LOCAL GEOTECHNICS

4 May 2020

Report on

Geotechnical Investigation

Minninup Pool Tourism Project, Collie WA

Project:
LG0862020GI REV_0

Client: Shire of Collie

Geotech | Civil | Pavement | Drainage

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LOCAL GEOTECHNICS

04 May 2020

To

Shire of Collie

87 Throssell Street, Collie, WA 6225

Dear Sir/Madam,

RE: Geotechnical Investigation for Minninup Pool Tourism Project, Collie WA

This letter presents our report on a geotechnical investigation carried out at Minninup Pool Tourism Project, Collie WA. The report must be thoroughly read and implemented in full, no partial implementation of this report is allowed.

If you have any questions in regards to the geotechnical site investigation or we can be of further assistance, please do not hesitate to contact Local Geotechnics.

Sincerely yours

Dr. Harun Meer
Ph.D.(Geotech), M. Eng. (Geotech), B. Eng. (Civil), MIE Aust
Director
Local Geotechnics

Project	**LG0862020GI** **Geotechnical Investigation**
Site Location	**Minninup Pool Tourism Project, Collie WA**

Rev	Description	Date	Prepared by	Approved by
0	Issued to client	4 May 2020	M Seet & R Khan	H Meer

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EXECUTIVE SUMMARY

Local Geotechnics (LG) was engaged by Shire of Collie to undertake a geotechnical investigation for Minninup Pool Tourism Project, located at southern end of the Collie Golf Club, Collie, WA (the site).

Two sites, approximately 6.6 ha and 4.8 ha, within the reserve were identified for the project. First site, known as the old hockey ground (Area 1) was identified for camp ground and eco cabins with associated visitor's infrastructure and amenities. The second site known as Kings Park (Area 2), was identified for boutique style eco accommodation or sola eco lodge.

A geotechnical site investigation, that comprised onsite underground services check, hand auger test holes drilling and Dynamic Cone Penetrometer tests, was undertaken on 6 and 8 April 2020 to assess the prevailing subsurface conditions for the proposed development.

Subsurface conditions for Area 1 inferred from the site investigation can be described as:

- Topsoil, Silty SAND (SM)- fine grained, light grey or light brown, slightly moist, very loose to medium dense, with organics, grass, roots, extending to a depth of around 0.2 m.
- Silty SAND (SM) - Clayey SAND (SC)- fine grained, light grey, light brown to light yellow, dry to slightly moist, medium dense to dense, loose pockets in places, silt fines, trace low plasticity clay, in places with sub rounded gravel up to 25 mm in size, coffee rock layer in place. This layer was extended up to the maximum investigated depth 1.6m.

Subsurface conditions for Area 2 inferred from the site investigation can be described as:

- Topsoil, Silty SAND (SM)- fine grained, light grey, dark brown, dry in places, very loose to medium dense, silt fines, extending to a depth of around 0.2 m, overlying,
- Silty SAND - Gravelly Silty SAND (SM) - fine grained, yellow to light yellow, brown, slightly moist, loose to very dense, silt fines, with sub rounded gravel and sub angular cobbles, gravel size approximately between 25 mm and 70mm. This layer was extended up to the maximum investigated depth 2.5 m.

Groundwater was not encountered at any of the test locations during the time of investigation. However, because of the close proximity of the Collie River, water level (Reduced Level, RL) of the river can be considered as the groundwater level (RL) for both sites, Area 1 & Area 2.

Site class (AS2870-2011) – Based on the subsurface and surrounding site conditions observed during the field investigation, the site was classified as "**Class P**". Provided the earthworks and compaction are completed as per the recommendations presented in Section 7.7.3, the site can be reclassified to "**Class M**" in accordance AS 2870 -2011.

Earthquake sub-soil class (AS1170.4-2007) – "**Class Ce** - Shallow Soil".

Geotechnical strength and stiffness parameters for the existing ground are presented in Section 7.4. Other parameters such as bearing capacities for strip and pad footing, CBR value, stormwater drainage are recommended in Chapter 7.0 of the report.

We recommend that a geotechnical engineer supervises the site activities to ensure that all demolition debris, roots, have been adequately removed from the area and that site is safely excavated and adequately backfilled and compacted as per the procedures described in the report.

1.0 INTRODUCTION

Local Geotechnics (LG) was engaged by Shire of Collie to undertake a geotechnical investigation for Minninup Pool Tourism Project, located at southern end of the Collie Golf Club, Collie, WA (the site). The location of the project site is shown in Figure 1.

Figure 1. Site Location Aerial View (Source: Google Map)

The site is located at Minninup Pool Reserve, Collie, WA. LG was given to understand by the client that the site will be developed for tourist attraction and accommodation.

Two sites within the reserve were identified for short term tourist accommodation. One site, known as the old hockey ground (Area 1 in Figure 1), was identified for camp ground and eco cabins with associated visitor's infrastructure and amenities. The other site known as Kings Park (Area 2 in Figure 1), was identified for exclusive, boutique style eco accommodation or wellness studio/ sola eco lodge. Geotechnical site investigation was required for the above-mentioned infrastructure at the two proposed leased areas.

A geotechnical site investigation, that comprised onsite underground services check, hand auger test holes drilling and Dynamic Cone Penetrometer tests, was undertaken on 6 and 8 April 2020 to assess the prevailing subsurface conditions for the proposed development.

This report presents the factual data obtained during the field investigation and recommendations and discussions on site classification, subsurface conditions, bearing pressure, foundation type, backfill and estimated settlements.

2.0 PROPOSED DEVELOPMENT

Area 1, the old hockey ground, is approximately 6.6 ha. An indicative concept design for Area 1 included the following:

- 50 x Camping sites (with power and potable water)
- 20 x Eco-cabins (fully self-contained)
- 8 x Motel style units
- Associated communal and administrative infrastructure including ablution facilities, camp kitchen, reception/managers residence with workshop/ storage, internal roads, parking bays.

