CORE GEOTECHNICAL CONSULTANTS

23 March 2021

GIBB Engineering & Architecture
14 Kloof Street
Gardens
Cape Town
8001

ATTENTION: MS B MENTOOR

Dear Bernie

PROJECT 138-20 MACASSAR BULK SERVICES AND INFRASTRUCTURE UPGRADES: – GEOTECHNICAL INVESTIGATION

At your request, we have carried out a geotechnical investigation for the proposed new upgrades to the bulk services associated with the new large scale residential development located in Macassar.

The proposed upgrades include the following:-

- Potential upgrades to the existing road infrastructure
- Potential upgrades to the existing bulk water and sewer networks

The objectives of this investigation were thus to determine the general site geotechnical conditions in light of these potential upgrades, inspect layer works of the existing road infrastructure, as well as comment on related geotechnical aspects such as excavation conditions, materials usage, soil permeability and drainage, where applicable.

Our findings and recommendations are outlined in this report.

1. Nature of the investigation

The investigation comprised:-

a) The inspection and formal soil profiling of eleven test pits excavated by hand. Six of these test pits (numbered LW) were excavated adjacent to the road at key road intersections, in order to sample and inspect the road layer works. The remainder of the test pits (numbered TH) were excavated in order to inspect and sample the general soil profile.

b) DPL (dynamic probe light) testing to assess soil strength and compressibility.

c) Laboratory testing (Grading analysis, Atterberg limits, Mod, CBR testing, compactability) to assess existing layer works and soil engineering properties.

All test positions are shown on the attached site plan (Figure 1). Copies of the recorded test pit, DPL profiles and laboratory tests are also attached.

2. Site description, geology and geohydrology

The proposed upgrades will mostly be along Macassar Road (M9), Albatros Road and Kramat Road, south of the N2 national highway, and east of Baden Powell Drive. The locality of the general site area is indicated in Figure 2.1.

The Macassar area is underlain from surface by unconsolidated sandy deposits of transported origin (Recent and Quaternary age). These sandy deposits essentially comprise white dune sands that have been reworked and calcretized in areas and clayey sands in a succession of the order of 20 m to 30 m thick in this area. Discontinuous calcrete bands are also common in this area.

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Figure 2.1. Locality of site area (indicated in red)

Weathered phyllite, greywacke and quartzitic sandstone rocks of the Tygerberg Formation (Malmesbury Group) directly underlie these sandy deposits. Weathered rock was encountered at depths of between 23.0 m and 29.0 m below surface in boreholes drilled in surrounding areas. These sediments typically comprise an upper completely weathered residual soil (stiff sandy clayey silt), grading relatively rapidly with increasing depth to rock.

The regional geology, with reference to the site area, is indicated in Figure 2.2

The profiles encountered in the road layer works test pits (test pits LW in the soil profiles and Figure 1, attached),are summarized in Table 2.1.

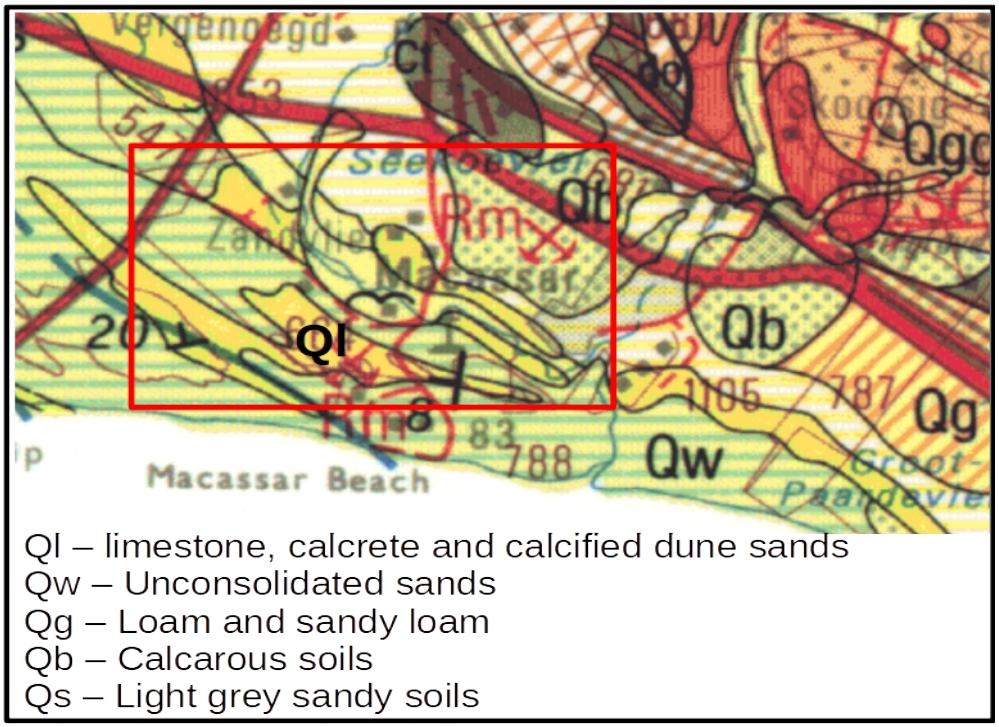


Figure 2.2. Regional geology of the general site area (indicated in red)

Table 2.1 Summary of road layer works encountered in test pits

Test pit	Asphalt thickness (mm)	Base course		Subbase		Underlying subgrade material
		Material	Thickness (mm)	Material	Thickness (mm)	
LW2	50	Silty sandy gravel (angular crushed stone)	150	Clayey silty sandy gravel	150	Fine sand
LW3	25	Silty sandy gravel (angular crushed stone)	115	Clayey sandy gravel	180	Fine sand-Engineered fill
LW6	20	Silty sandy gravel (angular crushed stone)	230	Clayey sandy gravel	170	Fine sand
LW7	35	Clayey sandy gravel	165	Clayey silty sandy gravel	200	Sand-Engineered fill
LW8	75	Angular crusher run gravel	140	Clayey sandy gravel	185	Fine sand
LW10	80	Sandy calcrete gravel	212	Calcrete gravel with calcrete cobbles	300	Fine sand

The soil profile encountered in the test pits adjacent to the roads (test pits TH in the soil profiles and Figure 1, attached), comprised an upper loose sandy fill, consisting of fine to medium sand with variable amounts of foreign materials such as gravel, calcrete and isolated pieces of domestic waste (plastic). The thickness of the fill generally varied between 0.3m to 0.8m. Depth of fill is however expected to increase in areas where elevation levels were raised adjacent to the natural drainage lines associated with the Eerste River (such as south and north-east of the intersection of Kramat and Macassar Road, and south of the intersection of Albatros Road and Macassar Road). For most of the area, the sandy fill is underlain by transported sands that extend to depths in excess of 1.5m.

In the northern part of the site, along Kramat Road (TH5), a stiff clayey sand horizon was found to underlie the transported sands, at a depth of 1.3m.

Towards the west, close to Baden Powell Drive, pedogenic calcrete soils were encountered close to surface and resulted in early refusal in TH9. In TH9b, calcretized silty sand with calcrete gravel was encountered within the upper 1.1m from surface. These soils were in turn underlain by a weakly cemented (calcretized) clayey sand horizon which extended to a depth in excess of 1.6m.

Groundwater was not encountered within any of the test pits. The investigation was however conducted at the end of the dry summer period and the presence of any perched water table would need to be confirmed towards the end of the wet winter period, after maximum regional recharge has taken place. Any groundwater flow is expected to follow the regional topography towards the natural drainage lines. A shallow perched water table is expected within 0.5m from natural ground level in areas within, and immediately adjacent to, the natural drainage lines associated with the Eerste River. Seasonal flooding and marshy conditions are also expected in these areas. Previous road earthworks have however mostly raised elevation levels in these areas. There is also potential for a localized perched water table to develop overlying low permeability clayey soils and pedogenic soils, within 1.0-1.5m of surface in areas where these soils were encountered.

3. Geotechnical evaluation

Laboratory test results for the road layer works are summarized in Table 3.1, while results for the in-situ soils tested are summarized in Table 3.2. On the basis of the field investigation and soils engineering data, the following points relating to geotechnical conditions on the site may be made:-

a) Soil profiles and DPL tests indicate that the in-situ transported sands and sandy fill encountered at surface across most of the regional area,generally have a high compressibility within the upper 0.5m to 1.0m before consistency improves (moderately compressible). Deeper zones of high compressibility are also expected in areas where a deep sandy profile is expected. Soil improvement, such as compaction, will thus be required below any new bulk service pipelines as well to improve strength of the sandy soils for use as a subgrade (where applicable). The hardpan pedogenic horizons (calcrete), generally encountered towards the west (TH9, TH9b), are moderately to well cemented.

b) The results of the road layer works testing are summarized in Table 3.1. Apart from the base coarse material sampled at test hole LW6 (along Kramat Road), which classifies as a G6 quality material, all base coarse materials in other areas are of a G5 quality material. Subbase materials in all test pits sampled classify as G6 quality materials.

Table 3.1 Summary of existing road layer works engineering properties

Test Pit	LW3		LW6		LW8		LW10	
Material	**Base coarse**	**subbase**	**Base coarse**	**subbase**	**Base coarse**	**subbase**	**Base coarse**	**subbase**
Depth (mbgl)	0.025-0.14	0.14-0.32	0.02-0.25	0.25-0.42	0.075-0.215	0.215-0.4	0.08-0.22	0.22-0.52
Description	Silty sandy gravel	Clayey sandy gravel	Sandy gravel	Clayey sandy gravel	Angular crusher run gravel	Clayey sandy gravel	Sandy calcrete gravel	Calcrete gravel
LL	18	19	-	23	16	23	15	16
PI	6	7	NP	7	5	9	5	6
LS	2	2	-	3	2	4	2	2
GM	2.55	2.19	2.31	2.6	2.48	2.33	1.79	1.49
CBR @ 93%	40	26	20	20	34	24	33	27
CBR @ 95%	48	35	35	28	45	35	47	36
TRH14 class	G5	G6	G6	G6	G5	G6	G5	G6

Key: LL – liquid limit. PI – plasticity index. GM – grading modulus. NP – non-plastic. CBR – California Bearing Ratio

c) In terms of material properties, the transported sands are non plastic. They have a low to moderate post compaction strength. As a construction or roadworks material these soils should be suitable for use as general fill, general subgrade and in most cases, a lower quality selected layer material (G9).The sandy soils could potentially classify as a G8 quality material in areas where calcrete gravel is present.

The sandy soils are expected to have a moderate to lower-moderate permeability value. In terms of use as a pipe bedding material, although they have a compactability factor that does not exceed 0.4, in terms of required grading they will however only be suitable for use as selected fill and not as a selected granular material (according to SANS 1200 LB), as these soils are not singularly graded.

d) Stiff clayey sands as encountered along Kramat road were sampled for testing as part of the nearby Macassar Housing project. These stiff clayey soils generally have a moderate plasticity (Pi<20). Poor workability and drainage (very low permeability expected) properties, as well as a

potential for some minor heave movement(<15mm expected) will generally make these soils unsuitable for use in construction, as a subgrade or for use as a pipe bedding material.

e) No difficulty in excavation was encountered within the transported soils (sands and clayey sands). Refusal was however met within the dense to very dense calcrete, encountered in TH09.

f) Although sidewall collapse did not occur, collapse is expected within the loose cohesionless sandy soils in excavations deeper than 1.5m. Such excavations will require shoring or battering of sidewalls, for safety reasons.

g) Seepage was not encountered within any of the test pits. The investigation was however conducted at the end of the dry summer period. A perched water table could potentially develop overlying the stiff clayey soils and pedogenic calcrete, within 1.0-1.5m of surface and potentially within 0.5m of surface in areas close to the natural drainage lines associates with the Eerste River and its adjacent flood plains.

Table 3.2 Summary of in-situ soils engineering properties

Test Pit	TH1	TH4	TH5	LW8	TH9
Depth (mbgl)	0.7-1.55	1.0-1.55	0.6-1.3	0.4-1.15	0.2-0.8
Description	Transported sand	Transported sand	Transported sand	Transported sand	Sandy fill with calcrete gravel
LL	-	-	-	-	-
PI	NP	NP	NP	NP	NP
LS	-	-	-	-	-
GM	1.02	0.96	1.09	1.09	1.12
MC	5	5.7	4	5.7	4.9
CBR @ 93%	6	8	6	9	12
CBR @ 95%	9	11	9	12	16
Compactability	0.4	0.4	0.4	0.4	0.4
USCS Soil Class	SP	SP	SP	SP	SP/SM
TRH14 class	G10	G9	G10	G9	G8
Potential usage (construction)	General fill/subgrade	General fill/Selected layer/subgrade	General fill/subgrade	General fill/Selected layer/subgrade	General fill/Selected layer/subgrade
Potential usage (pipe bedding)- (SANS 1200-LB)	Selected fill	Selected fill	Selected fill	Selected fill	Selected fill

Key: LL – liquid limit. PI – plasticity index. MC – in-situ moisture content. GM – grading modulus. NP – non-plastic. CBR – California Bearing Ratio

4. Recommendations for design and construction

4.1 Excavation conditions

Excavation within the loose, transported sandy soils, sandy fill and clayey sands, can be classified as "soft excavation", in terms of the SANS 1200 D Earthworks Specification. Light plant or even hand excavation should be suitable within the upper 1.5m within these soils. Excavation within the pedogenic (calcretized) gravelly sandy soils and pedogenic hardpan calcrete however classifies as "soft to intermediate excavation" and larger plant equipment such as tracked excavators, fitted with rock buckets, may be required for excavations within this material. The use of pneumatic power tools may be required for hand excavation within these cemented materials.

Sidewall collapse is expected in cohesionless sandy soils in excavations deeper than 1.5m. Sidewall collapse may even occur at shallower depths if a shallow perched water table is encountered.

Excavations deeper than 1.5m will thus require formal shoring or battered sidewalls. Sidewalls would need to be trimmed back to an angle of not more than 45° to the horizontal. This batter angle will likely need to be flattened further (30-35°) under wet saturated conditions. Excavations deeper than 3m will require more formal lateral support measures.

4.2 Foundation recommendations

Given the geotechnical conditions encountered, the following should be noted with regards to allowable bearing pressures and the founding of any ancillary structures that may be associated with the bulk service upgrades:-

- Any uncontrolled sandy fill is unsuitable for conventional founding purposes.
- The transported sandy soils are highly compressible within the upper 0.5m to 1.0m from surface. They are thus only suitable for the founding of lightly loaded structures, or soil improvement (compaction) will be required.
- The stiff clayey sands, calcretized soils and weakly cemented soils have a moderate compressibility and will also form a more competent founding horizon, provided bearing pressure limitations apply.
- Recommended allowable bearing pressures for soils encountered on site, are summarized in Table 4.1.
- Structures can generally be founded conventionally using the allowable bearing pressures and soil improvement recommendations in Table 4.1 as a guideline. Expected settlement under these conditions will generally not exceed 15-20mm. A site specific geotechnical investigation is however recommended to confirm geotechnical conditions and foundation recommendations prior to construction.

