed		-2.5		-	-
Top Unit 2	loose/very loose sand	-2.5	2.5	25	-
Top Unit 3	stiff clay	-5	2	-	50
Top Unit 4a	medium dense sand	-7	5.5	30	-
Top Unit 4b	loose/very loose sand	-12.5	1.5	25	-
Top Unit 5	stiff clay	-14	>3	-	50

Preliminary analyses using L-Pile software (produced by Ensoft), assuming an 11.5 m deep pile (toe at RL -9.5 m) and a shear load of 25 kN at the top of the pile, indicates that a 219 x 8.2 CHS pile will not be suitable for the lateral loads discussed in Section 3.4, and that a larger pile size will be required.

Further analysis can be conducted when loads and pile sizes, and the top of boat ramp level are decided.

Also, the lakebed level has to be confirmed. The LPILE analysis assumed a lakebed level of RL -2.5 m. The lakebed level at BH01 and BH02 was RL -0.4 m and RL -2.3 m, respectively.

Some propellor disturbance should probably be allowed for where the lakebed is shallow.

With more data on the lakebed level along the length of the ramp and the pontoon jetty it may be possible that with a higher level towards the shore, the pile spacing can be decreased as the structures move away from the shore to allow for the greater length of pile above the lakebed.

Methods of reducing the lateral load on the piles could include reducing the pile spacing or installing structural connections between piles.

3.7 Construction

No construction difficulties are expected with the jetty footings provided the new piles are away from existing piles.

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Frank O'Dea **George Black**

APPENDIX A

Figure 1	**Test location plan**
Figure 1A	**Soil classification sheet**
Logs	**BH01 and BH02**
Results	**Geotechnical laboratory tests, 9 sheets**
Results	**Environmental laboratory tests, 1 sheet**

CO-ORDINATE DATUM / PROJECTION: GDA2020 MGA55
ELEVATION DATUM: AHD
SURVEY BY BLACK GEOTECHNICAL USING LEICA ZENO FLX100 INSTRUMENT WITH REPORTED ACCURACY: HORIZ. ±20 mm & VERT. ±30 mm
AERIAL IMAGE: BLACK GEOTECHNICAL PTY LTD - CAPTURE DATE DD/MM/YYYY

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REVISION	DETAILS OF AMENDMENT	DATE
A	First Issue / Draft / Preliminary / Additional test locations added	DD/MM/YY

PROJECT TITLE / ADDRESS
Lake Tyers Aboriginal Trust: Proposed Boat Ramp & Pontoon Jetty

DRAWING TITLE
Borehole Locations

SCALE	SIZE	DRAWN	CHECKED	PROJECT NO.	DRAWING NO.	REV.
NTS	A3-L	FOD	-	V2367	FIGURE 1	A

DESCRIPTIVE TERMS & GRAPHIC SYMBOLS FOR SOIL

FIG. 1A

Doc. Ver. 2.5

CLASSIFICATION BASED ON UNIFIED SOIL CLASSIFICATION. AS1726 – 1993

WATER

▽	Water level at time of drilling.	GROUNDWATER NOT OBSERVED Groundwater observation was not possible due to water used in drilling process. Groundwater may be present.
▼	Static water level.	
→	Water inflow to borehole or test pit.	GROUNDWATER NOT ENCOUNTERED No groundwater was encountered at time of drilling or excavation in the borehole or test pit.
←	Water loss in borehole.	

SAMPLES AND TESTS

SPT	Standard Penetration Test (AS1289.6.3.1 – 2004). Blows per 150 mm. N = Blows for 300 mm after 150 mm seating.	SV	Shear Vane. Measures Shear Strength (s_u). Peak Strength/Residual Strength.
DCP	Dynamic Penetrometer Test (AS1289.6.3.2 – 1997). Blows per 100 mm.	N	SPT with sample collected from spoon.
U63	Undisturbed sample (Push Tube) – 63 mm diameter. 50 mm tube may be used (U50).	N*	SPT with no sample collected in spoon.
PP	Pocket Penetrometer. Measures Unconfined Compressive Strength (UCS).	Nc	SPT with solid cone. No sample.
D	Disturbed sample.	N'(60)	Corrected normalised N-value. Also known as $N_{1,60}$.
B	Bulk disturbed sample.	R	DCP / SPT refusal.

SOIL GRAPHICS (Sample)


CLAY (CL, CI, CH)


FILL


SILT (ML, MH)


GRAVEL (GW, GP)


SAND (SW, SP)


COBBLES AND BOULDERS

Graphic representation of mixed materials, such as silty clay, would be a combination of these symbols.