Area 2, the Kings Park, is approximately 4.8 ha. An indicative concept design for Area 2 included the following:

- 6 x Sola eco lodge
- Associated ablution facilities, internal roads and parking bays.

3.0 SCOPE AND OBJECTIVE

The scope and objectives of the investigation are as follows:

- Mobilisation and demobilisation of an engineer to the site;
- Conducting of sub-surface probing at thirty (30) locations at the site to a target depth of 2.5 m, refusal or pit collapse, whichever was encountered first;
- Logging of the site soil profile and groundwater level as per **AS1726**;
- Collection of soil samples for laboratory testing as deemed necessary;
- Conducting of Dynamic Cone Penetrometer (DCP) tests alongside the test pits, to a depth of 1.0 m from the ground surface or refusal;
- Recording of test locations by using a hand-held GPS;
- Backfilling of all test holes with the site materials;
- Conducting of laboratory tests at NATA accredited laboratory which included:
    - Particle Size Distribution Tests.
    - Atterberg Limit Tests.
- Objectives of the investigation are to prepare an investigation report which included:
    - Details of investigation;
    - Desktop study information;
    - Site plan showing the locations of test holes;
    - Logging of soil strata and identify soil/rock layer profiles as per **AS1726;**
    - Water table information, if encountered;
    - Laboratory test data;
    - Interpretation of:
    - Site Classification as per **AS2870;**
    - Recommendations on site preparation including compaction criteria as per **AS 3798**;

4.0 SITE CONDITIONS

4.1 Surface Condition

Area 1

Area 1 is located at the western side of the development zone. The area was mostly covered with trees of all sizes, long grass, vegetation and white sand. The overall topography was undulating. There was an access track from the Minninup Road. No water ponding was observed during the field investigation.

Area 2

Area 2 is located at the eastern side of the development zone. The area was mostly covered with trees of all sizes, long grass, vegetation and white sand. The area was observed to be sloped westward, towards the Collie River. The site was accessible by an existing gravel road from the south, which terminated at the north-western end. No water ponding was observed during the field investigation.

The site photos taken during the field investigation are shown in Appendix D.

4.2 Site Geology

A review of Environmental Geological Western Australia survey Map of Collie 1:50,000 (Sheet 2131 III) was conducted before site investigation. An extracted geological map is shown in Figure 2.

Area 1 is underlain by SAND (S_{14}). The Sand (S14) was described as white to pale grey, fine to medium, occasionally coarse, angular to sub-angular quartz, little fines, poorly to moderately sorted.

Environmental Geological map of Collie also revealed that Area 1 soil has high shear strength, low compressibility, high permeability, low consolidation, no shrink swell potential, no cohesion, and high ease of excavation. Alluvial sand of broad, shallow valleys, well drained, loose, high water table, prone to flooding in part.

Area 2 is underlain by LATERITE (LA_3). The Laterite unit was described as massive, indurated, nodular and vesicular, iron cemented, much fine to medium angular quartz and occasionally some well rounded quartz and quartzite pebbles.

Environmental Geological map of Collie also revealed that Area 2 soil has high shear strength, medium to high permeability, no shrink swell potential, and low ease of excavation. Extensive deposits occurring on ridge crests within coal basin, is lateritized and iron cemented, silty sands of Sm_5.

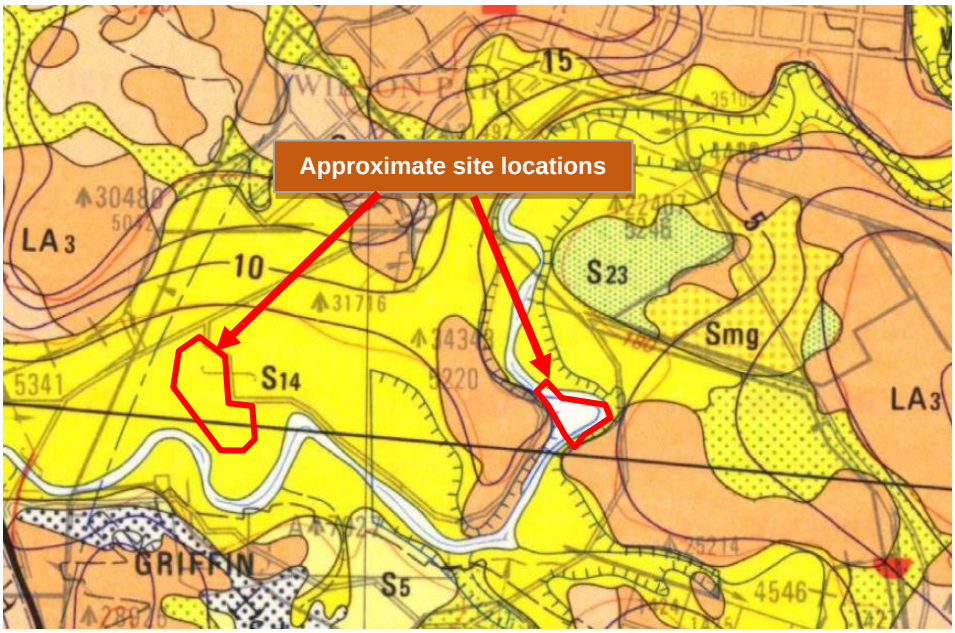


Figure 2. Extracted Geological Map (Ref. 1:50,000 Geology Series Collie sheet)

5.0 FIELD WORKS

5.1 General

The field investigation comprised a visual inspection of the site, sub-surface probing by using a hand auger at thirty (30) locations, up to a depth of 2.5 m or refusal, Dynamic Cone Penetrometer (DCP) testings alongside the test holes, soil sampling and laboratory testings.

Thirty (30) Test Holes (TH01 to TH30) were conducted at the site by using a hand auger. Twenty (20) test holes (TH01 to TH20) were undertaken at Area 1 and ten (TH21 to TH30) were undertaken at Area 2.

The test locations are shown in the site sketch in Appendix A. The key information of the field tests is summarised in Table 1.