Table 4.1 Allowable bearing pressures of soils encountered on site.

Founding soils	Allowable bearing capacity (kPa)	Comment
1a) Highly to moderately compressible transported sands (without compaction)	50	Based on the soil profiles and DPL test results. Will only be suitable for the founding of lightly loaded ancillary structures.
1b) Highly to moderately compressible transported sands, with compaction from surface to 93% Mod AASTHO maximum dry density.	80	Allowable bearing pressure can be improved through compaction from surface to at least 93% Mod AASHTO maximum dry density, using a heavy vibratory roller.
1c) Highly to moderately compressible transported sands, with compaction from surface to 95% Mod AASTHO maximum dry density.	100	Allowable bearing pressure can be improved through compaction from surface to at least 95% Mod AASHTO maximum dry density, using a heavy vibratory roller.
2) Weakly to moderately cemented calcretized) gravelly sands and stiff clayey sands.	120	These soils are generally encountered within 1.0m of surface and will form a competent founding horizon for moderate loads.

4.3 Specialized pipeline installation techniques

Depending on the final proposed upgrades and the final route chosen, specialized trenchless methods may need to be considered in order for any new bulk services to cross either Albatros Road, Kramat Road and Macassar Road.

The following specialized trenchless methods of pipeline installation, where applicable, could possibly be considered:-

A) **Horizontal directional drilling (HDD)**

- In order to limit traffic disturbance in the area, it is likely that directional drilling will be used in order for any new pipeline to cross beneath most of the major busy roadways in the area.
- Depending on whether the drilling method to be used has a soils removal process, a certain minimum depth of cover may well be required to prevent surface heaving. The ratio of depth of cover to pipe diameter may vary from 5:1 to 10:1
- A minimum drilling depth of 1.5m below road level is recommended to avoid any existing services adjacent to the roads.
- Apart from zones of dense to very dense pedogenic calcrete soils no real difficulty in excavation or areas of hard rock were encountered within any of the test pits. There should thus be no soil profile related problem that is likely to negate the possibility of directional drilling.
- Drilling mud such as bentonite may be required to stabilize the boreholes in the saturated sandy soils in areas close to the natural drainage lines, due to the potential for a shallow perched water table expected within these areas.
- A certain clearance area is needed on either side of the roadways in order to achieve the correct entry and exit angle, which may require additional earthworks in the form of jacking/drilling and receiving pits.

B) **Horizontal pipe jacking**

- Horizontal pipe jacking could potentially also be considered as a possible alternative to direction drilling.
- Depending on the pipeline diameter, a minimum depth of cover will however also be required.
- A minimum jacking depth of 1.5m is recommended beneath the roads in order to avoid existing services and any engineered fill acting as a sub-base layer for the road.
- Apart from very dense to dense zones of calcrete, mostly encountered in areas close to Baden Powell Drive, and stiff clayey sands encountered along Kramat Road, no hard rock or difficulty in excavation was encountered. Apart from the pedogenic soils, no excavation "difficulty" related problems are foreseen with regards to the use of this method.
- The shallow perched water table is expected within 1.0m-1.5m of surface and possibly shallower in the lower lying areas close to drainage lines. This may prevent deep pipe jacking areas such as along the intersection of Kramat Road and Macassar Road, and at the intersection of Albatros Road and Macassar Road, which are located adjacent to natural drainage lines. In these areas temporary well points may be required in order to lower the water table.
- Pipe jacking requires access pits of fixed dimensions to be constructed on either of the road. Depending on depth of the jacking system, excavations deeper than 2.0m may require side-wall stabilization (formal shoring or battered sidewalls as discussed in Section 4.1) as well as de-watering, if excavations extend below the perched water table.

4.4 Assessment of lateral bearing strength for thrust block design

As a result of the thrust forces that act on a buried pressurized pipeline, especially in areas where changes in fluid velocity, pipe size or pipeline direction occur, thrust restraint will need to be achieved by transferring the thrust forces via thrust blocks, into the soil structure located outside these thrust blocks. The main objective of the design would be to distribute the thrust forces to the soil structure in such a manner that damage does not occur to the restrained pipe system and joint separation does not occur in any unrestrained joints. Following the geotechnical investigation, the following should be noted with regards to thrust block design, if and where applicable:-

- It is envisaged that any new bulk services will be situated at a depth of between 1.0m and 3.0m below surface.
- Following the soil profiles and laboratory testing results, the shear strength properties of the main soil groups expected at a depth of between 1.0m and 3.0m, are summarized in Table 4.2.
- The change in passive earth pressures with depth, for each soil classification (from Table 4.2), is shown graphically in Figure 4.1.
- Figure 4.1 indicates that there can be considerable variation in passive earth pressure depending on the soil type and depth.

Table 4.2 Soil shear strength properties for thrust block design

Soil description	USCS soil classification	Soil unit weight (kg/m3)	Approx. friction angle ϕ'	Approx cohesion c' (kPa)
Transported sands	SP	18-19	30	0
Cemented sands and calcretized soils	SM	17-19	31-34	5
Clayey sand	SC	16-17	28-30	5-10

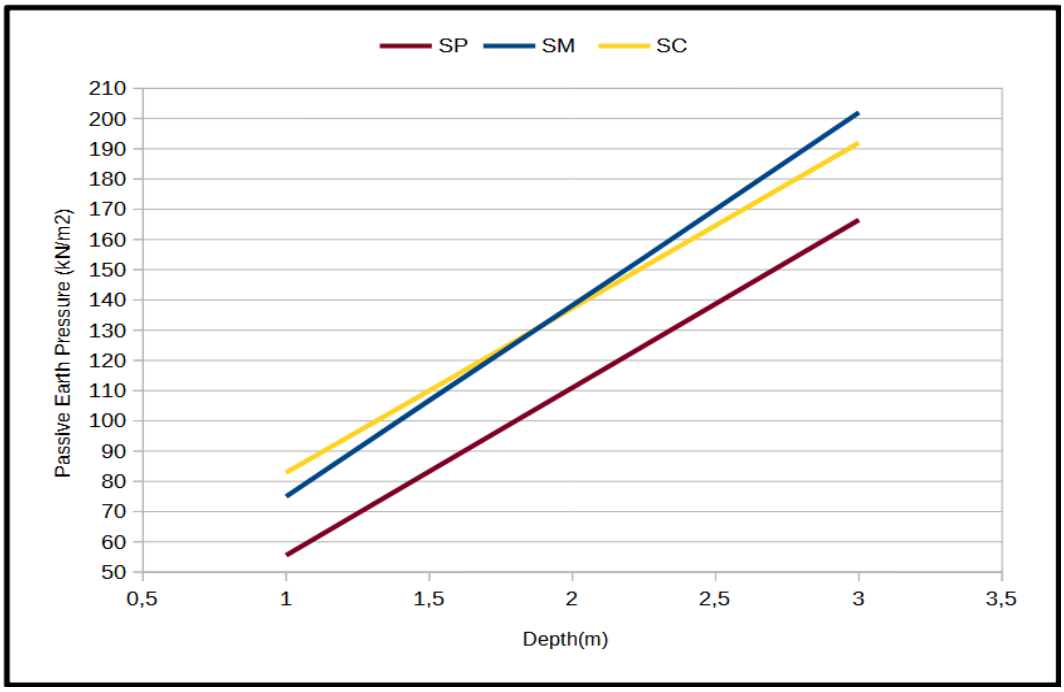


Figure 4.1. Plot of passive earth pressure with depth for the major soil classes encountered

4.5 Drainage

Although groundwater was not encountered within any of the test pits, a perched water table may be encountered within 1.0m to 1.5m of surface during wet winter periods, especially overlying the very low permeability clayey sands and pedogenic soils. In lower lying areas close to natural drainage lines and flood plains associated with the Eerste River, this level could rise to within 0.5m of surface.

Excavations in these areas are likely to require dewatering. Conventional dewatering through the use of sump pumps, should provide the most suitable dewatering measure. Deep excavations with high seepage rates may however require more extensive dewatering measures, such as the installation of temporary wellpoints around the perimeter of the excavation, in order to temporarily lower the phreatic surface during earthworks.

The general implementation of sound water management measures in accordance with good engineering practice is essential. These measures would include the effective design of storm water drainage for roads and the adequate collection and disposal of storm water.

We trust that this report meets your present requirement and would be pleased to discuss any aspects with you.

Kind regards



EUGENE LAUBSCHER

Encl: Site plan (Fig. 1)
Test pit soil profiles 11)
DPL profiles (11)
Laboratory test results (14)



Client:	Gibb				
Project:	Macassar Bulk Services Upgrade				
Title:	Plan layout showing site locality and test positions				
Date:	03 -21	**Traced by:**	EL		
Scale:	NTS	**Fig no.:**	1	**Job no.:**	138 -20

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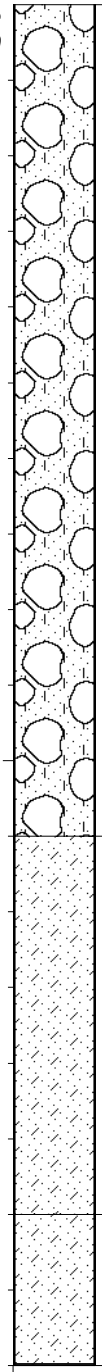
MACASSAR BULK SERVICES
BADEN POWELL DRIVE

TEST PIT SOIL PROFILES

HOLE No: TH09b
Sheet 1 of 1

JOB NUMBER: 017-21

Scale 1:10



0.00 Dry cream dense with zones of very dense weakly to moderately calcretised silty sand with calcrete boulders.
Pedogenic.

1.10 Moist creamy light brown medium dense to dense weakly calcretised clayey sand.
Transported.

1.60 Moist cream medium dense weakly cemented slightly clayey sand.
Transported.

1.80

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
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SETUP FILE : STANDARD.SET

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DIAM :
DATE :
DATE : 2 March 2021
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Y COORD :

HOLE No: TH09b

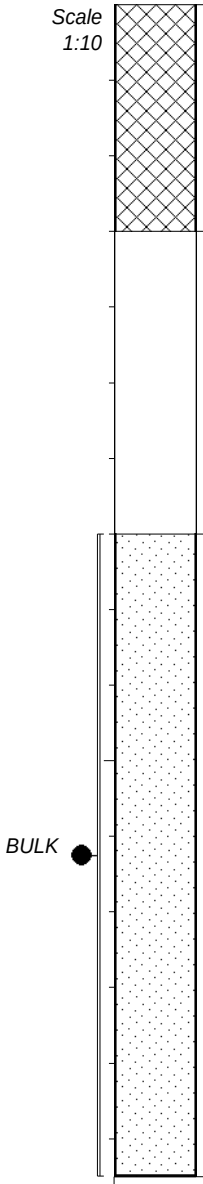
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MACASSAR BULK SERVICES
MACASSAR ROAD

TEST PIT SOIL PROFILES

HOLE No: TH01
Sheet 1 of 1

JOB NUMBER: 017-21



Dry light brown loose intact fine sand with fine root material and some blue stone pebbles.
Fill. *contains isolated foreign materials.

Slightly moist brown and off white medium dense becoming dense intact fine sand with some calcrete gravels.
Fill.

Dry off white dense intact fine sand.
Transported (aeolian).

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.
4) BULK sample at 0.7--1.55m.

CONTRACTOR :
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DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

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DIAM :
DATE :
DATE : 2 March 2021
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HOLE No: TH01

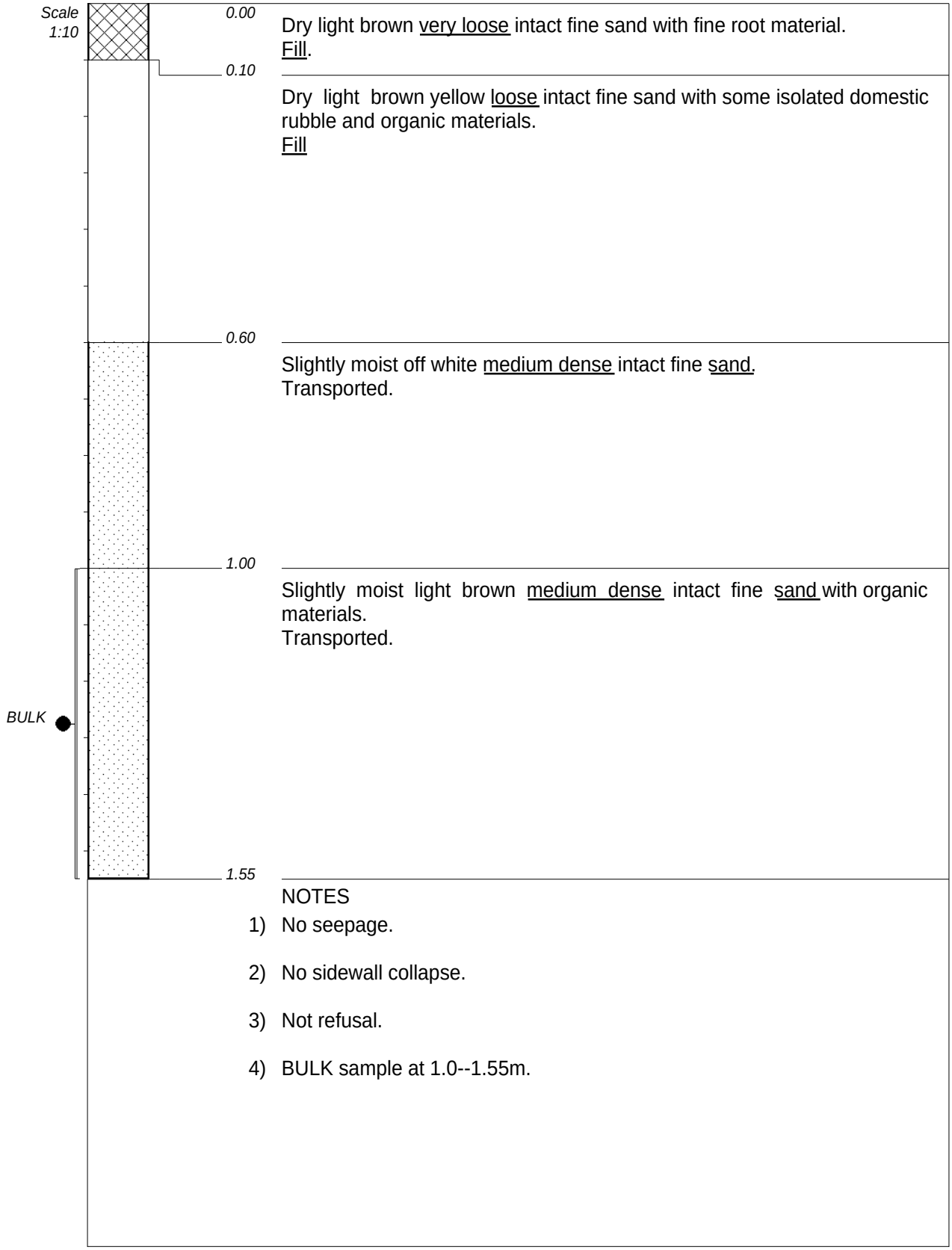
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MACASSAR BULK SERVICES
MACASSAR ROAD

TEST PIT SOIL PROFILES

HOLE No: TH04
Sheet 1 of 1

JOB NUMBER: 017-21



0.00 – 0.10: Dry light brown very loose intact fine sand with fine root material. Fill.