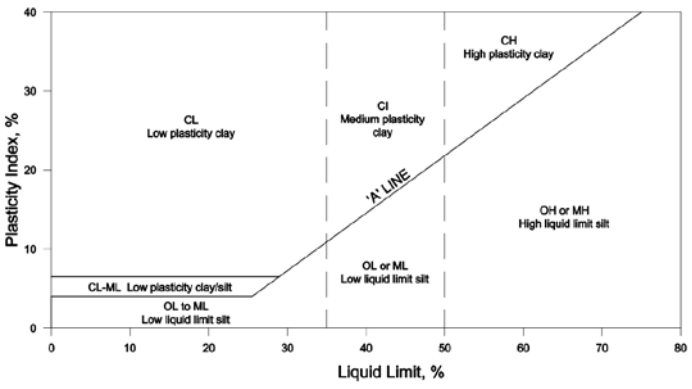
DRILLING METHOD

SSA	Solid Stem Auger	WB	Washbore
HSA	Hollow Stem Auger	ODEX	ODEX Retractable Bit System
HA	Hand Auger	AIRH	Down-the-hole Air Hammer
EX	Excavator	HE	Hand Excavation
BH	Backhoe	CC	Concrete Coring
NMLC	52mm Diamond Core	RCB	Rock Core Barrel
NDD	Non-Destructive Drilling	MC	Macro Core

PARTICLE SIZE

Boulders		> 200mm
Cobbles		63 to 200mm
Gravel	Coarse	20 to 63mm
	Medium	6.0 to 20mm
	Fine	2.0 to 6.0mm
Sand	Coarse	0.6 to 2.0mm
	Medium	0.2 to 0.6mm
	Fine	0.075 to 0.2mm
Silt		0.002 to 0.075mm
Clay		< 0.002mm

PLASTICITY PROPERTIES



PLASTICITY

Description	*Liquid Limit*
Low	< 35%
Medium	30 to 50%
High	> 50%

SECONDARY COMPONENT

Trace	0 to 5%
Presence just detectable by feel or eye	
With	5 to 12%
Presence easily detectable by feel or eye	

MOISTURE CONDITION

Dry	Looks and feels dry
Moist	Feels cool, darkened in colour, no free water or remoulding
Wet	Feels cool, darkened in colour, free water or remoulding
W	Natural moisture content
Wp	Plastic limit

CONSISTENCY

s_u kPa, AS1726 Table A4

TERM	very soft	soft	firm	stiff	very stiff	hard
s_u kPa	12	25	50	100	200	

If a soil crumbles on test it is described as friable.

DENSITY INDEX

I_d %, AS1726 Table A5

TERM	very loose	loose	medium dense	dense	very dense
I_d %	15	35	65	85	

BLACK GEOTECHNICAL

REPORT OF BOREHOLE: BH01

Job No	: V2367	Easting	: 597131.02	Sheet	: 1 OF 2
Client	: Gippsland Ports	Northing	: 5811622.28	Logged	: FOD
Project	: Lake Tyers Aboriginal Trust - Boat Ramp & Pontoon Jetty	UTM	: 55H	Logged Date	: 04/03/2025
Location	: Lake Tyers VIC	Drill Rig	: Comacchio GEO205	Checked	: GB
Contractor	: Star Drilling	Inclination	: -90 deg	Checked Date	: 03/04/2025

General comments: RL +0.38 m AHD

Drilling Method	Elevation / Depth (m)	Graphic Log	Classification Code	Material Description	Consistency / Relative Density	SPT	Samples
WB - SPT				Lake water			0-0.1, Enviro
	-0.4 / 0.8		SC	Clayey SAND; very loose to loose; black; wet; with shells	VL-L		
						1.8-2.25, 1, 1, 0 N = 1	1.8-1.9, Enviro
	-2.9 / 3.3		SC	Clayey SAND; loose; fine grained; blue-grey; wet	L	3.3-3.75, 2, 3, 5 N = 8	3.3-3.6, Disturbed
	-4.4 / 4.8		SC	Becoming medium dense	MD	4.8-5.25, 6, 6, 8 N = 14	
	-4.7 / 5.1		CL	Sandy CLAY; stiff; high plasticity; blue-grey mottled brown; w > wp	St		5.1-5.25, Disturbed
	-5.9 / 6.3		CL	Becoming very stiff; blue-grey; moist	VSt	6.3-6.75, 3, 7, 10 N = 17	
	-7.4 / 7.8		SC	Clayey SAND; medium dense; fine grained; grey brown; wet	MD	7.8-8.25, 10, 12, 11 N = 23	
	-8.9 / 9.3		SP	SAND; medium dense; medium grained; grey brown; wet	MD	9.3-9.75, 8, 12, 16 N = 28	

BLACK GEOTECHNICAL

REPORT OF BOREHOLE: BH01

Job No	: V2367	Easting	: 597131.02	Sheet	: 2 OF 2
Client	: Gippsland Ports	Northing	: 5811622.28	Logged	: FOD
Project	: Lake Tyers Aboriginal Trust - Boat Ramp & Pontoon Jetty	UTM	: 55H	Logged Date	: 04/03/2025
Location	: Lake Tyers VIC	Drill Rig	: Comacchio GEO205	Checked	: GB
Contractor	: Star Drilling	Inclination	: -90 deg	Checked Date	: 03/04/2025

General comments: RL +0.38 m AHD

Drilling Method	Elevation / Depth (m)	Graphic Log	Classification Code	Material Description	Consistency / Relative Density	SPT	Samples
WB - SPT			SP	SAND; medium dense; medium grained; grey brown; wet	MD		
						10.8-11.25, 9, 13, 15 N = 28	
	-11.9 / 12.3		SP	Becoming dense	D	12.3-12.75, 13, 14, 21 N = 35	
	-13.4 / 13.8		SC	Clayey SAND; loose; medium grained; grey brown; wet	L	13.8-14.25, 2, 4, 6 N = 10	
	-14.9 / 15.3		CL	Sandy CLAY; very stiff; low plasticity; pale brown; w = wp; with shells and rootlets	VSt	15.3-15.75, 4, 6, 12 N = 18	
						16.8-17.18, 10, 15, 13 N = null N = R 13/75mm	
	-16.7 / 17.1		CL	Sandy CLAY; very stiff to hard; low plasticity; dark grey; w = wp	VSt-H		
				BH01 refusal at 17.18m			