Table 1. Field Investigation Summary

Test ID	Coordinates (MGA94)		Termination Depth (m)	Remarks
	Northing (m)	Easting (m)		
Area 1				
TH01/DCP01	6 306 671	419 515	0.9	Refusal on boulder
TH02/DCP02	6 306 686	419 500	1.2	Refusal on gravel
TH03/DCP03	6 306 668	419 467	0.4	Refusal on boulder
TH04/DCP04	6 306 680	419 470	1.0	Refusal on gravel
TH05/DCP05	6 306 725	419 468	1.4	Refusal on gravel
TH06/DCP06	6 306 713	419 455	0.5	Refusal on coffee rock
TH07/DCP07	6 306 735	419 436	1.4	Refusal on gravel
TH08/DCP08	6 306 757	419 523	1.0	Refusal on gravel
TH09/DCP09	6 306 740	419 517	1.0	Refusal on gravel
TH10/DCP10	6 306 723	419 499	0.8	Refusal on coffee rock
TH11/DCP11	6 306 742	419 488	0.8	Refusal on coffee rock
TH12/DCP12	6 306 769	419 484	0.5	Refusal on coffee rock
TH13/DCP13	6 306 748	419 457	1.6	Refusal on gravel
TH14/DCP14	6 306 764	419 444	1.6	Refusal on gravel
TH15/DCP15	6 306 746	419 536	1.0	Refusal on gravel
TH16/DCP16	6 306 626	419 662	0.8	Refusal on gravel
TH17/DCP17	6 306 597	419 484	0.8	Refusal on gravel
TH18/DCP18	6 306 622	419 542	0.8	Refusal on gravel
TH19/DCP19	6 306 590	419 556	0.8	Refusal on very dense layer
TH20/DCP20	6 306 575	419 579	1.0	Refusal on very dense layer
Area 2				
TH21/DCP21	6 306 603	420 946	0.9	Refusal on boulder
TH22/DCP22	6 306 625	420 936	0.5	Refusal on gravel
TH23/DCP23	6 306 603	420 946	2.5	Reached target depth
TH24/DCP24	6 306 605	420 866	1.2	Refusal on gravel
TH25/DCP25	6 306 747	420 643	0.5	Refusal on boulder
TH26/DCP26	6 306 704	420 684	0.5	Refusal on boulder

Test ID	Coordinates (MGA94)		Termination Depth (m)	Remarks
	Northing (m)	Easting (m)		
TH27/DCP27	6 306 705	420 733	0.5	Refusal on boulder
TH28/DCP28	6 306 683	420 769	0.5	Refusal on boulder
TH29/DCP29	6 306 676	420 810	0.5	Refusal on boulder
TH30/DCP30	6 306 630	420 798	0.5	Refusal on boulder

5.2 Survey

Field investigation locations were determined at the site randomly and were recorded by using a Garmin 12 channel handheld GPS with a claimed accuracy of ±5m. Approximate coordinates (GDA94/MGA 94) of all tests are shown in Table 1. All fieldwork was carried out by or under the direction of LG in general accordance with AS1726 (2017).

5.3 Test Hole Logs

The subsurface profile exposed in the test holes were logged in accordance with AS1726 and was photographed to provide a visual record of subsurface conditions encountered. Following these activities, test holes were progressively backfilled in the reverse order of the excavation works.

Test holes in Area 1 were terminated at various depths due to hand auger refusal on boulder, gravel, coffee rock, or very dense layer.

Test holes, TH21 to TH24, were terminated at various depths due to hand auger refusal on boulder or gravel. TH23 was drilled to the target depth of 2.5 m. Test holes, TH25 to TH30, were terminated at a depth of 0.5 m due to refusal on boulder.

Details of the soil profile logs are included in Appendix B.

Groundwater was not encountered in any of the THs during the field investigation.

5.4 Dynamic Cone Penetrometer (DCP) Tests

The Dynamic Cone Penetrometer (DCP) test is a relatively quick field test to determine the penetration resistance of the soil tested. The soils consistency or density (depending on soil cohesiveness) can then be estimated.

A total of 30 Dynamic Cone Penetrometer (DCP01 to DCP30) tests were conducted alongside the hand auger test holes. DCP test data was used to determine the field density of soil materials by using Standard Australia HB 160-2006. The following observations were made from the DCP tests:

- Area 1 (DCP01 to DCP20): very loose to very dense condition
- Area 2 (DCP21 to DCP30): very loose to very dense condition

DCP data are presented in Table 2 (DCP1 to 20 was conducted at Area 1 and DCP21 to 30 was conducted at Area 2. DCP certificates are presented in Appendix B.

Table 2. Summary of DCP Test Data (Ref. Table 6.4.6.2, HB 160-2006)

Area 1 (DCP01 to 20):

DCP Location	DCP01	DCP02	DCP03	DCP04	DCP05	DCP06	DCP07	DCP08	DCP09	DCP10
Depth (mm)	**No. of Blows/100mm (Density Classification)**									
0-100	3 (MD)	5 (D)	5 (D)	2 (MD)	1 (L)	2 (MD)	5 (D)	1 (L)	1 (L)	2 (MD)
100-200	4 (D)	5 (D)	7 (D)	3 (MD)	3 (MD)	3 (MD)	5 (D)	1 (L)	3 (MD)	3 (MD)
200-300	3 (MD)	7 (D)	10 (VD)	2 (MD)	5 (D)	5 (D)	3 (MD)	2 (MD)	4 (D)	6 (D)
300-400	4 (D)	5 (D)	11 (VD)	2 (MD)	6 (D)	5 (D)	4 (D)	1 (L)	6 (D)	7 (D)
400-500	5 (D)	4 (D)	11 (VD)	2 (MD)	8 (D)	6 (D)	4 (D)	2 (MD)	6 (D)	8 (D)
500-600	3 (MD)	4 (D)	12 (VD)	1 (L)	14 (VD)	R	5 (D)	3 (MD)	4 (D)	14 (VD)
600-700	20 (VD)	5 (D)	12 (VD)	4 (D)	10 (VD)		5 (D)	3 (MD)	3 (MD)	R
700-800	R	8 (D)	R	5 (D)	7 (D)		5 (D)	3 (MD)	4 (D)	
800-900		7 (D)		7 (D)	7 (D)		5 (D)	5 (D)	4 (D)	
900-1000		9 (VD)		17 (VD)	8 (D)		6 (D)	7 (D)	4 (D)	