0.10 – 0.60: Dry light brown yellow loose intact fine sand with some isolated domestic rubble and organic materials. Fill

0.60 – 1.00: Slightly moist off white medium dense intact fine sand. Transported.

1.00 – 1.55: Slightly moist light brown medium dense intact fine sand with organic materials. Transported.

BULK sample at 1.0--1.55m.

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.
4) BULK sample at 1.0--1.55m.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
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HOLE No: TH04

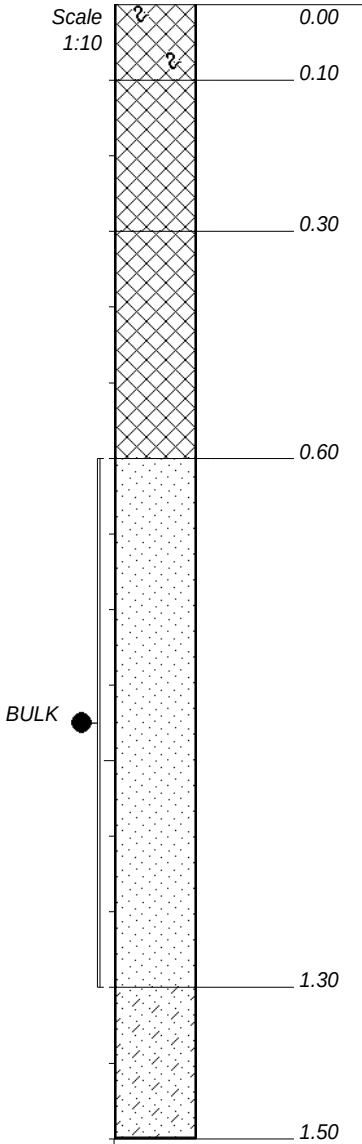
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MACASSAR BULK SERVICES
KRAMAT ROAD

TEST PIT SOIL PROFILES

HOLE No: TH05
Sheet 1 of 1

JOB NUMBER: 017-21



0.00	Dry brown loose gravelly sand with root material. Fill.
0.10	Dry brown dense gravelly sand. Fill - engineered subbase.
0.30	Slightly moist light brown loose fine to medium sand with isolated gravels. Fill - contains isolated pieces of plastic.
0.60	Dry cream loose to medium dense intact fine sand. Transported.
1.30	Moist mottled yellow and brown firm to stiff intact clayey sand. Transported.
1.50	

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.
4) BULK sample at 0.6--1.3m.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
DATE : 2 March 2021
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X COORD :
Y COORD :

HOLE No: TH05

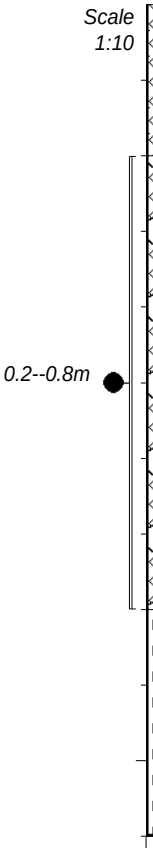
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MACASSAR BULK SERVICES
BADEN POWELL DRIVE

TEST PIT SOIL PROFILES

HOLE No: TH09
Sheet 1 of 1

JOB NUMBER: 017-21



0.00 – 0.20: Dry light brown loose intact fine sand with root material. Fill.

0.20 – 0.80: Dry becoming moist cream and light brown very dense intact calcrete gravel with calcrete cobbles and some stone pebbles. Fill.

0.80 – 1.10: Dry cream very dense strongly cemented calcrete. Pedogenic.

NOTES

1) No seepage.
2) No sidewall collapse.
3) Refusal on Calcrete.
4) Bulk Sample at 0.2--0.8m.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
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DATE :
DATE : 2 March 2021
DATE : 23/03/2021 13:23
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X COORD :
Y COORD :

HOLE No: TH09

CORE GEOTECHNICAL CONSULTANTS

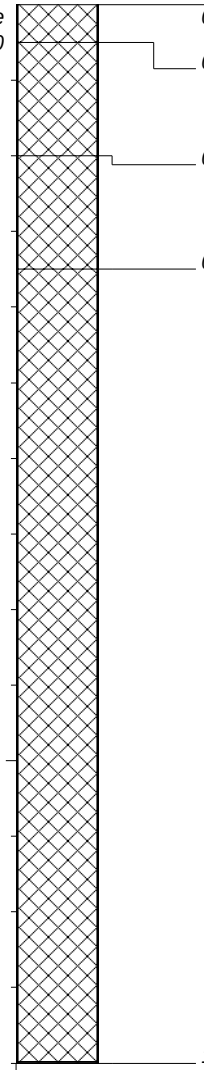
MACASSAR BULK SERVICES
MACASSAR ROAD

TEST PIT SOIL PROFILES

HOLE No: LW02
Sheet 1 of 1

JOB NUMBER: 017-21

Scale 1:10



0.00	Asphalt.
0.05	Dry brown dense to very dense silty sandy angular gravel. Fill - engineered base course.
0.20	Dry brown and orange dense to very dense clayey silty sandy angular gravel. Fill - engineered subbase.
0.35	Dry to slightly moist cream medium dense fine sand. Fill - likely engineered fill used to raise elevation levels for road. No waste or foreign materials.
1.40	

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
DATE : 2 March 2021
DATE : 23/03/2021 13:23
TEXT : ..vicessoilprofiles(1).txt

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: LW02

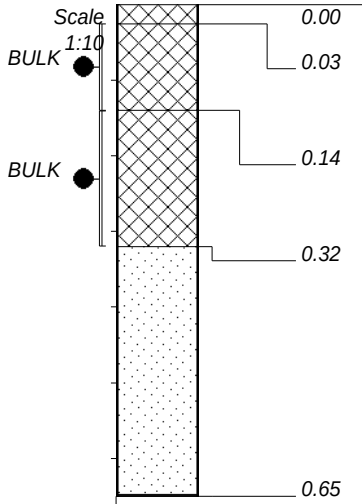
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
MACASSAR ROAD

TEST PIT SOIL PROFILES

HOLE No: LW03
Sheet 1 of 1

JOB NUMBER: 017-21



Asphalt.

Slightly moist grey dense intact crusher run angular gravel. Fill - engineered base course.

Slightly moist to moist yellowish olive dense intact slightly clayey crusher run angular gravel. Fill - engineered subbase.

Moist light yellowish off white very dense intact very fine sand. Transported.

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.
4) BULK sample at 0.025--0.14m.
5) BULK sample at 0.14--0.32m.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
DATE : 2 March 2021
DATE : 23/03/2021 13:23
TEXT : ..vicessoilprofiles(1).txt

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: LW03

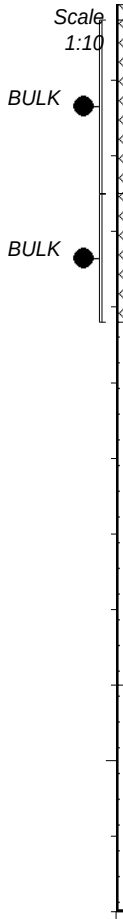
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
KRAMAT ROAD

TEST PIT SOIL PROFILES

HOLE No: LW06
Sheet 1 of 1

JOB NUMBER: 017-21



0.00	Asphalt.
0.02	Slightly moist yellowish orange dense intact sandy rounded and angular crushed sandstone gravel. Fill - engineered base course.
0.25	Moist grey dense intact angular clayey sandy crusher run gravel. Fill - engineered subbase.
0.42	Slightly moist to moist light brownish off white dense intact fine sand. Transported (aeolian).
0.90	Moist dark brown dense intact fine sand. Transported.
1.20	

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.
4) BULK Sample at 0.02--0.25m.
5) BULK Sample at 0.250--0.420m.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
DATE : 2 March 2021
DATE : 23/03/2021 13:23
TEXT : ..vicessoilprofiles(1).txt

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: LW06

CORE GEOTECHNICAL CONSULTANTS

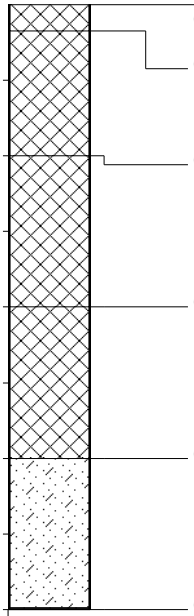
MACASSAR BULK SERVICES
KRAMAT ROAD

TEST PIT SOIL PROFILES

HOLE No: LW07
Sheet 1 of 1

JOB NUMBER: 017-21

Scale 1:10



0.00	Asphalt.
0.04	Dry orange dense to very dense silty sandy rounded and angular crushed sandstone gravel Fill - engineered base course.
0.20	Dry orange and brown dense clayey silty sandy crushed angular run gravel. Fill - engineered subbase.
0.40	Slightly moist cream medium dense to dense fine sand. Fill - engineered fill.
0.60	Moist orange brown stiff clayey sand. Transported.
0.80	

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
DATE : 2 March 2021
DATE : 23/03/2021 13:23
TEXT : ..vicessoilprofiles(1).txt

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: LW07

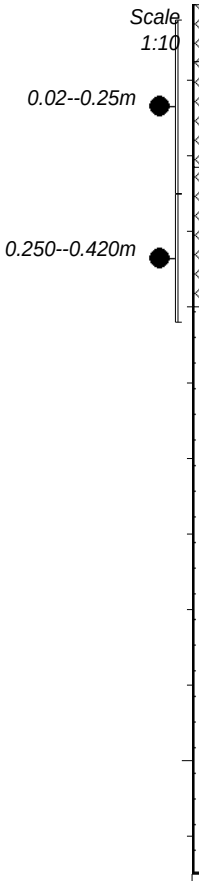
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
MACASSAR ROAD

TEST PIT SOIL PROFILES

HOLE No: LW08
Sheet 1 of 1

JOB NUMBER: 017-21



0.00	Asphalt.
0.07	Dry to slightly moist grey dense intact angular crusher run gravel. Fill - engineered base course.
0.21	Slightly moist to moist yellowish olive dense intact slightly clayey angular crusher run gravel. Fill - engineered subbase.
0.40	Slightly moist off white fine sand - subgrade. Transported (aeolian).
1.15	

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.
4) Bulk Sample at 0.02--0.25m.
5) Bulk Sample at 0.250--0.420m.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
DATE : 2 March 2021
DATE : 23/03/2021 13:23
TEXT : ..vicessoilprofiles(1).txt

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: LW08

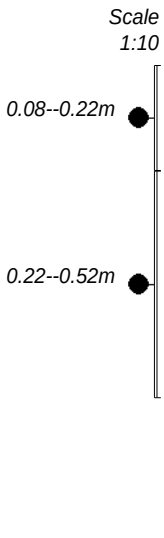
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
BADEN POWELL DRIVE

TEST PIT SOIL PROFILES

HOLE No: LW10
Sheet 1 of 1

JOB NUMBER: 017-21



Asphalt.

Moist yellowish off white medium dense intact sandy calcrete gravel. Fill - engineered base course.

Moist off white dense intact calcrete gravel with calcrete cobbles. Fill - subbase.

Moist light yellowish off white dense intact fine sand - subgrade. Transported (aeolian).

NOTES

1) No seepage.
2) No sidewall collapse.
3) Not refusal.
4) Bulk Sample at 0.08--0.22m.
5) Bulk Sample at 0.22--0.52m.

CONTRACTOR :
MACHINE : Hand dug
DRILLED BY :
PROFILED BY : Eugene Laubscher
TYPE SET BY :
SETUP FILE : STANDARD.SET

LOCATION:
DIAM :
DATE :
DATE : 2 March 2021
DATE : 23/03/2021 13:23
TEXT : ..vicessoilprofiles(1).txt

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: LW10

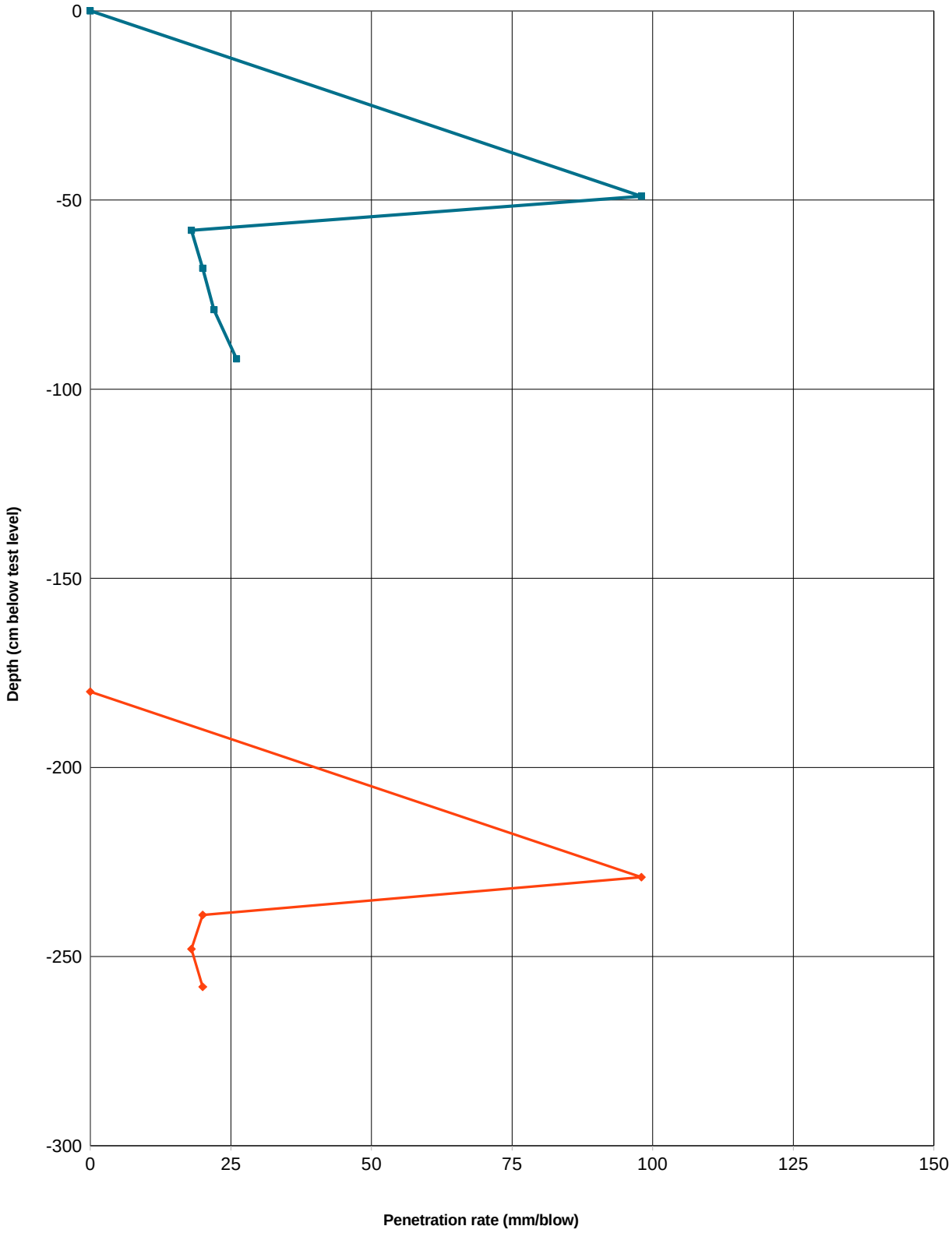
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MACASSAR BULK SERVICES
MACASSAR ROAD