BLACK GEOTECHNICAL

REPORT OF BOREHOLE: BH02

Job No	: V2367	Easting	: 597139.98	Sheet	: 1 OF 2
Client	: Gippsland Ports	Northing	: 5811628.59	Logged	: FOD
Project	: Lake Tyers Aboriginal Trust - Boat Ramp & Pontoon Jetty	UTM	: 55H	Logged Date	: 05/03/2025
Location	: Lake Tyers VIC	Drill Rig	: Comacchio GEO205	Checked	: GB
Contractor	: Star Drilling	Inclination	: -90 deg	Checked Date	: 03/04/2025

General comments: RL +0.31 m AHD

Drilling Method	Elevation / Depth (m)	Graphic Log	Classification Code	Material Description	Consistency / Relative Density	SPT	Samples
			WATR	Lake water			
	-2.3 / 2.6		SC	Clayey SAND; very loose to loose; fine grained; black; wet; with shells	VL-L	3.6-3.75, 1, 0, 0 N = 0	
	-4.8 / 5.1		CL	Sandy CLAY; stiff; medium plasticity; blue-grey mottled brown; w > wp	St	5.1-5.55, 3, 4, 7 N = 11	5.1-5.2, Enviro 5.2-5.4, Disturbed
	-6.7 / 7		SC	Clayey SAND; medium dense; fine grained; blue-grey; wet	MD	6.6-7.05, 4, 5, 6 N = 11	6.6-6.8, Disturbed
	-8.2 / 8.5		SC	Becoming silty		8.1-8.55, 4, 7, 6 N = 13	
	-9.3 / 9.6		CL	Sandy CLAY; firm; low plasticity; blue-grey mottled brown; w = wp	F	9.6-10.05, 3, 2, 3 N = 5	

REPORT OF BOREHOLE: BH02

Job No	: V2367	Easting	: 597139.98	Sheet	: 2 OF 2
Client	: Gippsland Ports	Northing	: 5811628.59	Logged	: FOD
Project	: Lake Tyers Aboriginal Trust - Boat Ramp & Pontoon Jetty	UTM	: 55H	Logged Date	: 05/03/2025
Location	: Lake Tyers VIC	Drill Rig	: Comacchio GEO205	Checked	: GB
Contractor	: Star Drilling	Inclination	: -90 deg	Checked Date	: 03/04/2025

General comments: RL +0.31 m AHD

Drilling Method	Elevation / Depth (m)	Graphic Log	Classification Code	Material Description	Consistency / Relative Density	SPT	Samples
			CL	Sandy CLAY; firm; low plasticity; blue-grey mottled brown; w = wp	F	9.6-10.05, 3, 2, 3 N = 5	
	-10.8 / 11.1		SP	No sample and very loose - Likely medium grained Sand	VL	11.1-11.55, 3, 1, 2 N = 3	
	-12.3 / 12.6		CL	Silty CLAY; firm; medium to high plasticity; blue-grey mottled brown; w > wp	F	12.6-13.05, 3, 2, 5 N = 7	
	-12.6 / 12.95		CL	Becoming sandy			
	-13.8 / 14.1		CL	Sandy CLAY; stiff; medium plasticity; orange mottled pale brown; w > wp; with shells	St	14.1-14.55, 3, 4, 6 N = 10	
						15.6-16.05, 4, 5, 5 N = 10	
	-16.8 / 17.1		CL	Sandy CLAY; very stiff to hard; low plasticity; dark grey; w < wp	VSt-H	17.1-17.42, 3, 11, 2 N = null N = R 2/15mm	
				BH02 refusal 17.42m 2025-03-05			

This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

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MOISTURE CONTENT REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5467-1
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	24/03/2025 Page 1 of 1

Test Procedures:	AS1289.2.1.1, AS1289.1.1

Sample Number	14874/S/25-14019	14874/S/25-14020	14874/S/25-14021	14874/S/25-14022
ID / Client ID	-	-	-	-
Lot Number	-	-	-	-
Date / Time Sampled	12/03/2025	12/03/2025	12/03/2025	12/03/2025
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Sampled By	Client Supplied	Client Supplied	Client Supplied	Client Supplied
Tested By	Layla Somo	Layla Somo	Layla Somo	Layla Somo
Date Tested	13/03/2025	13/03/2025	13/03/2025	13/03/2025
Material Source	Onsite	Onsite	Onsite	Onsite
Material Type	Clayey SAND	Sandy CLAY	Sandy CLAY	Sandy CLAY
Borehole No.	BH01	BH01	BH02	BH02
Depth	2.5	4.25	2.5	4
Moisture Content (%)	**17.6**	**18.9**	**18.8**	**20.9**

Sample Number				
ID / Client ID				
Lot Number				
Date / Time Sampled				
Sampling Method				
Sampled By				
Tested By				
Date Tested				
Material Source				
Material Type				
Borehole No.				
Depth (m)				
Moisture Content (%)				

Remarks

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Approved Signatory: Jagdish Chand
Form ID: W20Rep Rev 3