DCP Location	DCP11	DCP12	DCP13	DCP14	DCP15	DCP16	DCP17	DCP18	DCP19	DCP20
Depth (mm)	**No. of Blows/100mm (Density Classification)**									
0-100	1 (L)	1 (L)	1 (L)	1 (L)	5 (D)	5 (D)	2 (MD)	1 (L)	1 (L)	1 (L)
100-200	1 (L)	3 (MD)	2 (MD)	2 (MD)	5 (D)	5 (D)	3 (MD)	<1 (VL)	<1 (VL)	1 (L)
200-300	5 (D)	6 (D)	3 (MD)	5 (D)	4 (D)	5 (D)	7 (D)	1 (L)	1 (L)	1 (L)
300-400	7 (D)	7 (D)	4 (D)	5 (D)	3 (MD)	9 (VD)	10 (VD)	4 (D)	2 (MD)	2 (MD)
400-500	9 (VD)	18 (VD)	4 (D)	3 (MD)	3 (MD)	9 (VD)	7 (D)	8 (D)	5 (D)	4 (D)
500-600	11 (VD)	R	4 (D)	4 (D)	3 (MD)	10 (VD)	8 (D)	R	8 (D)	4 (D)
600-700	R		3 (MD)	5 (D)	3 (MD)	12 (VD)	9 (VD)		12 (VD)	8 (D)
700-800			6 (D)	6 (D)	5 (D)	R	9 (VD)		R	10 (VD)
800-900			6 (D)	6 (D)	5 (D)		9 (VD)			12 (VD)
900-1000			7 (D)	6 (D)	6 (D)		10 (VD)			R

Area 2 (DCP21 to 30):

DCP Location	DCP21	DCP22	DCP23	DCP24	DCP25	DCP26	DCP27	DCP28	DCP29	DCP30
Depth (mm)	**No. of Blows/100mm (Density Classification)**									
0-100	2 (MD)	4 (D)	1 (L)	1 (L)	8 (D)	2 (MD)	10 (VD)	2 (MD)	12 (VD)	4 (D)
100-200	2 (MD)	8 (D)	<1 (VL)	1 (L)	8 (D)	8 (D)	18 (VD)	8 (D)	25 (VD)	18 (VD)
200-300	2 (MD)	10 (VD)	1 (L)	3 (MD)	10 (VD)	12 (VD)	R	14 (VD)	R	R
300-400	2 (MD)	R	<1 (VL)	4 (D)	14 (VD)	R		R		
400-500	3 (MD)		2 (MD)	8 (D)	R					
500-600	7 (D)		3 (MD)	10 (VD)						
600-700	8 (D)		5 (D)	10 (VD)						
700-800	6 (D)		5 (D)	R						
800-900	7 (D)		6 (D)							
900-1000	7 (D)		6 (D)							

Note: Density Classification is obtained based on Number of blows required for 100 mm penetration of DCP
Very Loose (VL) < 1; Loose (L) 1 – 2; Medium Dense (MD) 2 – 3; Dense (D) 4 – 8; Very Dense (VD) > 8; R = Refusal

6.0 LABORATORY TEST

6.1 General

Laboratory tests were conducted at Kanga & Associates, a NATA accredited laboratory. The following laboratory tests were scheduled and undertaken:

- Particle Size Distribution Test (AS 1289 3.6.1)
- Atterberg Limit Test (AS 1289 2.1.1)

6.2 Laboratory Test Results

The laboratory test results are summarised in Table 3. Laboratory test certificates are included in Appendix C.

Table 3. Summary of Laboratory Test Data

Sample Location	Area 1 TH02 0.6 m – 1.2 m	Area 1 TH16 0.4 m – 0.8 m	Area 2 TH21 0.2 m – 0.8 m	Area 2 TH30 0.1 m – 0.5 m
Particle Size Distribution (PSD)				
Gravel (%)	1	1	3	77
Sand (%)	72	72	85	18
Fines < 75µm (%)	27	27	12	5
Atterberg Limits (PI)				
Liquid Limit, LL (%)	24	24	Not Obtainable	Not Obtainable
Plastic Limit, PL (%)	17	18	Not Obtainable	Not Obtainable
Plasticity Index, PI (%)	7	6	Non Plastic	Non Plastic
Linear Shrinkage (%)	3	3	Not Obtainable	Not Obtainable

Particle size distribution testing was undertaken in accordance with Australian Standard, AS 1289.3.6.1.

Area 1

The soil samples from Area 1 comprise of approximately 27% fines and 72% sand. The tested materials can be classified as Silty SAND (SM) or Clayey SAND (SC).

Area 2

The soil samples from the east of Area 2 comprise between 5% and 12% fines, 18% and 85% sand and 3% and 77% gravel. The tested materials can be classified as Silty SAND (SM) and Sandy Gravel (GP).

7.0 ENGINEERING CONSIDERATIONS AND RECOMMENDATIONS

7.1 Inferred Subsurface Conditions at Area 1

Subsurface conditions inferred from the site investigation can be described as follows:

- **Topsoil, Silty SAND (SM)-** fine grained, light grey or light brown, slightly moist, very loose to medium dense, silt fines, with organics, grass, roots, extending to a depth of around 0.2 m, overlying,
- **Silty SAND (SM) - Clayey SAND (SC)-** fine grained, light grey, light brown to light yellow, dry to slightly moist, medium dense to dense, loose pockets in places, silt fines, trace low plasticity clay, in places with sub rounded gravel up to 25 mm in size, coffee rock layer in place. This layer was extended up to the maximum investigated depth 1.6m.