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: TH1
LEVEL: GL
DPL NO: TH1b
LEVEL: -1.8m



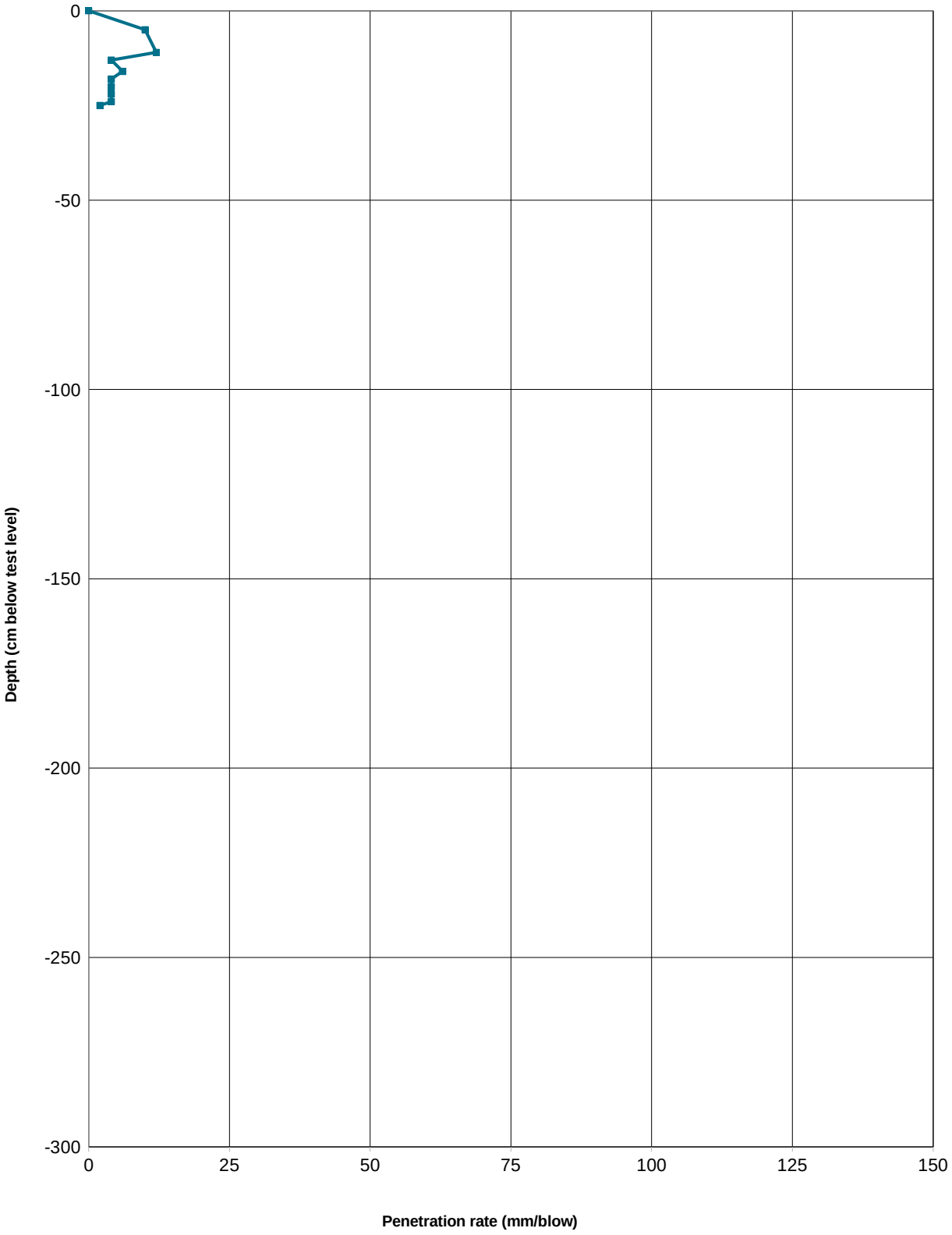
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
MACASSAR ROAD

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: LW2
LEVEL: GL



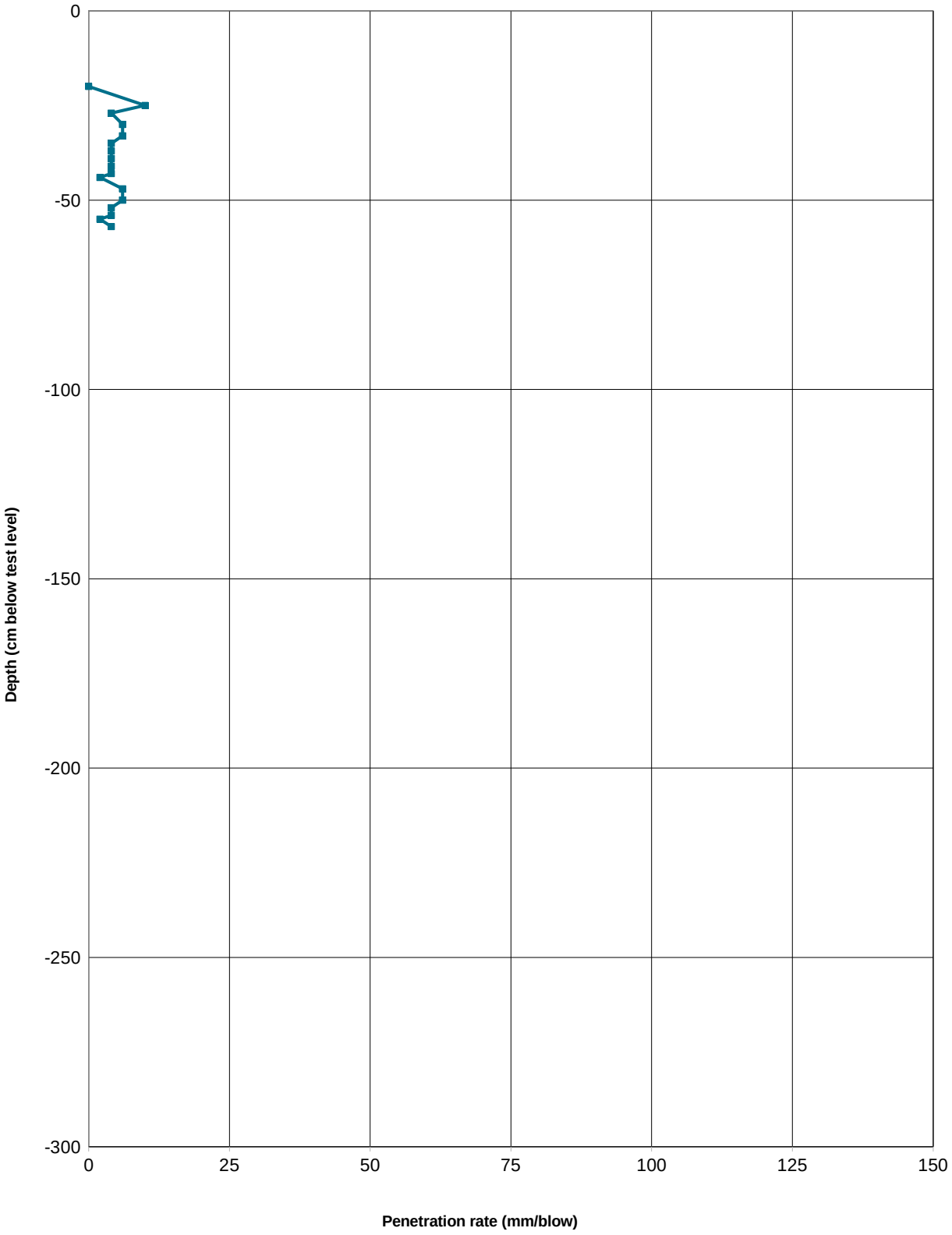
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
MACASSAR ROAD

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: LW3
LEVEL: -0.2m



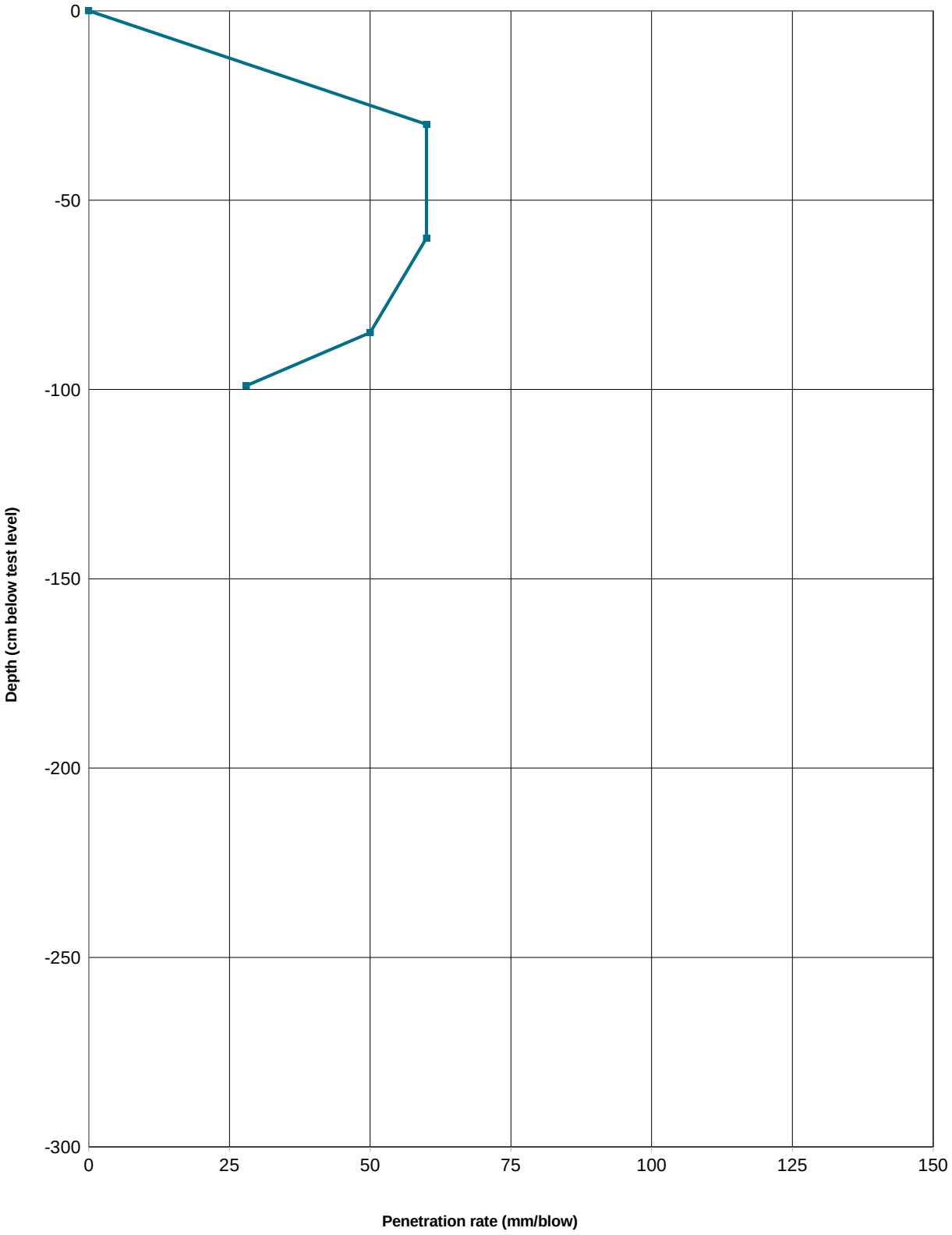
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MACASSAR BULK SERVICES
MACASSAR ROAD

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: TH4
LEVEL: GL



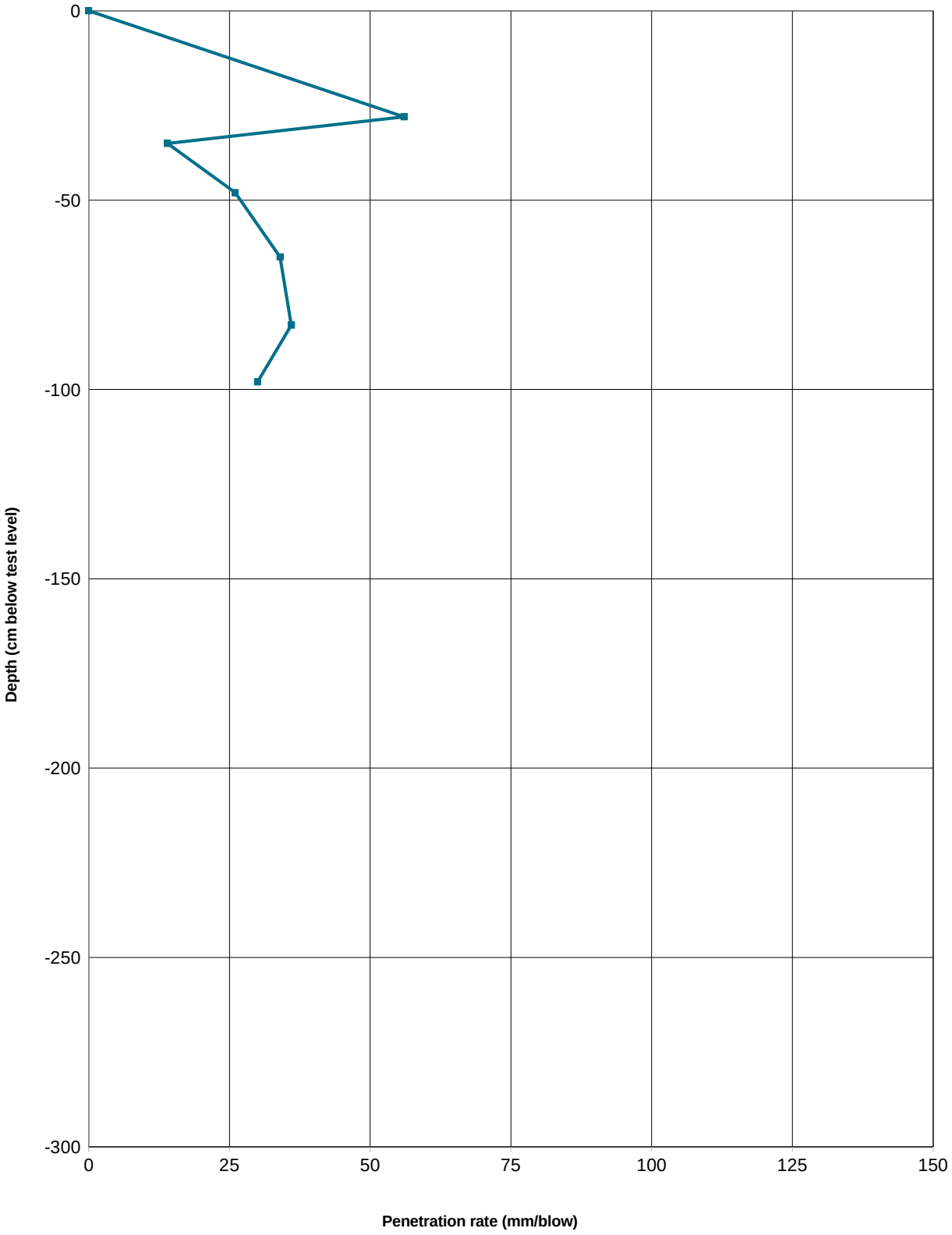
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
KRAMAT ROAD