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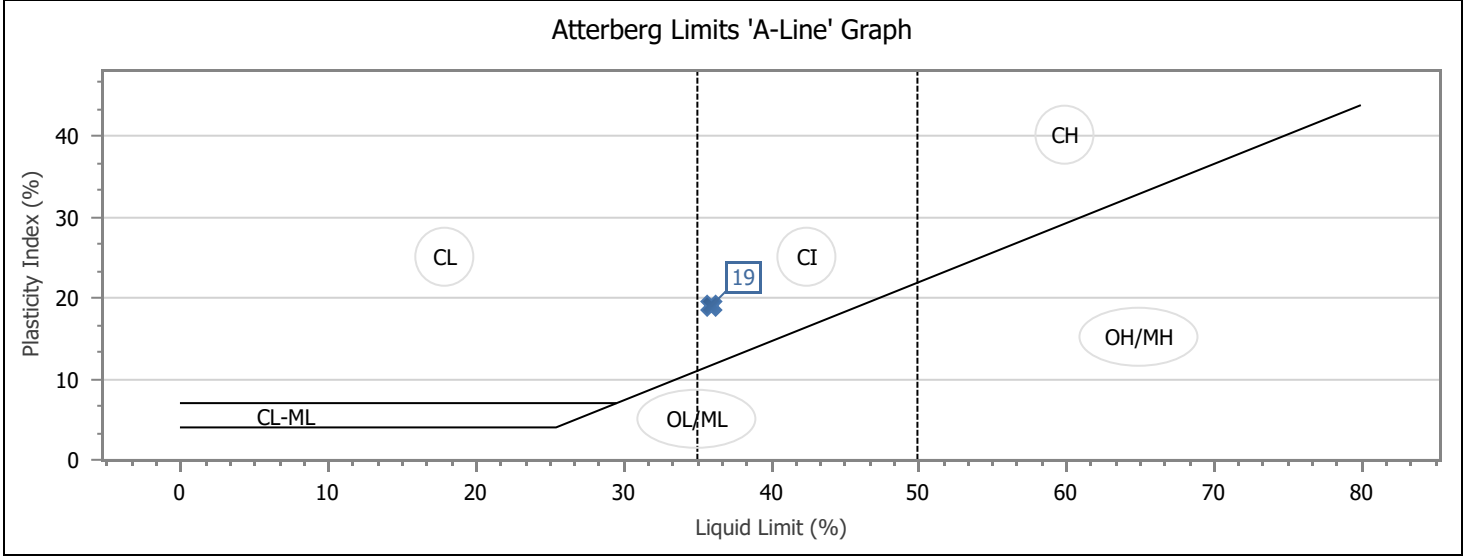
ATTERBERG LIMITS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5468-1
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	24/03/2025 Page 1 of 4

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	14874/S/25-14019	Sample Location	
Sampling Method	Tested As Received	Borehole No.	BH01
Date Sampled	12/03/2025	Depth (m)	2.5
Sampled By	Client Supplied		
Date Tested	19/03/2025		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Onsite
LL Water Type	Potable	Material Type	Clayey SAND
LL Device Type	Cassagrande	Specification	-
Client Reference	-	Prep Mat > 53mm (%)	-
Material Description	Sandy Clay		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**36**	
Plastic Limit (%)		**17**	
Plasticity Index (%)		**19**	
Linear Shrinkage (%)		**8.0**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 124.9mm / None		



Remarks

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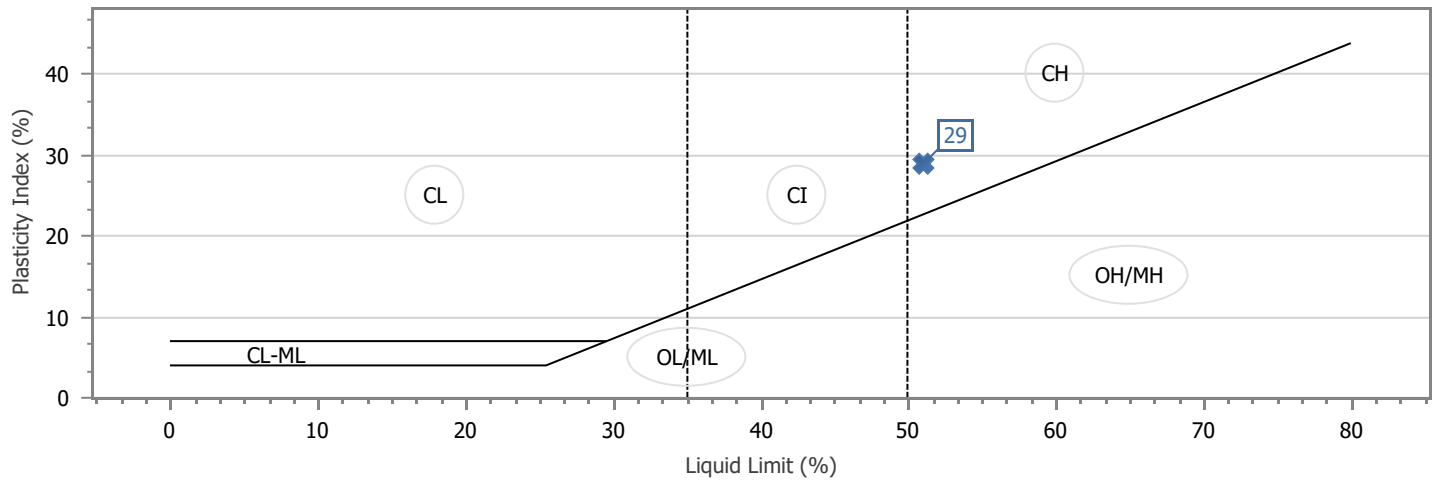
ATTERBERG LIMITS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5468-1
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	24/03/2025 Page 2 of 4