7.2 Inferred Subsurface Conditions at Area 2

Subsurface conditions inferred from the site investigation can be described as follows:

- **Topsoil, Silty SAND (SM)-** fine grained, light grey, dark brown, slightly moist, dry in places, very loose to medium dense, silt fines, extending to a depth of around 0.2 m, overlying,
- **Silty SAND - Gravelly Silty SAND (SM) -** fine grained, yellow to light yellow, brown, slightly moist, loose to very dense, silt fines, with sub rounded gravel and sub angular cobbles, gravel size approximately between 25 mm and 70mm. This layer was extended up to the maximum investigated depth 2.5 m.

7.3 Groundwater

Groundwater was not encountered at any of the test locations during the time of investigation. However, because of the close proximity of the Collie River, water level (Reduced Level, RL) of the river can be considered as the groundwater level (RL) for both sites, Area 1 and Area 2.

7.4 Geotechnical Strength and Stiffness Parameters

Geotechnical parameters for a generalised subsurface profile, were inferred from the site investigation data and are presented in Table 4 below.

Table 4. Inferred Geotechnical Parameters for Existing Subsurface at Area 1 & 2

Approx. layer depth (m, bgl)	Layer Description	Soil Parameters					k (m/s)
		ϕ' (deg.)	c'/c_u (kN/m^2)	γ (kN/m^3)	E_u/E' (MPa)	ν'	
0 – 0.6	Silty SAND (SM) Very loose to Medium dense	30	-/-	18	-/10	0.3	4 x10^{-5} to 5 x10^{-7}
0.6 – 2.5	Gravelly Silty SAND (SM) Medium dense to dense	34	-/-	20	-/60	0.3	1 x10^{-6} to 1 x10^{-9}

Notes: Approx. = Approximate, bgl = below ground level, ϕ' = Drained friction angle, c' = Drained cohesion, c_u = Undrained shear strength, γ = Bulk density, E_u = Undrained Elastic Modulus, E' = Drained Elastic Modulus, ν' = Drained Poisson's Ratio, k = Coefficient of Permeability.

7.5 Site Classification

Based on the subsurface and surrounding site conditions observed during the field investigation, the site was classified as "**Class P**" in accordance with AS 2870-2011 "Residential Slabs and Footings".

The site classification 'Class P' was based on the following basis:

- 'Very loose to loose sand' of the site within the surficial 0.6 m depth is considered to be an unstable foundation ground.
- Excessive foundation settlement may occur due to loading on the loose and compressible foundation ground.
- Presence of potential organic matter from the existing vegetation, flood plain of the Collie River and the land uses.

Site Classification Upgrade

Provided the earthworks and compaction are completed as per the recommendations presented in Section 7.7.3, the site can be reclassified to "**Class M**" in accordance with the definitions provided in the Australian Standard AS 2870 -2011 "Residential Slabs and Footings - Construction".

Class "M" sites will experience between 20 mm and 40 mm of surface movement due to soil wetting and drying cycles associated with seasonal changes in available moisture.

7.6 Earthquake Design Factor

Australian Standard AS1170.4-2007 Structural design actions Part 4 "Earthquake actions in Australia" is recommended for earthquake consideration. AS1170.4-2007 outlines the design criteria required for a structure in consideration of the risk of being subjected to earthquake loads. Earthquake design factors are summarised in Table 5.

Table 5. Earthquake Design Factors

Factor/Class	Value/Name	Ref. AS1170.4- 2007
Hazard Factor (z)	0.09	Section 3 Table 3.2
Site sub-soil class	**Class C_e** – Shallow Soil	Section 4 Clause 4.1

7.7 Earthworks Recommendation

7.7.1 Suitability of Excavated Materials for use as Fill

In situ sands are considered to be suitable for reuse as structural fill material.

7.7.2 Structural Fill

Suitable materials for structural fill shall be a clean sand fill. The fill material at compaction should comprise sand that is free from oversized material (i.e. material > 75 mm in any dimension), contains less than 5% fines (material passing 0.075 mm sieve), and free from foreign material, organic material or other deleterious material. It should also be free from industrial waste, solid waste, or construction and demolition debris.

7.7.3 Site Preparation

Earthworks should be carried out in general accordance with the Australian Standard AS 3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments". The following are general guidelines to be followed during preparation of the site areas within the proposed development footprints:

- Remove and grub all root masses and tree stumps, if any.
- Strip top soil and any uncontrolled fill, cobbles and boulders, paved materials, demolition debris, green waste, weeds/grass, organic matter or other deleterious material, if any and stockpile them separately.
- Excavate to 0.6 m depth. Stockpile the materials for reuse as backfill.
- Compact /proof roll the exposed surface, targeting around 1 m of medium dense sandy material underneath, with required number of passes, a minimum of 10 passes, of a heavy vibratory roller to a dense state, i.e., to 95% of MMDD in accordance with AS1289.5.2.1. The material at compaction should be moisture conditioned within -1% to +2% of its optimum moisture content.

- Backfill the site to the required design finished level. Backfill using the stockpiled sand in loose layer lift thickness not exceeding 300 mm and compact using a heavy vibratory roller to 95% of MMDD in accordance with AS1289.5.2.1. The material at compaction should be moisture conditioned within -1% to +2% of its optimum moisture content.
- Undertake necessary excavation to the required depth for the proposed shallow foundation, raft, pad and strip footing or pile cap. Compact the foundation bases to dense state using a hand held compactor.
- Care will need to be taken when compacting in the vicinity of existing structures to avoid damage from excessive vibrations.
- For site maintenance, it is recommended to follow the CSIRO publication "Guide to Home Owners on Foundation Maintenance and Footing Performance" in Building Technology File Number 18. This document provides important information on the implications of plumbing, property maintenance, site classification on foundation design, drainage and performance expectations.

It is recommended that a geotechnical engineer supervises the site activities to ensure that all roots, demolition debris have been adequately removed from the area and that site is safely excavated and adequately backfilled and compacted as per the procedures described above.

7.8 Foundation Type & Bearing Capacity

Strip and Pad foundation will be fine this site. If the earthworks as described in Section 7.7.3 are undertaken prior to the building construction, ground will have sufficient bearing capacity to support typical size pad and strip foundations at the design ground level.