JOB NO.: 138-20

DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: TH5
LEVEL: GL



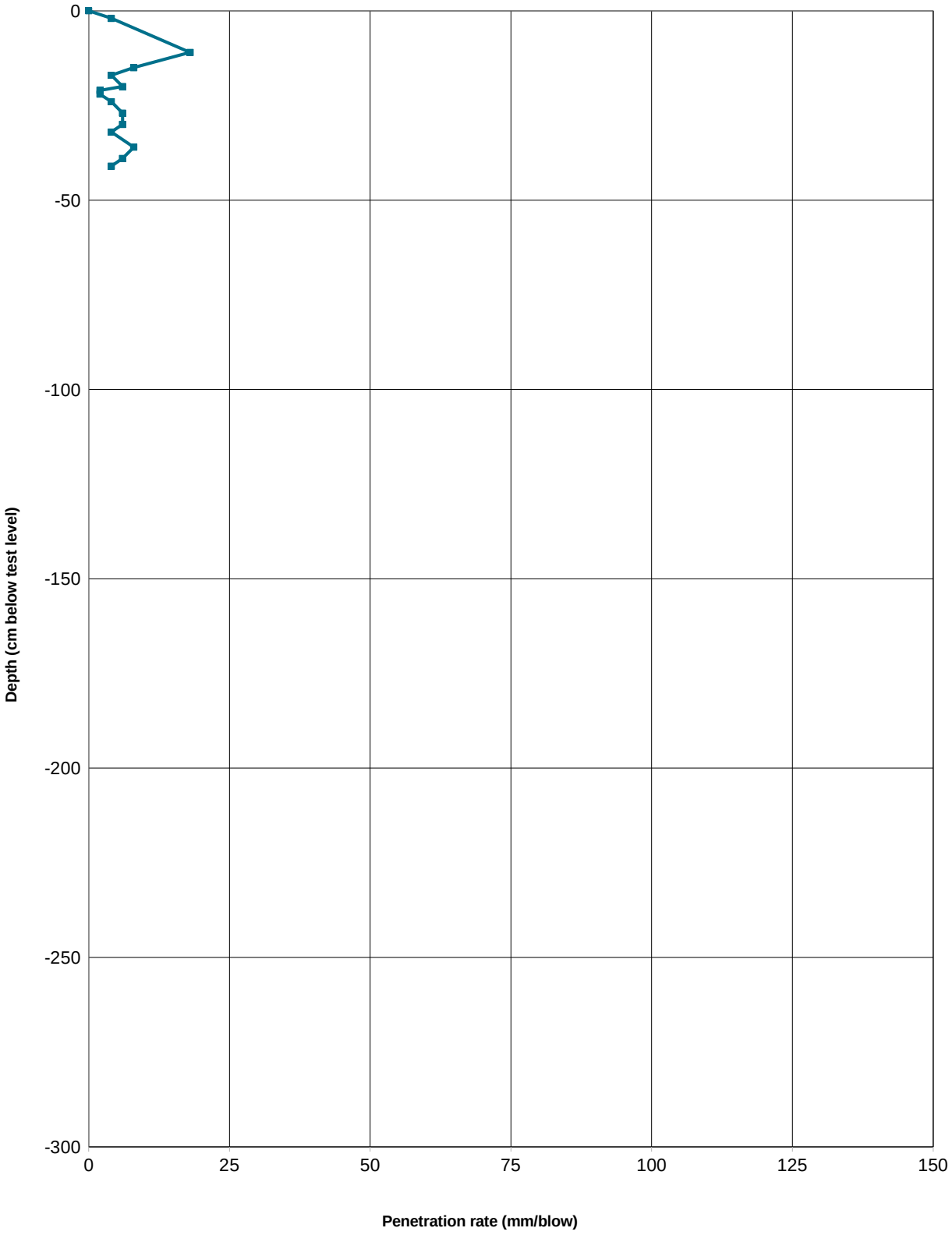
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
KRAMAT ROAD

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: LW6
LEVEL: GL



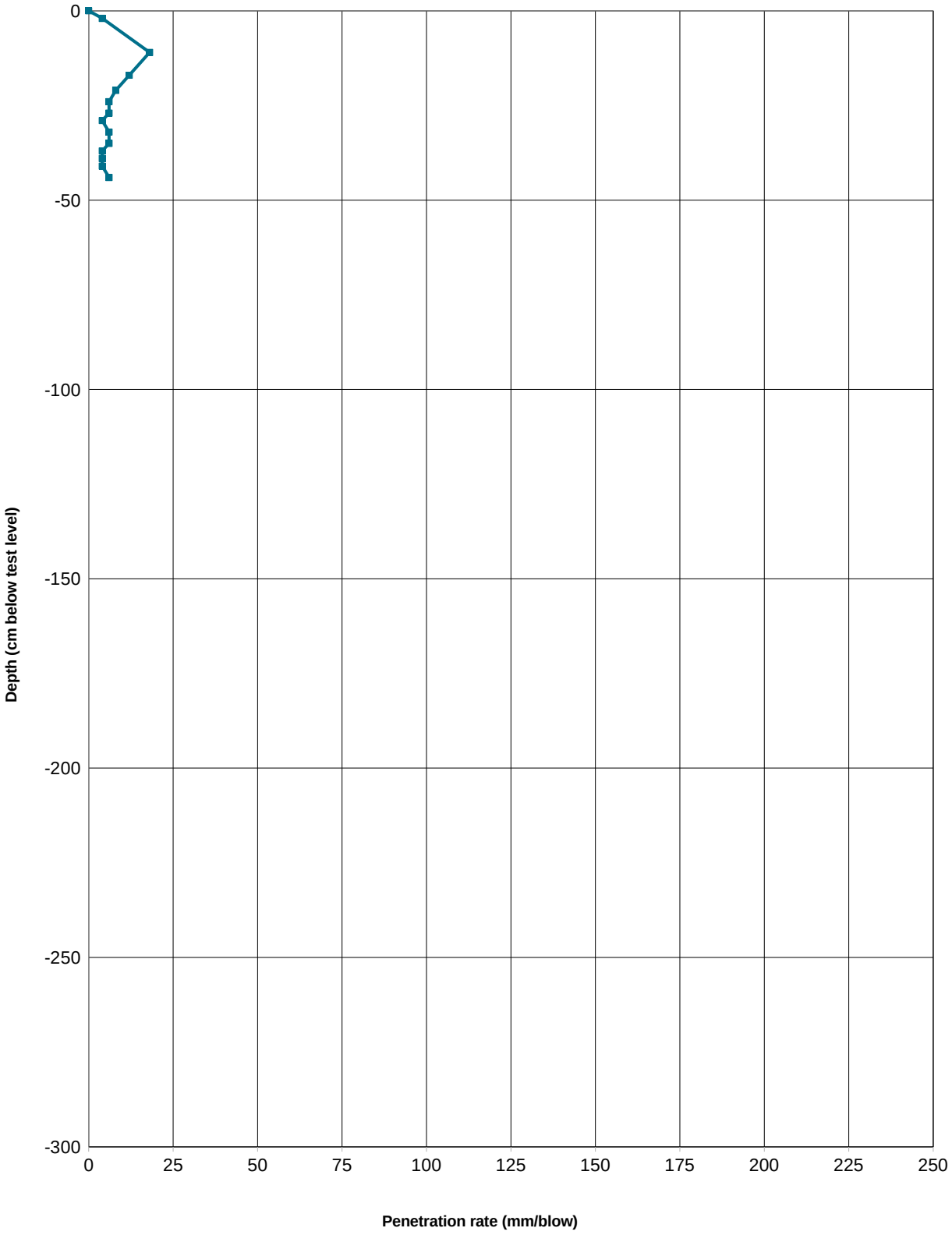
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
KRAMAT ROAD

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: LW7
LEVEL: GL



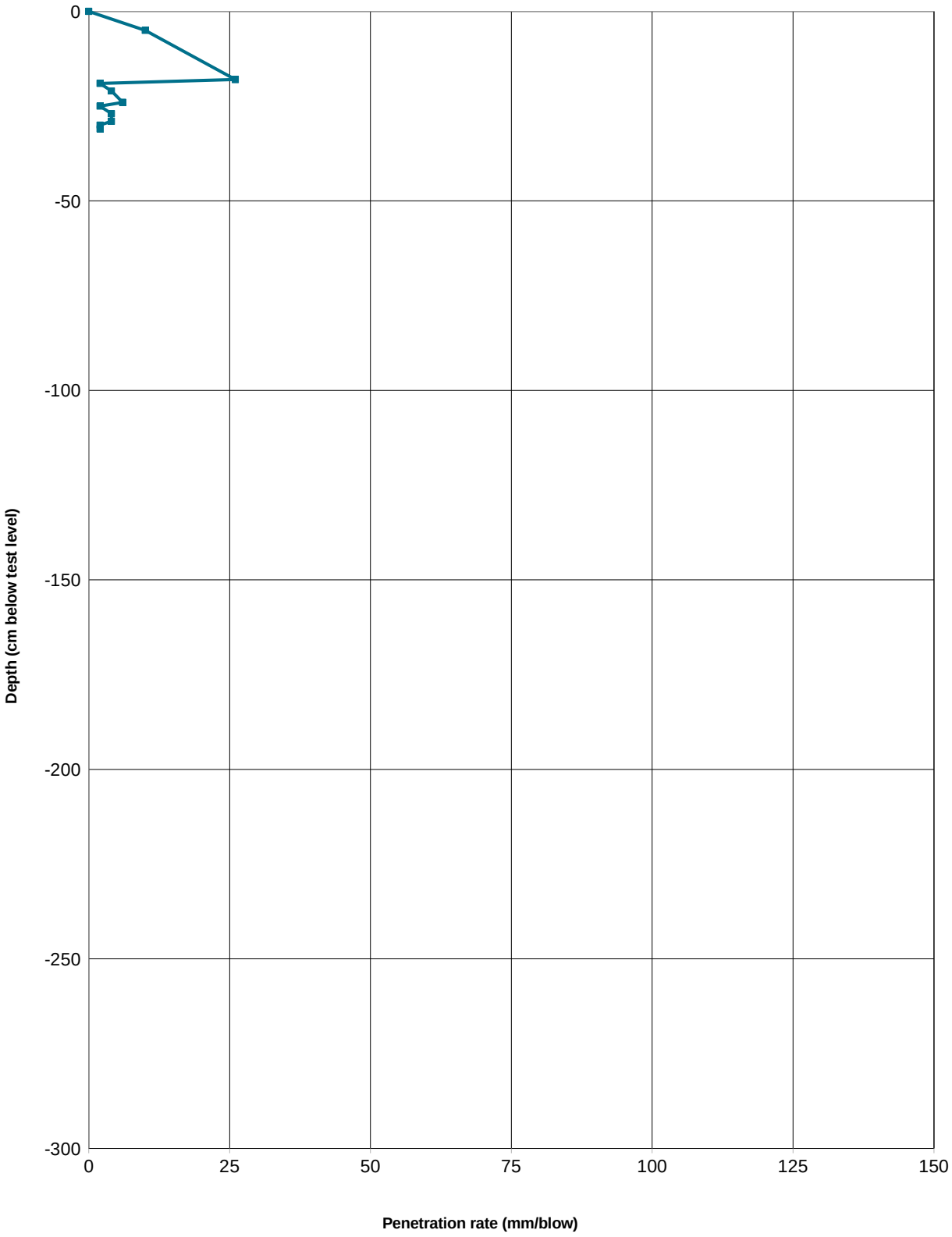
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
MACASSAR ROAD

JOB NO.: 138-20

DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: LW8
LEVEL: GL



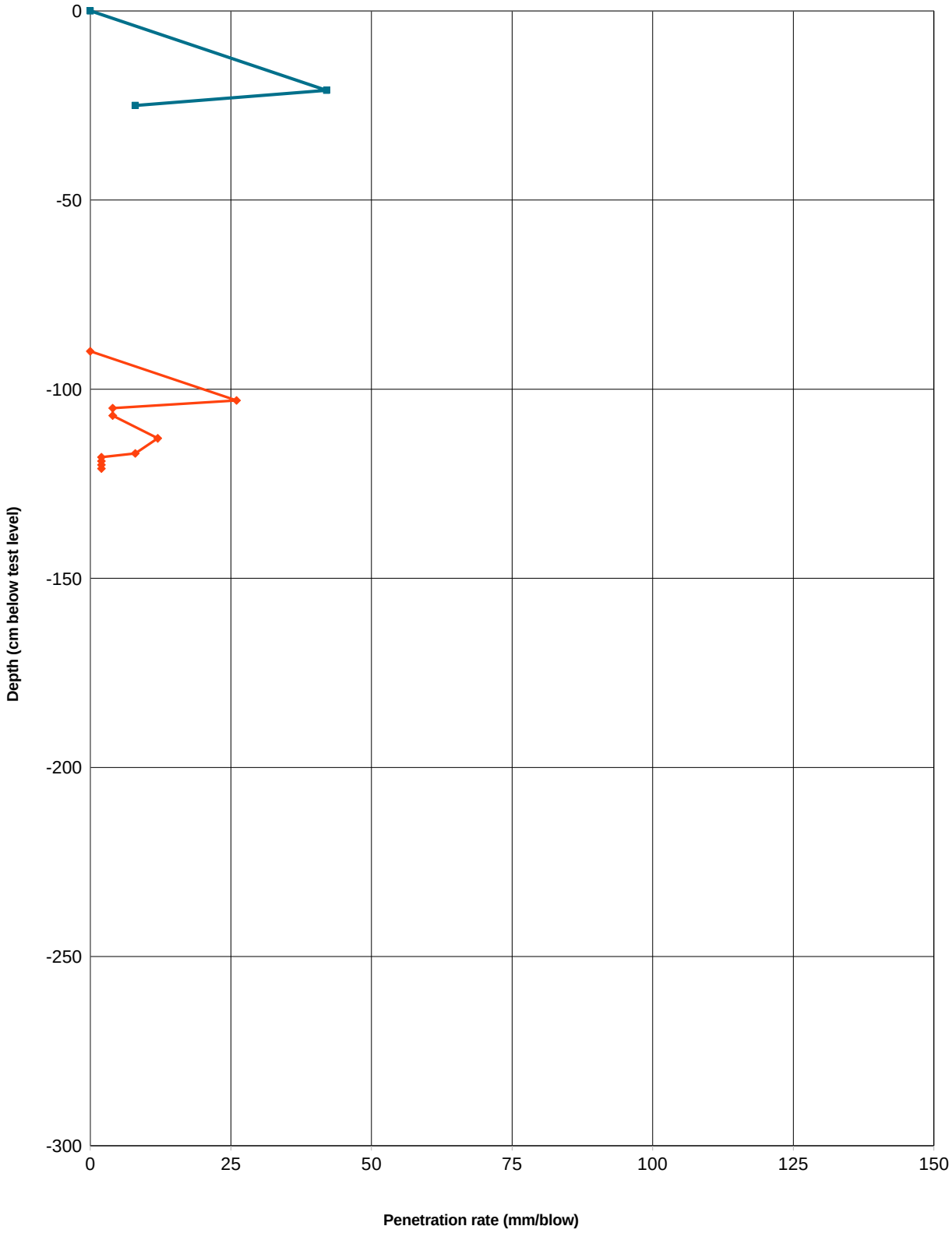
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
BADEN POWELL DRIVE