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	14874/S/25-14020	Sample Location	
Sampling Method	Tested As Received	Borehole No.	BH01
Date Sampled	12/03/2025	Depth (m)	4.25
Sampled By	Client Supplied		
Date Tested	18/03/2025		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Onsite
LL Water Type	Potable	Material Type	Sandy CLAY
LL Device Type	Cassagrande	Specification	-
Client Reference	-	Prep Mat > 53mm (%)	-
Material Description	Sandy Clay		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**51**	
Plastic Limit (%)		**22**	
Plasticity Index (%)		**29**	
Linear Shrinkage (%)		**10.5**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 249.7mm / Cracking		

Atterberg Limits 'A-Line' Graph



Remarks

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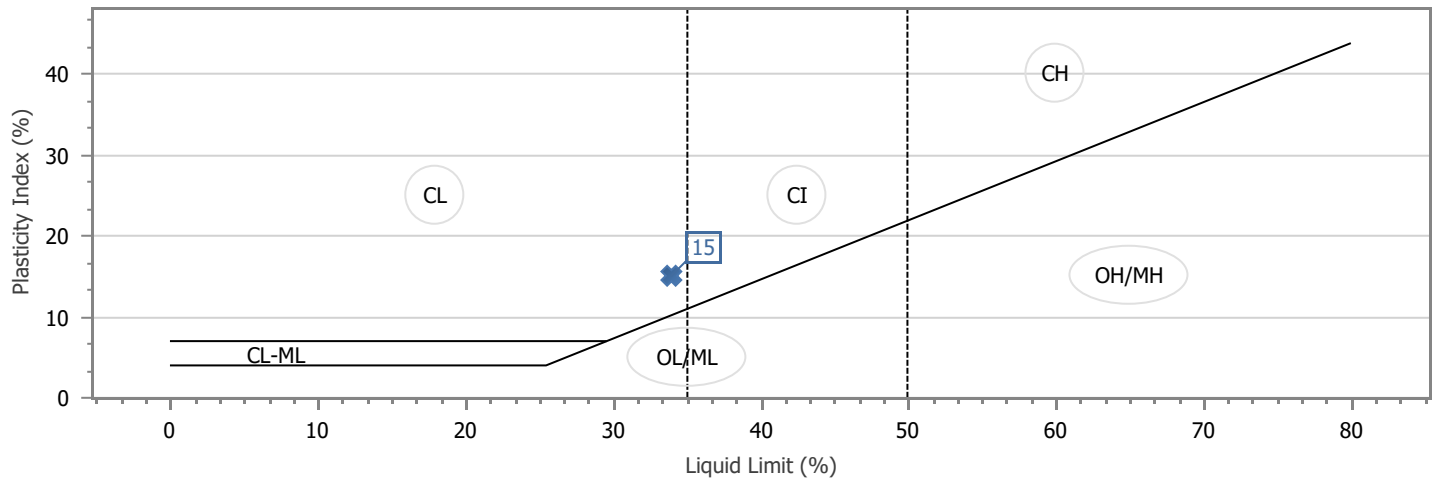
ATTERBERG LIMITS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5468-1
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	24/03/2025 Page 3 of 4

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	14874/S/25-14021	Sample Location	
Sampling Method	Tested As Received	Borehole No.	BH02
Date Sampled	12/03/2025	Depth (m)	2.5
Sampled By	Client Supplied		
Date Tested	18/03/2025		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Onsite
LL Water Type	Potable	Material Type	Sandy CLAY
LL Device Type	Cassagrande	Specification	-
Client Reference	-	Prep Mat > 53mm (%)	-
Material Description	Sandy Clay		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**34**	
Plastic Limit (%)		**19**	
Plasticity Index (%)		**15**	
Linear Shrinkage (%)		**7.0**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 249.7mm / None		