The allowable bearing pressures presented in Table 6 are preliminary estimated to limit settlements to less than 25 mm and provide a minimum factor of safety of 2.0 against general bearing capacity failure. These bearing pressures do not consider eccentric loading conditions and interaction effects (i.e. loadings from adjacent foundations).

Furthermore, the calculations assume that the areas beneath the pad and strip foundations have been compacted to a density ratio of 95% modified compaction, MMDD, and are founded at least 0.5 m below final ground grading levels.

Table 6. Allowable Bearing Pressures for Typical Strip and Pad Footings

Embedment Depth (m)	Footing Type	Footing Width (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	Strip	0.5	90	10
		1	100	20
		1.5	150	20
		2	200	25
0.5	Pad	1	100	20
		2	180	20
		3	200	25
		4	250	25

7.9 California Bearing Ratio (CBR) for Roads & Carpark's Subgrade

The subgrade of the proposed carpark, internal roads, hardstand and driveway areas shall be prepared as per the general guidelines set out in Section 7.7.3 and compacted to a density ratio of 98% MMDD.

Based on the sandy material, a design CBR value of 12% can be considered for this project.

7.10 Excavatability

The loose to dense state of the in-situ sandy soils suggests that the materials should be excavatable with a standard earthmoving equipment (e.g., 20 to 30 tonne excavator).

7.11 Cut and Fill Batters

Temporary excavation up to 1 m depth can be conducted with a maximum dry slope angle of 1V: 2H. Cut and fill batters above groundwater table will generally be stable at 1V: 2H. Intermediate benches have to be created if excavation is deeper than 1m. However, batters constructed at 1V: 3H will enable re-establishment of vegetation and be less prone to damage from wetting, drying and erosion.

7.12 Stormwater Drainage

The site is underlain by the Silty Sand. According to AS/NZS 1547-2012, the material is described to have 'Soil Category 3 – Silty Loam'. Institute of Municipal Engineering Australia WA Division (1998) recommended that finished site levels be maintained at least 1.2 m above the annual average maximum groundwater level.

The recommended measure for the disposal of stormwater for the structures is offsite or local conventional system as approved by the shire. However, the volume of expected stormwater (worst case scenario) and the finished site level have to be assessed and designed by a suitably qualified professional for the proposed building considering the above-mentioned soil category and hydraulic conductivity rate.

8.0 LIMITATION OF USE

The ground is a product of continuing natural and man-made processes and therefore exhibits characteristics and properties which vary from place to place and can change with time. Geotechnical site investigation involves gathering and assimilating limited facts about these characteristics and properties in order to better understand or predict the behaviour of the ground at a particular site under certain conditions.

This site investigation has been carried out by inspection, using a limited amount of pit excavation, sampling, testing or other means of investigation. Achieving a full coverage of the site to ensure all variations is not practical and is seldom done due to cost constraints as well as the impracticality.

It should be noted that the subsurface conditions encountered by the limited number of pit excavations as part of this geotechnical site investigation represent the ground conditions at the locations where the samples were taken and where tests have been undertaken and as such are an extremely small proportion of the site to be developed. The facts reported in this document are directly relevant only to the ground at the place where, and time when, the investigation was carried out and are believed to be reported accurately.

Given the limited number of test holes and limited field and laboratory testings carried out with respect to the overall site area, variations between investigation locations are likely and ground conditions different to those presented in this report may be present within the subject site area. The risk associated with this variability and the impact it will have on the proposed development should be carefully considered.

The level of geotechnical investigation that has been completed to date is considered appropriate for the project objectives. If the above mentioned client, its subcontractors, agents or employees use this factual information for any other purpose for which it was not intended, then the client, its subcontractors, agents or employees does so at their own risk and Local Geotechnics will not and cannot accept liability in respect of the advice, whether under law of contract, tort or otherwise.

Any interpretation or recommendation given in this report is based on judgement and experience and not on greater knowledge of the facts reported. Local Geotechnics does not represent that the information or interpretation contained in this report addresses completely the existing features, subsurface conditions or ground behaviour at the subject site.