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: TH9
LEVEL: GL
DPL NO: TH9b
LEVEL: -0.9m



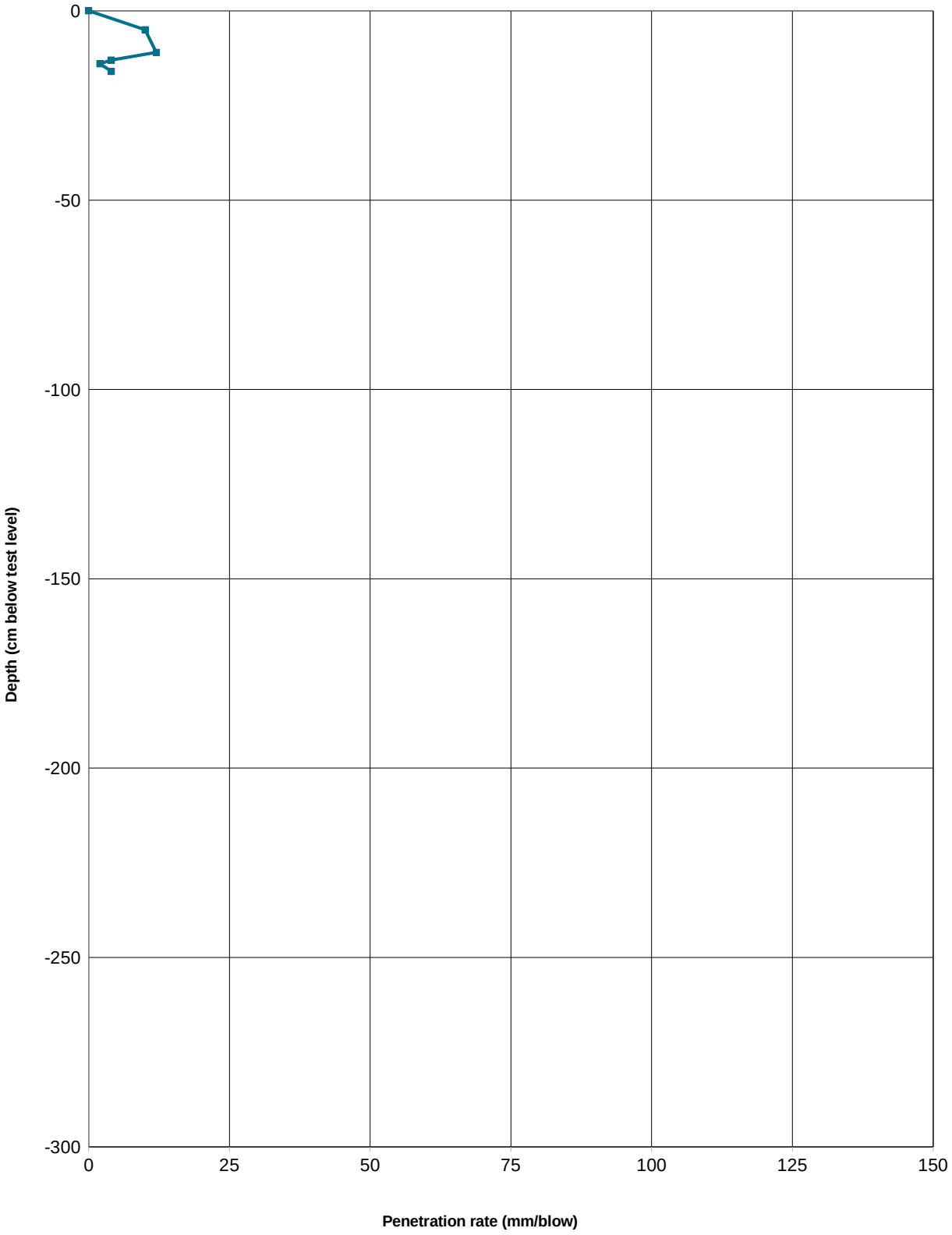
CORE GEOTECHNICAL CONSULTANTS

MACASSAR BULK SERVICES
BADEN POWELL DRIVE

DYNAMIC PROBE LIGHT (DPL) TEST

JOB NO.: 138-20

DPL NO: LW10
LEVEL: GL



CONTROL GEOSCIENCES (PTY) LTD

CIVIL ENGINEERING MATERIAL AND GEOTECHNICAL LABORATORY,
GEOTECHNICAL AND ENVIRONMENTAL SERVICES

A division of ControLab South Africa (Pty) Ltd – Accreditation Number: T0308

1986/091003/07

LABORATORY: 7 Milan Street, Airport Industria, Cape Town, Tel: (021) 934 1114, email: geosci@mweb.co.za
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OTHER CONTROLAB BRANCH OFFICES: East London, Johannesburg, Mthatha, Kokstad, Queenstown, Lusaka - Zambia

CLIENT: Core Geotechnical
4C Manor Mews
4 Lancaster Road
Kenilworth
7200

PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	off-white sand	**SAMPLE NO. :**	33361
POSITION :	TH 1 @ 0.7-1.55m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	
	4,75	
	2,36	
	2,00	
	1,18	100
	0,600	98
	0,425	93
	0,300	81
	0,150	38
	0,0750	5

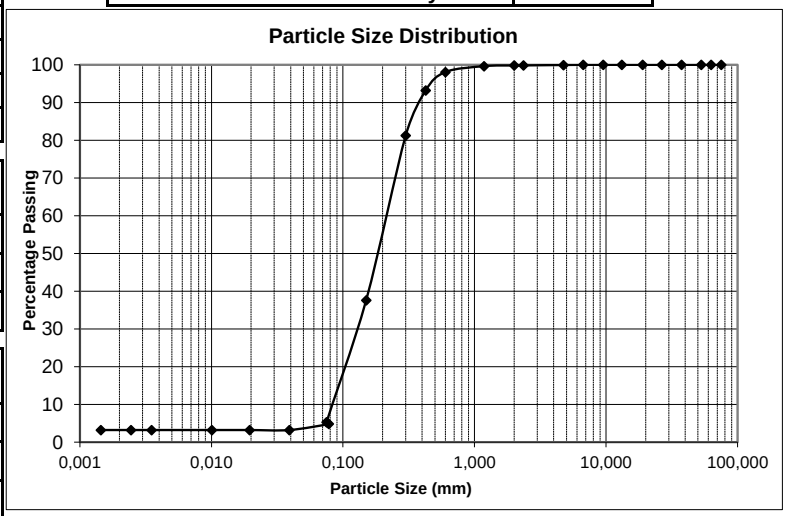
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0782	5
0,0391	3
0,0195	3
0,0101	3
0,0035	3
0,0024	3
0,0014	3

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	
pH:	
Conductivity mS/m:	

Atterberg Limits (SANS3001-GR10)	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	1612
O.M.C. (%)	15,9
C.B.R. @ 100% Comp.	24
C.B.R. @ 98 % Comp.	17
C.B.R. @ 95 % Comp.	9
C.B.R. @ 93 % Comp.	6
C.B.R. @ 90 % Comp.	3
Swell (max) %	0,10



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	0
Sand : Percentage - 4.75mm and + 0.075mm	95
Silt : Percentage - 0.075mm and + 0.005mm	2
Clay : Percentage - 0.005mm	3

The above test results are pertinent to the samples received and tested only. Technical Signatory: M Hofman
While the tests are carried out according to recognized standards Control Geosciences shall not be liable for erronous testing or reporting thereof.
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Remarks:

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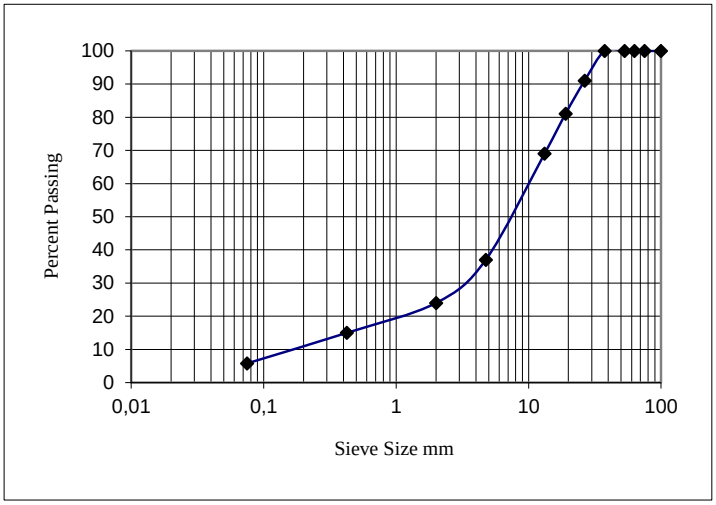
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

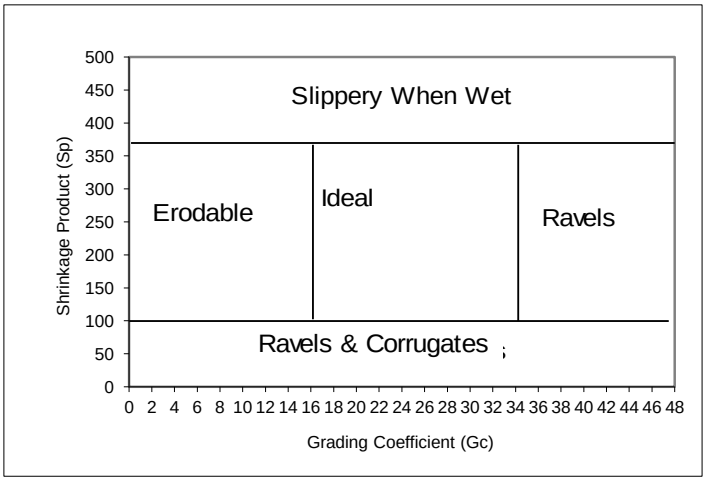
Client Ref. No.:		***Sample Number:***	33362
Client Sample Ref.:		***Sample Position:***	LW3-S
Client Sample Ref.:		***Depth:***	0.025-0.14m
Client Sample Ref.:		***Sample Description:***	grey crusher run gvl

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	
37,5	100
26,5	91
19	81
13,2	69
4,75	37
2,00	24
0,425	15
0,075	5,8



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	18
Plastic Index	6
Linear Shrinkage	2,0

Grading Modulus (GM)	2,55
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	**OMC**	**Percentage Compaction.**	**100%**	**98%**	**95%**	**93%**	**90%**
2326	6,6	**CBR Values**	70	60	48	40	34
						Max. %Swell	0

Technical Signatory: M Hofman

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CLIENT: Core Geotechnical
4C Manor Mews
4 Lancaster Road
Kenilworth
7200

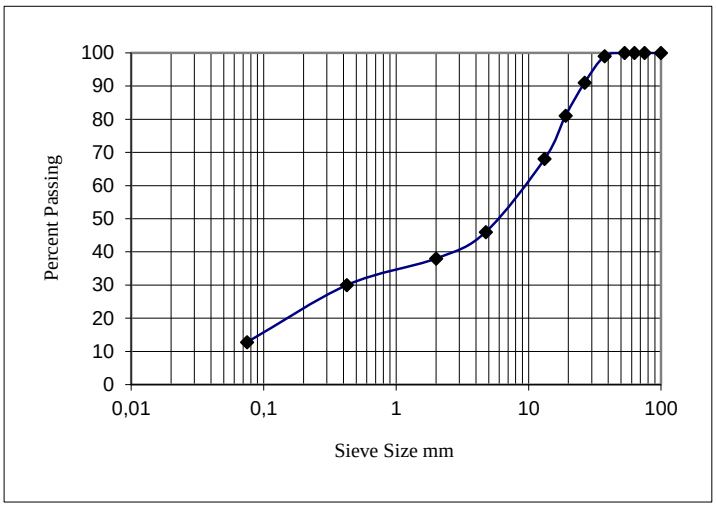
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

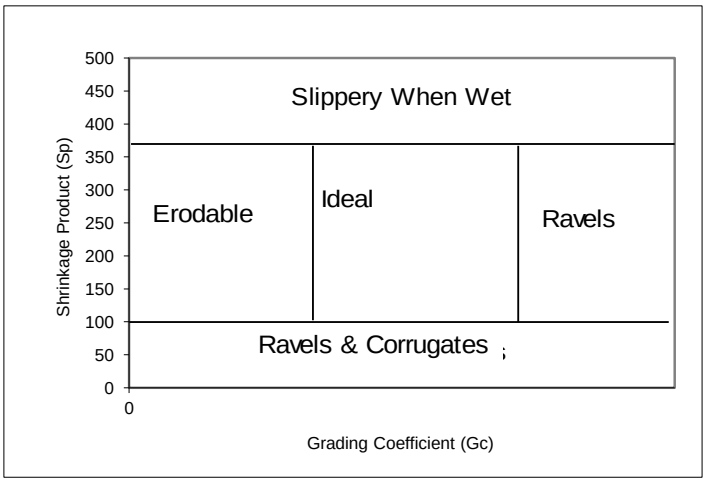
Client Ref. No.:		***Sample Number:***	33363
Client Sample Ref.:		***Sample Position:***	LW3-S
Client Sample Ref.:		***Depth:***	0,14-0,32m
Client Sample Ref.:		***Sample Description:***	yel olive crusher run

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	100
37,5	99
26,5	91
19	81
13,2	68
4,75	46
2,00	38
0,425	30
0,075	12,8



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	19
Plastic Index	7
Linear Shrinkage	2,0

Grading Modulus (GM)	2,19
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	**OMC**	**Percentage Compaction.**	**100%**	**98%**	**95%**	**93%**	**90%**
2272	6	**CBR Values**	70	51	35	26	18
						Max. %Swell	0,1