Atterberg Limits 'A-Line' Graph



Remarks

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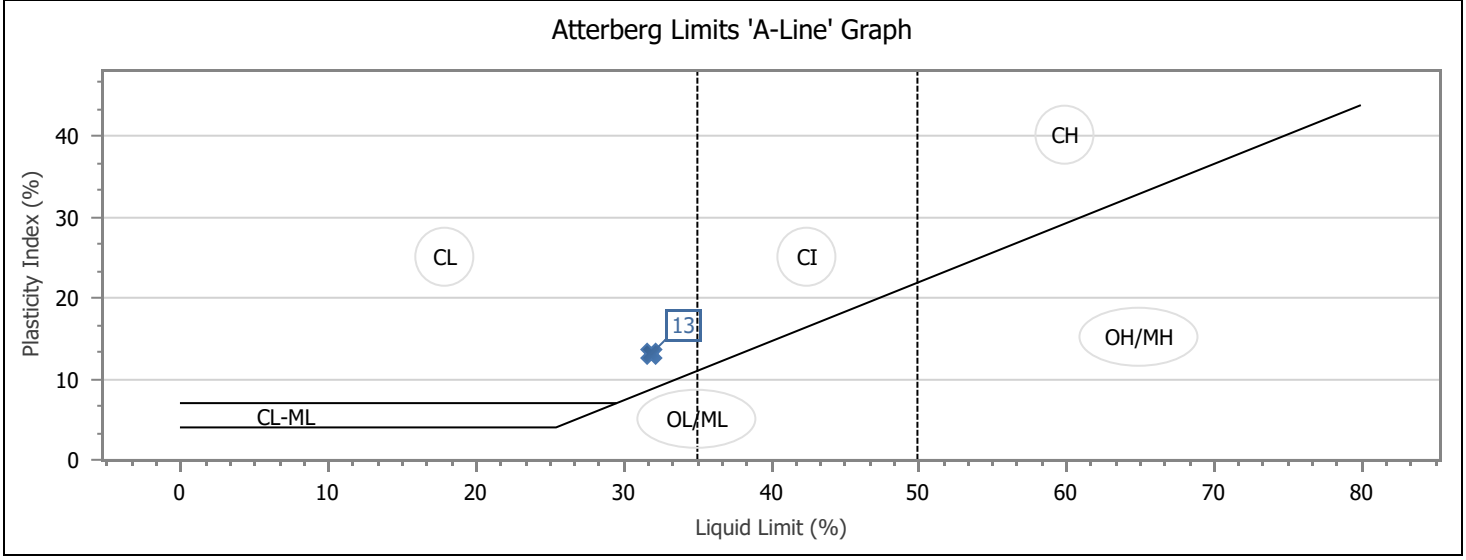
ATTERBERG LIMITS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5468-1
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	24/03/2025 Page 4 of 4

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	14874/S/25-14022	Sample Location	
Sampling Method	Tested As Received	Borehole No.	BH02
Date Sampled	12/03/2025	Depth (m)	4
Sampled By	Client Supplied		
Date Tested	18/03/2025		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Onsite
LL Water Type	Potable	Material Type	Sandy CLAY
LL Device Type	Cassagrande	Specification	-
Client Reference	-	Prep Mat > 53mm (%)	-
Material Description	Sandy Clay		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**32**	
Plastic Limit (%)		**19**	
Plasticity Index (%)		**13**	
Linear Shrinkage (%)		**6.5**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 124.9mm / None		



Remarks

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Form ID: W11Rep Rev 2

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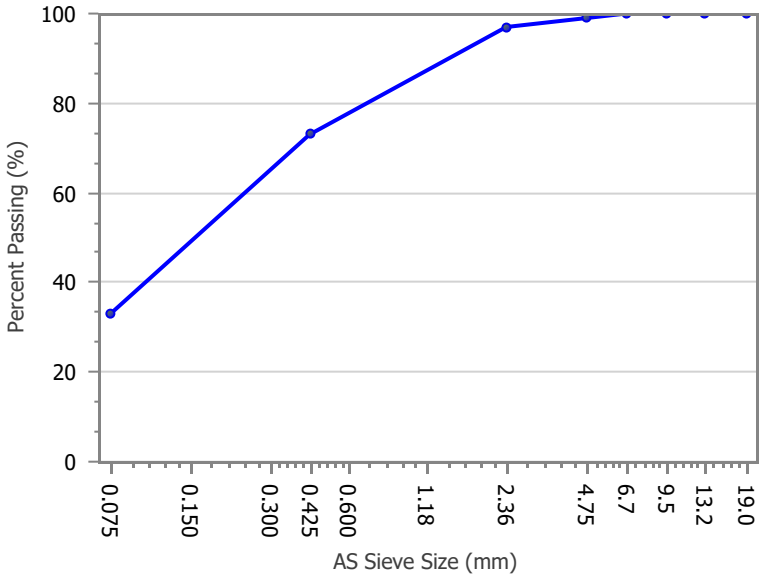
QUALITY OF MATERIALS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5469-2
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	27/03/2025 Page 1 of 4

Test Procedures	AS1289.3.6.1, AS1289.1.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	14874/S/25-14019	Borehole No.	BH01
Sampling Method	Tested As Received	Depth (m)	2.5
Date Sampled	12/03/2025		
Sampled By	Client Supplied		
Date Tested	26/03/2025	Material Source	Onsite
PSD Preparation	Washed	Material Type	Clayey SAND
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Sandy Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**100**	
4.75		**99**	
2.36		**97**	
0.425		**73**	
0.075		**33**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**36**		0.075/0.425 Fines Ratio		**0.45**	
Plastic Limit (%)		**17**		PI x 0.425 Ratio (%)		**1390.8**	
Plastic Index (%)		**19**		LS x 0.425 Ratio (%)		**585.6**	
Linear Shrinkage (%)		**8.0**		Shrinkage Observations	None		

Remarks	Re-Issued Report Replaces Report No 14874/R/25-5469-1 (reason: Added PSD Sample)