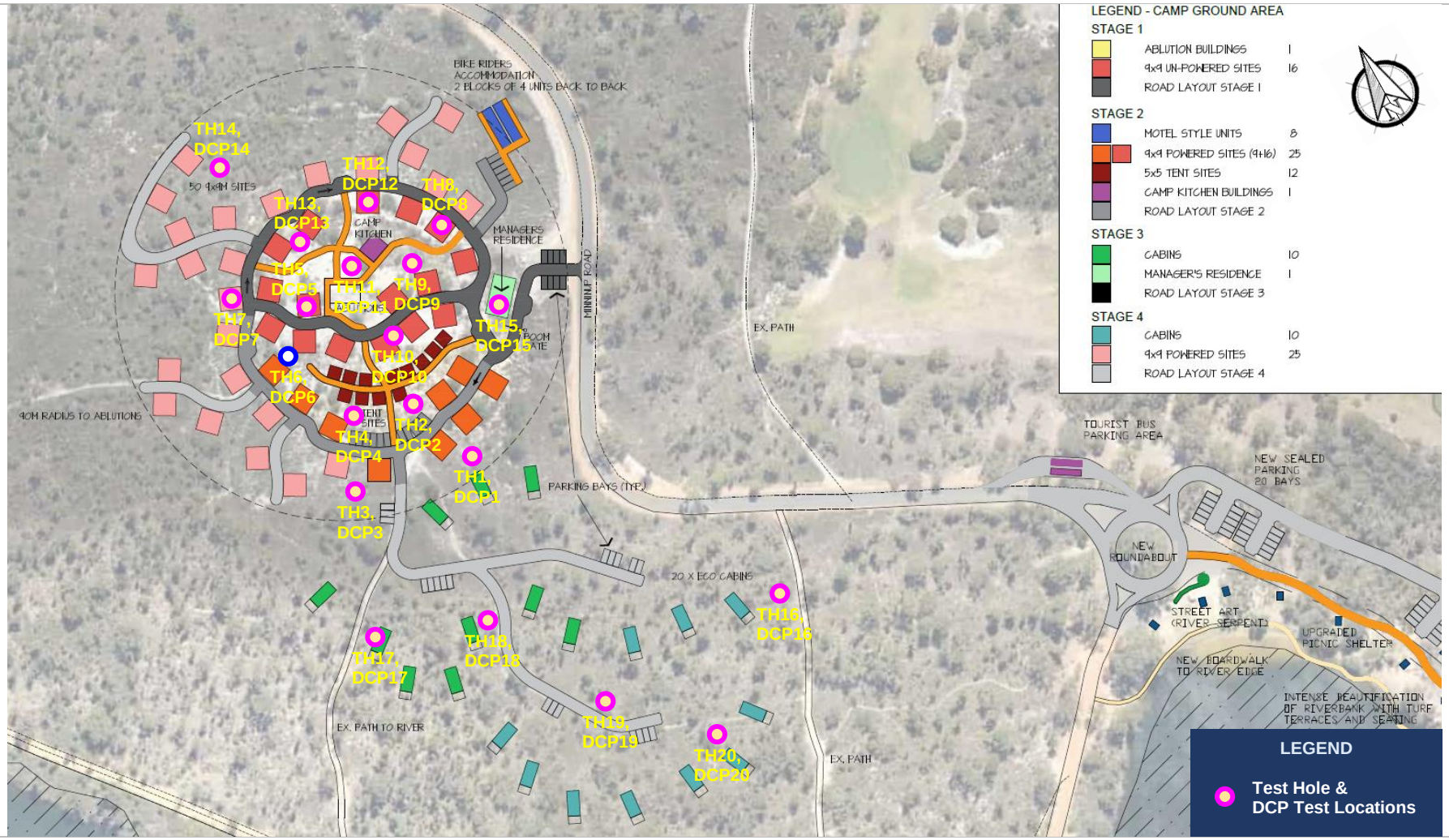
9.0 REFERENCES

- Geological Survey Map of Western Australia of *Collie 1:50,000.*
- Australian Standard AS1170.4-2007, “Earthquake Actions in Australia”.
- Australian/New Zealand Standard AS/NZS 1547-2012, “On-site Domestic Wastewater Management”.
- Australian Standard AS 1726-1993 *"Geotechnical Site Investigations".*
- Australian Standard AS 2870-2011, *"Residential Slabs and Footings".*
- Australian Standard AS 3798-2007, *"Guidelines on Earthworks for Commercial and Residential Developments".*
- Standards Australia, Hand Book HB 160-2006 *"Soil Testing".*
- Institute of Municipal Engineering Australia, WA Division Inc (1998), Local Government Guidelines for Subdivisional Development