Technical Signatory: M Hofman

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CLIENT: Core Geotechnical
4C Manor Mews
4 Lancaster Road
Kenilworth
7200

PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	lt brown sand	**SAMPLE NO. :**	33364
POSITION :	TH 4 @ 1.0-1.55m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	
	4,75	
	2,36	
	2,00	
	1,18	
	0,600	100
	0,425	98
	0,300	88
	0,150	36
	0,0750	6

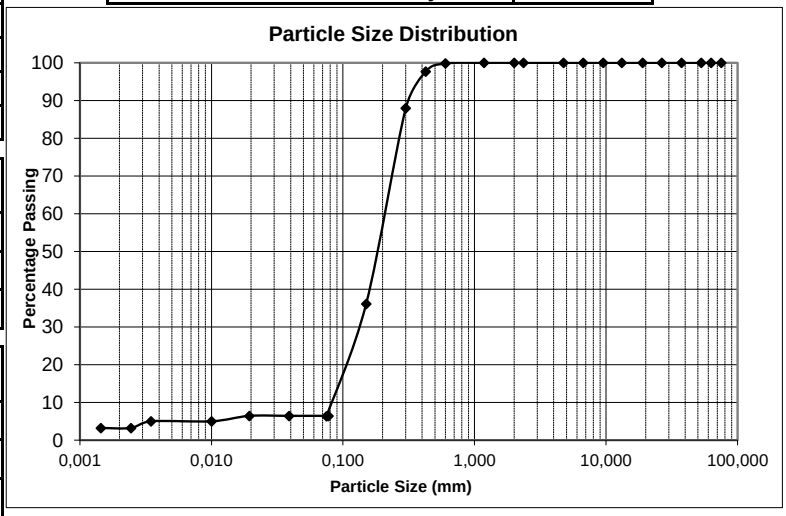
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0777	6
0,0388	6
0,0194	6
0,0100	5
0,0035	5
0,0024	3
0,0014	3

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	
pH:	
Conductivity mS/m:	

Atterberg Limits (SANS3001-GR10)	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	1536
O.M.C. (%)	18,0
C.B.R. @ 100% Comp.	30
C.B.R. @ 98 % Comp.	20
C.B.R. @ 95 % Comp.	11
C.B.R. @ 93 % Comp.	8
C.B.R. @ 90 % Comp.	4
Swell (max) %	0,00



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	0
Sand : Percentage - 4.75mm and + 0.075mm	94
Silt : Percentage - 0.075mm and + 0.005mm	1
Clay : Percentage - 0.005mm	5

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CLIENT: Core Geotechnical
4C Manor Mews
4 Lancaster Road
Kenilworth
7200

PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	light brown sand	**SAMPLE NO. :**	33365
POSITION :	TH 5 @ 0.6-1.3m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	100
	13,20	99
	9,50	98
	6,70	97
	4,75	97
	2,36	96
	2,00	96
	1,18	95
	0,600	95
	0,425	92
	0,300	83
	0,150	31
	0,0750	3

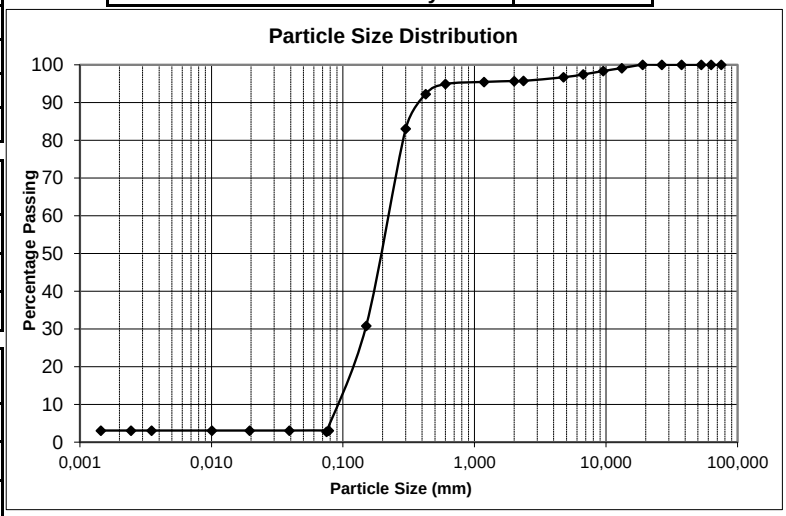
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0782	3
0,0391	3
0,0195	3
0,0101	3
0,0035	3
0,0024	3
0,0014	3

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	
pH:	
Conductivity mS/m:	

Atterberg Limits (SANS3001-GR10)	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	1564
O.M.C. (%)	15,4
C.B.R. @ 100% Comp.	23
C.B.R. @ 98 % Comp.	16
C.B.R. @ 95 % Comp.	9
C.B.R. @ 93 % Comp.	6
C.B.R. @ 90 % Comp.	3
Swell (max) %	0,10



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	3
Sand : Percentage - 4.75mm and + 0.075mm	94
Silt : Percentage - 0.075mm and + 0.005mm	0
Clay : Percentage - 0.005mm	3

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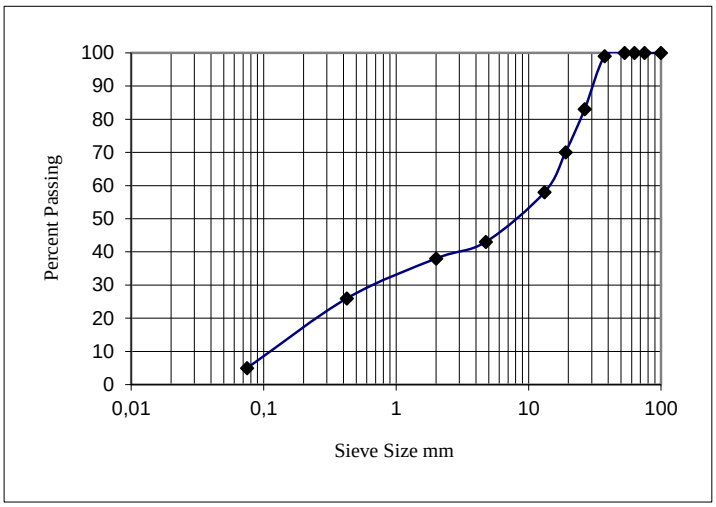
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

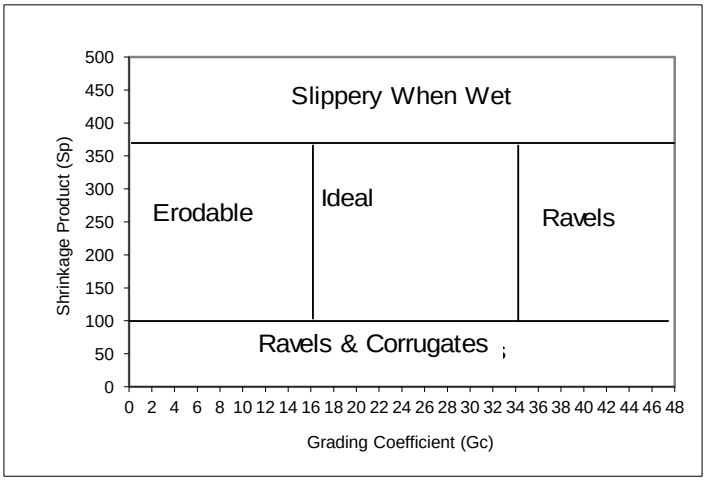
Client Ref. No.:		***Sample Number:***	33366
Client Sample Ref.:		***Sample Position:***	LW6-S
Client Sample Ref.:		***Depth:***	0.02-0.25m
Client Sample Ref.:		***Sample Description:***	yel or sst gvl

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	100
37,5	99
26,5	83
19	70
13,2	58
4,75	43
2,00	38
0,425	26
0,075	5



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	

Grading Modulus (GM)	2,31
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	**OMC**	**Percentage Compaction.**	**100%**	**98%**	**95%**	**93%**	**90%**
2134	6,6	**CBR Values**	150	80	35	20	9
						Max. %Swell	0

Technical Signatory: M Hofman

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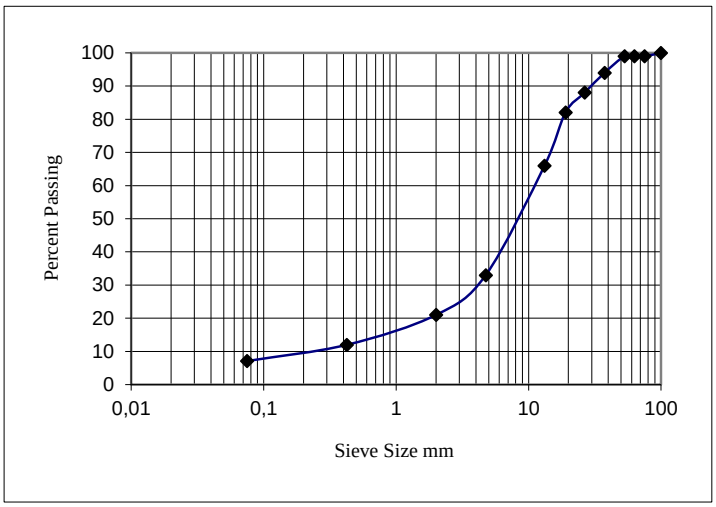
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

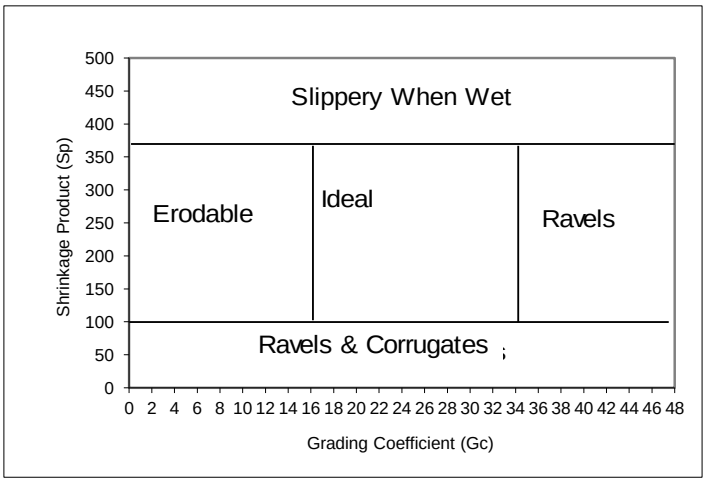
Client Ref. No.:		***Sample Number:***	33367
Client Sample Ref.:		***Sample Position:***	LW6-S
Client Sample Ref.:		***Depth:***	0.25-0.42m
Client Sample Ref.:		***Sample Description:***	grey crusher run gvl

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	99
63	99
53	99
37,5	94
26,5	88
19	82
13,2	66
4,75	33
2,00	21
0,425	12
0,075	7,1



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	23
Plastic Index	7
Linear Shrinkage	3,0

Grading Modulus (GM)	2,60
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	**OMC**	**Percentage Compaction.**	**100%**	**98%**	**95%**	**93%**	**90%**
2298	7,3	**CBR Values**	62	46	28	20	13
						Max. %Swell	0,1

Technical Signatory: M Hofman

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Kenilworth
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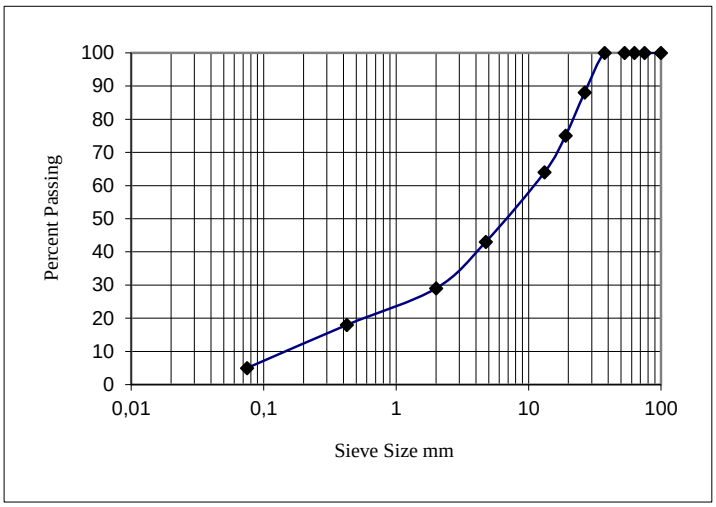
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

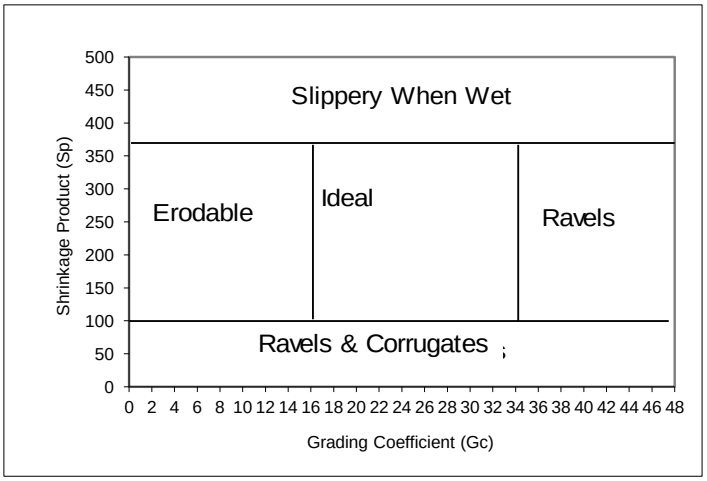
Client Ref. No.:		***Sample Number:***	33368
Client Sample Ref.:		***Sample Position:***	LW8-S
Client Sample Ref.:		***Depth:***	0.075-0.215m
Client Sample Ref.:		***Sample Description:***	grey crusher run gvl

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	
37,5	100
26,5	88
19	75
13,2	64
4,75	43
2,00	29
0,425	18
0,075	5



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	16
Plastic Index	5
Linear Shrinkage	2,0

Grading Modulus (GM)	2,48
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
2316	6,3	**CBR Values**	90	70	45	34	22
						Max. %Swell	0

Technical Signatory: M Hofman

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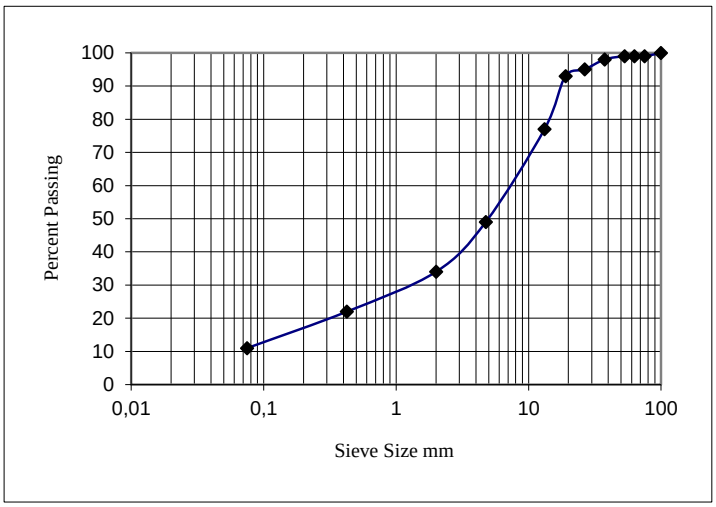
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