NATA

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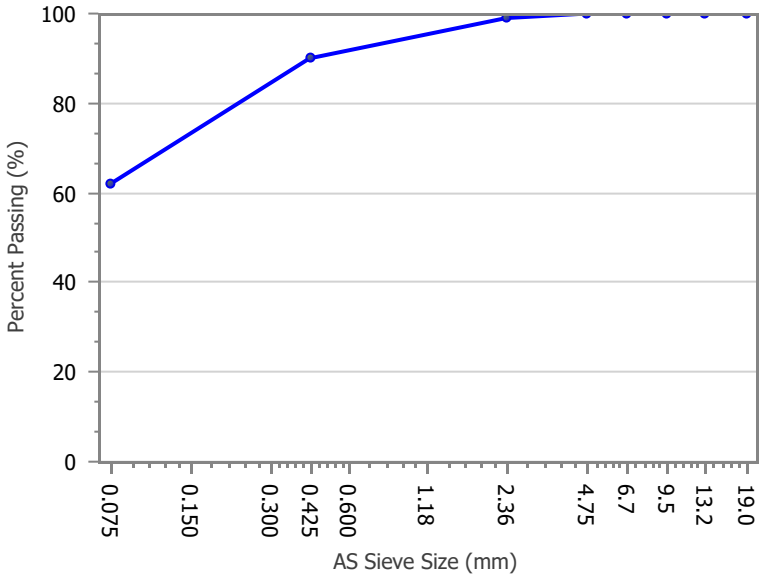
QUALITY OF MATERIALS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5469-2
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	27/03/2025 Page 2 of 4

Test Procedures	AS1289.3.6.1, AS1289.1.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	14874/S/25-14020	Borehole No.	BH01
Sampling Method	Tested As Received	Depth (m)	4.25
Date Sampled	12/03/2025		
Sampled By	Client Supplied		
Date Tested	21/03/2025	Material Source	Onsite
PSD Preparation	Washed	Material Type	Sandy CLAY
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Sandy Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**100**	
4.75		**100**	
2.36		**99**	
0.425		**90**	
0.075		**62**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**51**		0.075/0.425 Fines Ratio		**0.69**	
Plastic Limit (%)		**22**		PI x 0.425 Ratio (%)		**2607.1**	
Plastic Index (%)		**29**		LS x 0.425 Ratio (%)		**944.0**	
Linear Shrinkage (%)		**10.5**		Shrinkage Observations	Cracking		

Remarks	Re-Issued Report Replaces Report No 14874/R/25-5469-1 (reason: Added PSD Sample)

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 14874

Approved Signatory: Daniel Boyd
Form ID: W85Rep Rev 3

Construction Sciences
a kiwa company

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
60 - 64 Vella Drive,
Sunshine West VIC 3020

Laboratory: Melbourne Laboratory
Phone: 03 9364 9301
Fax: 03 9338 3255
Email: Melbourne@constructionsciences.net

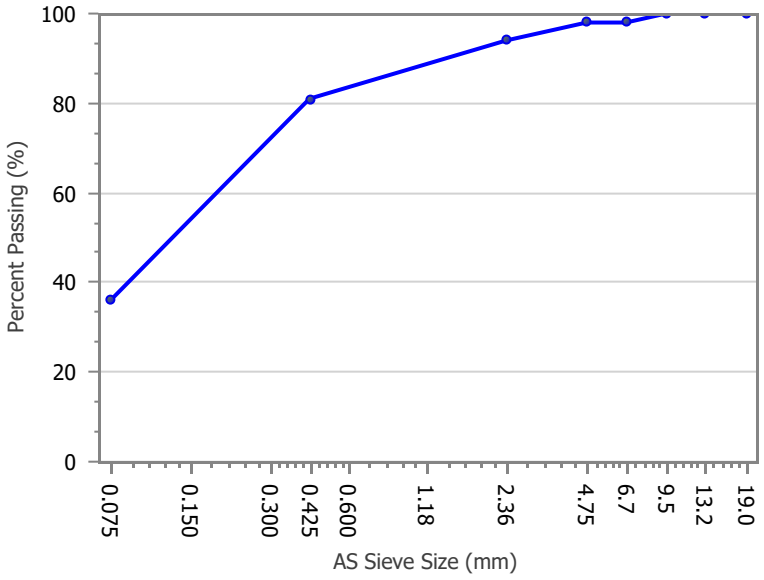
QUALITY OF MATERIALS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5469-2
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	27/03/2025 Page 3 of 4

Test Procedures	AS1289.3.6.1, AS1289.1.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	14874/S/25-14021	Borehole No.	BH02
Sampling Method	Tested As Received	Depth (m)	2.5
Date Sampled	12/03/2025		
Sampled By	Client Supplied		
Date Tested	21/03/2025	Material Source	Onsite
PSD Preparation	Washed	Material Type	Sandy CLAY
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Sandy Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**98**	
4.75		**98**	
2.36		**94**	
0.425		**81**	
0.075		**36**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**34**		0.075/0.425 Fines Ratio		**0.44**	
Plastic Limit (%)		**19**		PI x 0.425 Ratio (%)		**1221.0**	
Plastic Index (%)		**15**		LS x 0.425 Ratio (%)		**569.8**	
Linear Shrinkage (%)		**7.0**		Shrinkage Observations	None		

Remarks	Re-Issued Report Replaces Report No 14874/R/25-5469-1 (reason: Added PSD Sample)

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NATA

Accreditation Number: 1986
Corporate Site Number: 14874

Approved Signatory: Daniel Boyd
Form ID: W85Rep Rev 3

Construction Sciences
a kiwa company

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
60 - 64 Vella Drive,
Sunshine West VIC 3020

Laboratory: Melbourne Laboratory
Phone: 03 9364 9301
Fax: 03 9338 3255
Email: Melbourne@constructionsciences.net