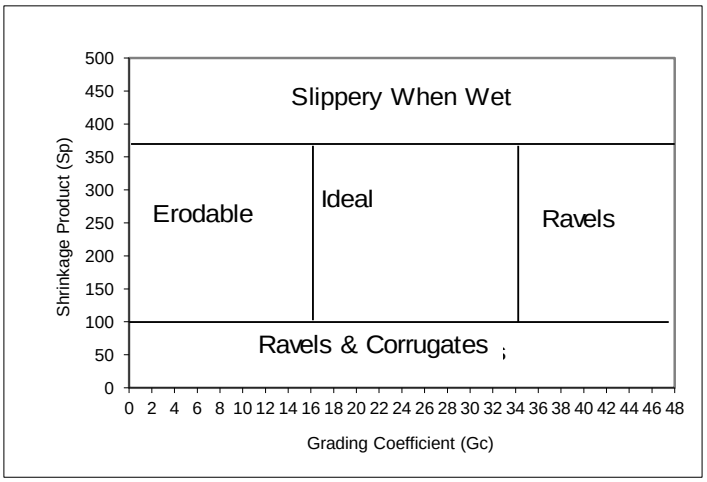
Client Ref. No.:		***Sample Number:***	33369
Client Sample Ref.:		***Sample Position:***	LW8-S
Client Sample Ref.:		***Depth:***	0.215-0.40m
Client Sample Ref.:		***Sample Description:***	yel olive crusher run gvl

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	99
63	99
53	99
37,5	98
26,5	95
19	93
13,2	77
4,75	49
2,00	34
0,425	22
0,075	11



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	23
Plastic Index	9
Linear Shrinkage	4,0

Grading Modulus (GM)	2,33
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	**OMC**	**Percentage Compaction.**	**100%**	**98%**	**95%**	**93%**	**90%**
2238	5,3	**CBR Values**	85	60	35	24	14
						Max. %Swell	0,3

Technical Signatory: M Hofman

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4 Lancaster Road
Kenilworth
7200

PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	off-white sand	**SAMPLE NO. :**	33370
POSITION :	LW8-S @ 0.4-1.15m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	
	4,75	
	2,36	
	2,00	100
	1,18	99
	0,600	96
	0,425	88
	0,300	72
	0,150	23
	0,0750	3

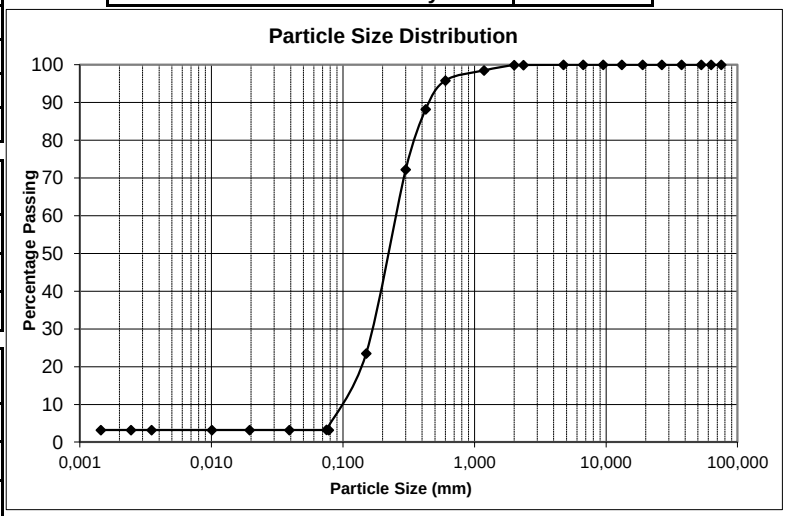
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0782	3
0,0391	3
0,0195	3
0,0101	3
0,0035	3
0,0024	3
0,0014	3

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	
pH:	
Conductivity mS/m:	

Atterberg Limits (SANS3001-GR10)	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	1520
O.M.C. (%)	19,2
C.B.R. @ 100% Comp.	25
C.B.R. @ 98 % Comp.	19
C.B.R. @ 95 % Comp.	12
C.B.R. @ 93 % Comp.	9
C.B.R. @ 90 % Comp.	6
Swell (max) %	0,00



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	0
Sand : Percentage - 4.75mm and + 0.075mm	97
Silt : Percentage - 0.075mm and + 0.005mm	0
Clay : Percentage - 0.005mm	3

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4 Lancaster Road
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7200

PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ASTM D422 SIEVE ANALYSIS

DESCRIPTION : yellow off-white calcrete gvl
POSITION : TH 9 @ 0.2-0.8m

SAMPLE NO. : 33371
CLIENT SAMPLE NO. :

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	100
	6,70	99
	4,75	99
	2,36	97
	2,00	97
	1,18	94
	0,600	87
	0,425	80
	0,300	69
	0,150	34
	0,0750	11

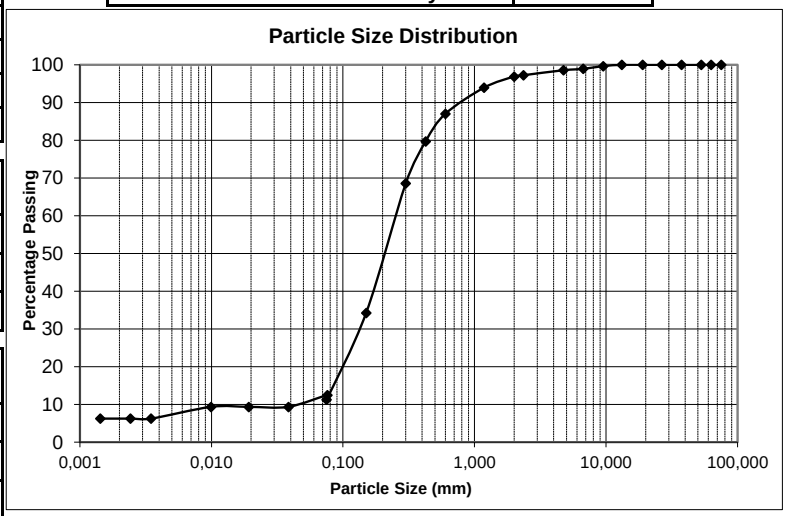
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0762	12
0,0385	9
0,0192	9
0,0099	9
0,0035	6
0,0024	6
0,0014	6

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	
pH:	
Conductivity mS/m:	

Atterberg Limits (SANS3001-GR10)	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	1747
O.M.C. (%)	12,8
C.B.R. @ 100% Comp.	30
C.B.R. @ 98 % Comp.	24
C.B.R. @ 95 % Comp.	16
C.B.R. @ 93 % Comp.	12
C.B.R. @ 90 % Comp.	7
Swell (max) %	0,00



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	1
Sand : Percentage - 4.75mm and + 0.075mm	88
Silt : Percentage - 0.075mm and + 0.005mm	4
Clay : Percentage - 0.005mm	7

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Kenilworth
7200

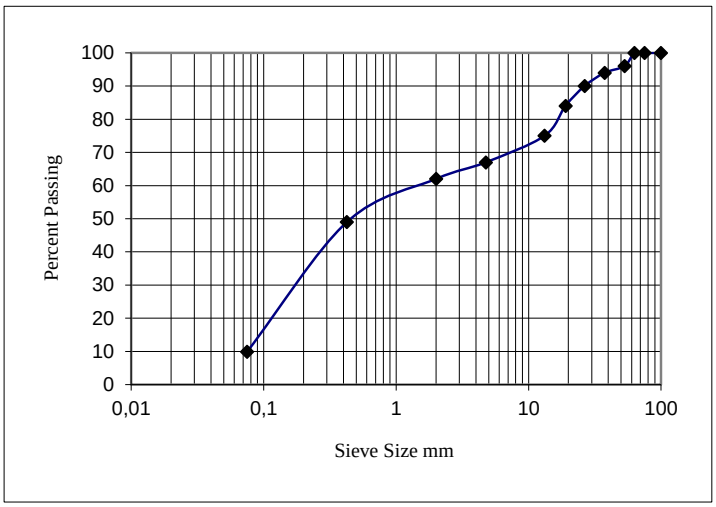
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

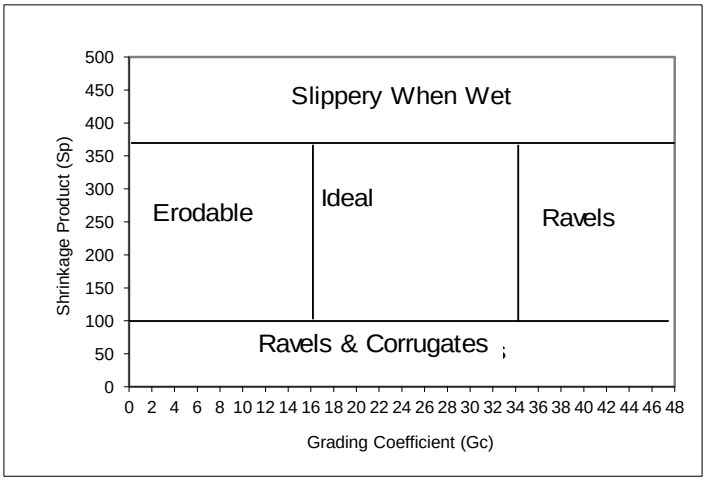
Client Ref. No.:		***Sample Number:***	33372
Client Sample Ref.:		***Sample Position:***	LW10-S
Client Sample Ref.:		***Depth:***	0.08-0.22m
Client Sample Ref.:		***Sample Description:***	off-white calcrete gvl

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	100
53	96
37,5	94
26,5	90
19	84
13,2	75
4,75	67
2,00	62
0,425	49
0,075	9,9



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	15
Plastic Index	5
Linear Shrinkage	2,0

Grading Modulus (GM)	1,79
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
2000	8,2	**CBR Values**	118	82	47	33	19
						Max. %Swell	0,1

Technical Signatory: M Hofman

The above test results are pertinent to the samples received and tested only.
While the tests are carried out according to recognized standards Control Geosciences shall not be liable for erroneous testing or reporting thereof. This report may not be reproduced except in full without prior consent of Control Geosciences.

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CIVIL ENGINEERING MATERIAL AND GEOTECHNICAL LABORATORY,
GEOTECHNICAL AND ENVIRONMENTAL SERVICES

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1986/091003/07

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CLIENT: Core Geotechnical
4C Manor Mews
4 Lancaster Road
Kenilworth
7200

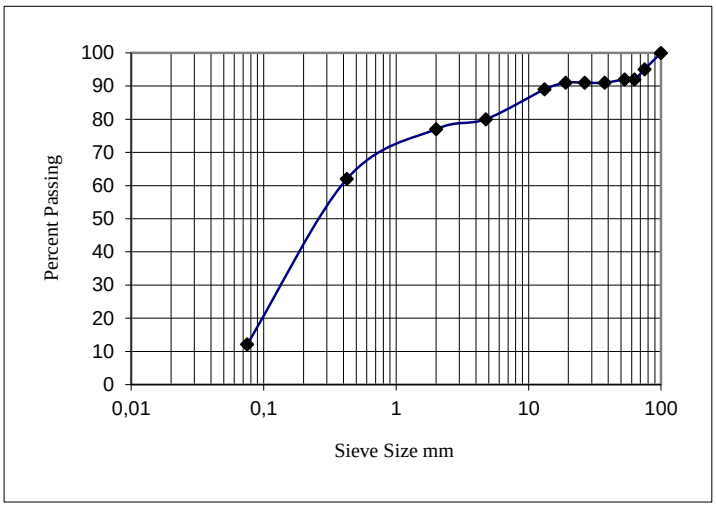
PROJECT: Macassar Bulk Services

DATE: 15-03-2021
REF: L210307

ROAD INDICATOR TEST SUMMARY

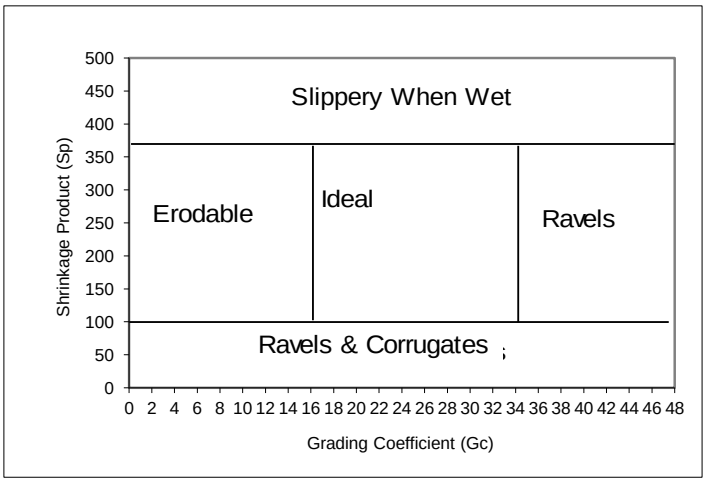
Client Ref. No.:		***Sample Number:***	33373
Client Sample Ref.:		***Sample Position:***	LW10-S
Client Sample Ref.:		***Depth:***	0.22-0.52m
Client Sample Ref.:		***Sample Description:***	off-white calcrete gvl

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	95
63	92
53	92
37,5	91
26,5	91
19	91
13,2	89
4,75	80
2,00	77
0,425	62
0,075	12,1



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	16
Plastic Index	6
Linear Shrinkage	2,0

Grading Modulus (GM)	1,49
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
1948	10,4	**CBR Values**	76	58	36	27	18
						Max. %Swell	0

Technical Signatory: M Hofman

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CLIENT: Core Geotechnical **PROJECT:** Macassar Bulk Services

REF: L210307

COMPACTABILITY (SABS 0120 PART 3)

SAMPLE NO:	33361	33364	33365	33370	33371				
POSITION	TH 1 0,7-1,55m	TH 4 1,0-1,55m	TH 5 0,6-1,3m	LW8-S 0,4-1,15m	TH 9 0,2-0,8m				
DESCRIPTION:									
Moisture Content %	5,0	5,7	4,0	5,7	4,9				
Compactabilty Factor	0,4	0,4	0,4	0,4	0,4				

COMPACTABILITY FACTOR	EVALUATION
UP TO & INCL 0.1	MATERIAL SUITABLE FOR BEDDING
OVER 0.1 UP TO & INCL 0.4	MATERIAL SUITABLE (EXCEPT FOR FLEXIBLE PIPES THAT MAY BE SUBJECT TO WATERLOGGED CONDITIONS AFTER LAYING) BUT REQUIRES EXTRA CARE IN COMPACTION
OVER 0.4	MATERIAL UNSUITABLE

Technical Signatory:
M Hofman