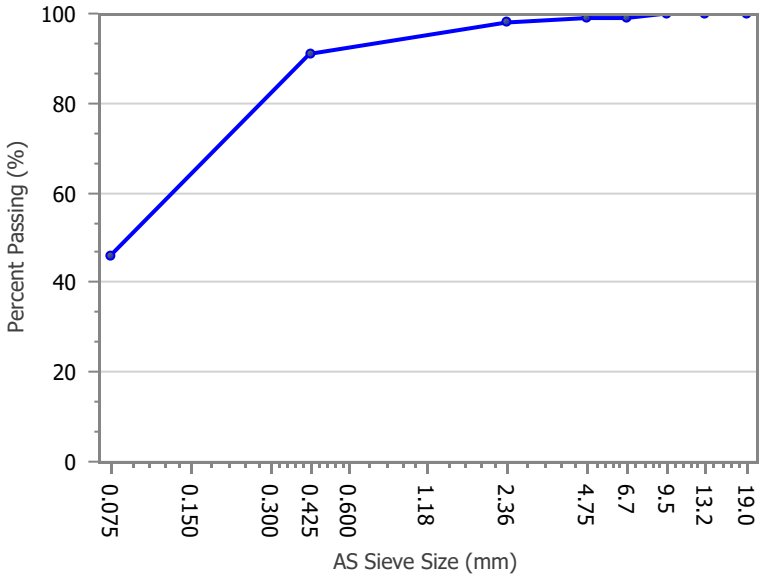
QUALITY OF MATERIALS REPORT

Client:	Black Geotechnical Pty Ltd	Report Number:	14874/R/25-5469-2
Client Address:	258 Hyde Street, YARRAVILLE	Project Number:	14874/P/2859
Project:	Lake Tyres Aboriginal Trust - V2367	Lot Number:	
Location:	Various	Internal Test Request:	14874/T/25-1981
Supplied To:	n/a	Client Reference/s:	V2367
Area Description:		Report Date / Page:	27/03/2025 Page 4 of 4

Test Procedures	AS1289.3.6.1, AS1289.1.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	14874/S/25-14022	Borehole No.	BH02
Sampling Method	Tested As Received	Depth (m)	4
Date Sampled	12/03/2025		
Sampled By	Client Supplied		
Date Tested	21/03/2025	Material Source	Onsite
PSD Preparation	Washed	Material Type	Sandy CLAY
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	Sandy Clay		

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**99**	
4.75		**99**	
2.36		**98**	
0.425		**91**	
0.075		**46**	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)	Test Result	Specification Minimum (%)	**Result**	Specification Maximum (%)
Liquid Limit (%)		**32**		0.075/0.425 Fines Ratio		**0.50**	
Plastic Limit (%)		**19**		PI x 0.425 Ratio (%)		**1183.0**	
Plastic Index (%)		**13**		LS x 0.425 Ratio (%)		**591.5**	
Linear Shrinkage (%)		**6.5**		Shrinkage Observations	None		

Remarks	Re-Issued Report Replaces Report No 14874/R/25-5469-1 (reason: Added PSD Sample)

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Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 14874

Approved Signatory: Daniel Boyd
Form ID: W85Rep Rev 3

amal ANALYTICAL PTY LTD Laboratory Services for the Environment and Occupational Health

Certificate of Analysis 20250678

Client Name:	Black Geotechnical	*Date Samples Received:*	11-Mar-25
Address:	258 Hyde Street, Yarraville VIC 3013	*Date Samples Analysed:*	17-Mar-25
Contact:	Frank O'Dea	*Certificate Issue Date:*	18-Mar-25
Job Number:	V2367	*Page:*	1 of 1
Client Reference:	Lake Tyers Boat Ramp & Pontoon		

Results

Laboratory ID:	AB2809	AB2810	AB2811
Sample Type:	Soil	Soil	Water
Date Sampled:	04-Mar-25	05-Mar-25	04-Mar-25
Client Reference:	BH01 - 1m	BH02 - 2.5m	BH01 - W

Analyte	LOR	Units			
Chloride	50	mg/kg	2400	2100	8000
Sulphate	100	mg/kg	430	360	1200
Conductivity	NA	uS/cm	1900	1600	
Resistivity	NA	ohm.cm	530	630	
pH (1:5 in H2O)	NA	pH units	7.5	9.5	7.8

Laboratory ID:			
Sample Type:			
Date Sampled:			
Client Reference:			

Analyte	LOR	Units
Chloride	50	mg/kg
Sulphate	100	mg/kg
Conductivity	NA	uS/cm
Resistivity	NA	ohm.cm
pH (1:5 in H2O)	NA	pH units

Report Details

Method ID	Details	Holding Days	Holding	Definitions
AGGRESS	Anions (1:5 aqueous) by IC. pH and conductivity (1:5 aqueous)	7	Exceeded	mg/kg - milligrams per kilogram
				LOR - Level of reporting

Remarks

Results Authorised By

S. Muhlnickel (B.A.Sc)
Laboratory Manager

Sample(s) are analysed as received on site by AMAL Analytical (Australia) Pty Ltd unless otherwise noted. Results pertain only to the sample(s) analysed and are reported on a dry weight basis for soils, and an 'as received' basis for other matrices. Where a sample holding time is exceeded, the validity of results cannot be guaranteed. This report supersedes any released prior and shall not be reproduced, except in full, without express written permission from the laboratory.

ilac-MRA NATA Accreditation No. 2431
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