APPENDIX A

SITE SKETCH

LOCAL GEOTECHNICS

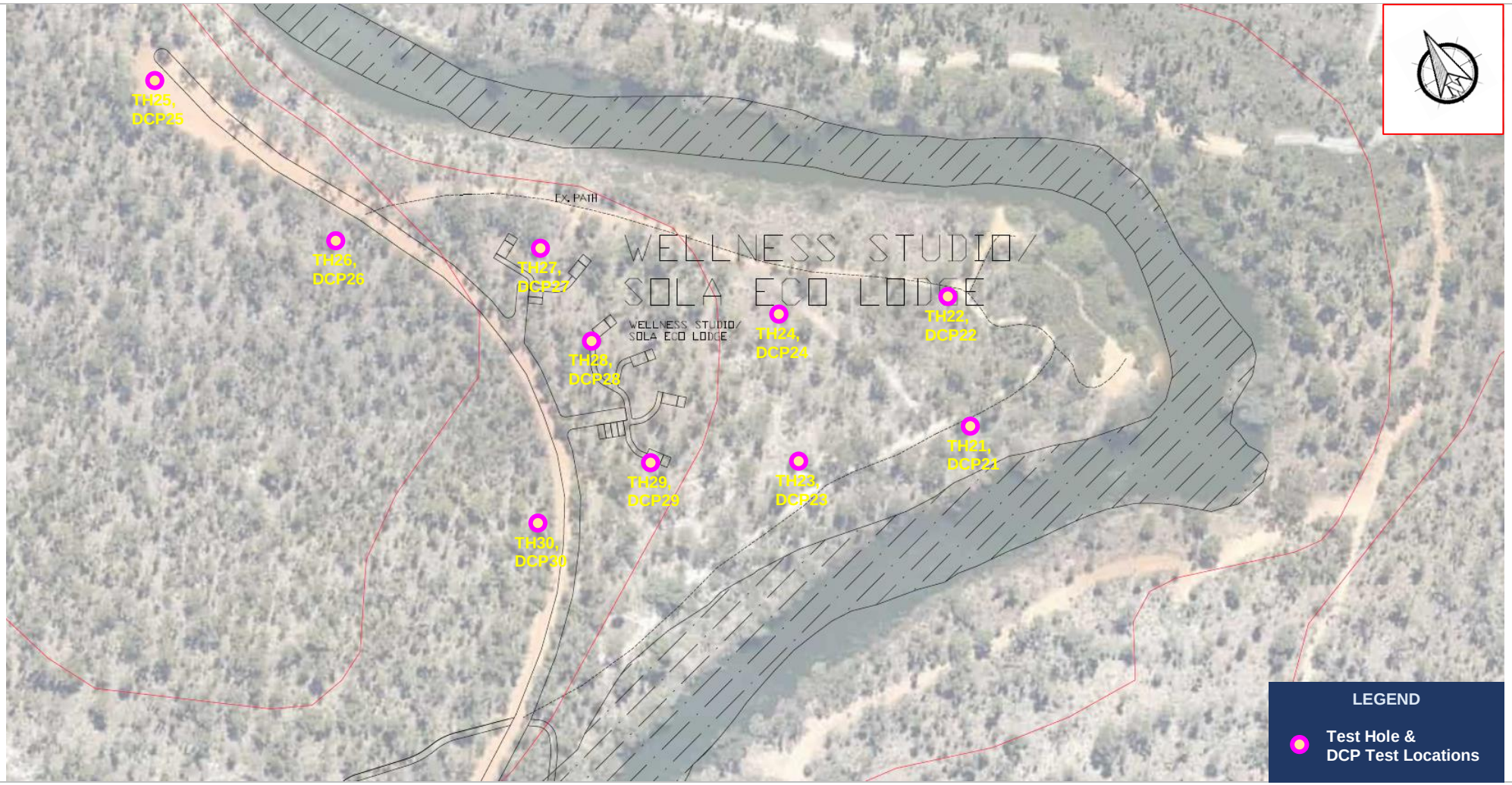


Site Sketch: Test Hole and DCP Test Locations

Reference	LG0862020GI
Client	Shire of Collie
Project	Geotechnical Investigation Location: Minninup Pool Tourism Project, Collie WA

LOCAL GEOTECHNICS

Unit 12, 8 Production Road Canning Vale WA 6155
PO Box 5050, Canning Vale South WA 6155
Phone: 08 9457 3517
E-mail: admin@localgeotechnics.com.au
Web: www.localgeotechnics.com.au



Site Sketch: Test Hole and DCP Test Locations

Reference	LG0862020GI
Client	Shire of Collie
Project	Geotechnical Investigation Location: Minninup Pool Tourism Project, Collie WA

LOCAL GEOTECHNICS

Unit 12, 8 Production Road Canning Vale WA 6155
PO Box 5050, Canning Vale South WA 6155
Phone: 08 9457 3517
E-mail: admin@localgeotechnics.com.au
Web: www.localgeotechnics.com.au

APPENDIX B

TEST PIT LOGS &
DCP TEST CERTIFICATES

LOCAL GEOTECHNICS

ENGINEERING LOG

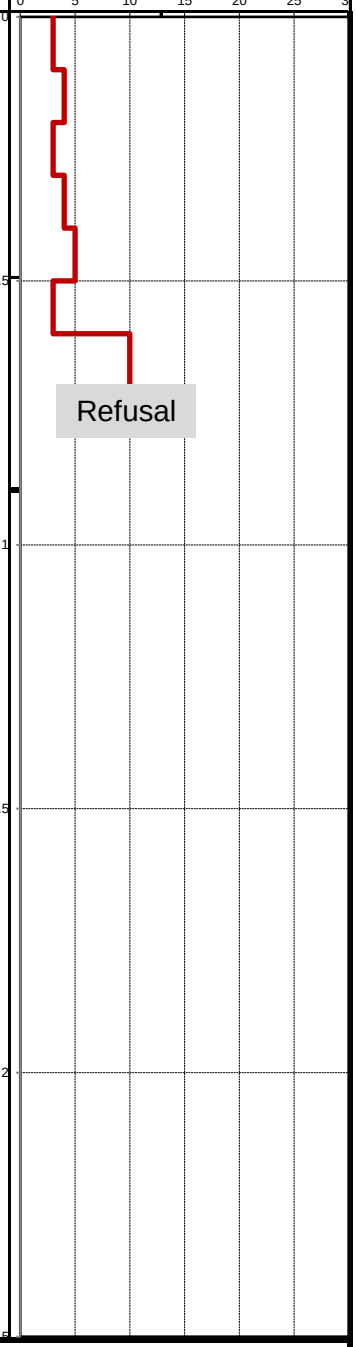
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**01**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 671** **Easting: 419 515**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey-brown, dry, medium dense, silt fines	
0.2						SM	**SILTY SAND-** fine grained, grey, dry, medium dense, silt fines	
0.4						SM	**SILTY SAND-** fine grained, yellow, dry, medium dense, silt fines, with sub rounded gravel up to 20 mm in size	
0.5						SM	**GRAVELLY SILTY SAND-** fine grained, yellow, slightly moist, dense, silt fines, sub rounded gravel up to 20 mm in size	
0.6								
0.9							**Terminated at a depth of 0.9 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

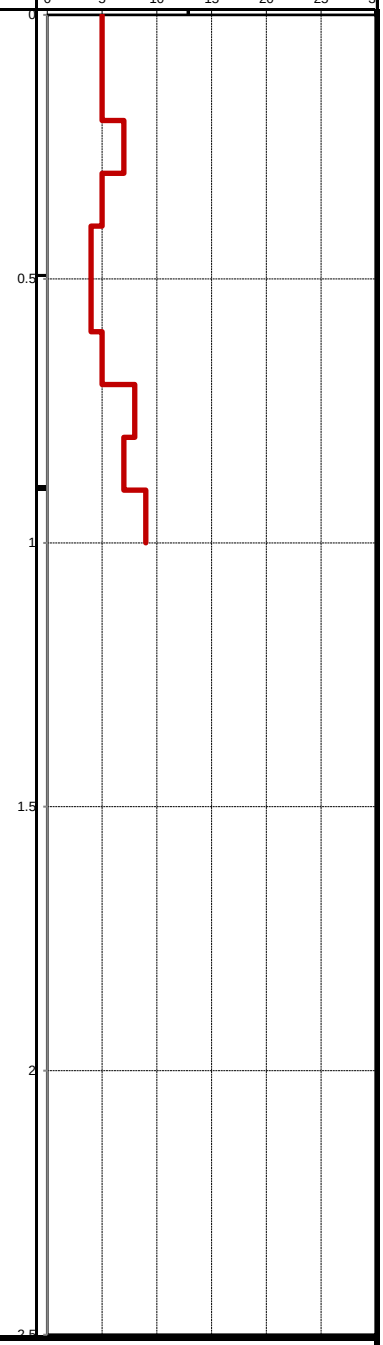
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**02**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 686** **Easting: 419 500**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, dry, dense, silt fines	
0.2						SM	**SILTY SAND-** fine grained, grey, dry, dense, silt fines	
0.4						SM	**SILTY SAND-** fine grained, yellow, dry, dense, silt fines, trace sub rounded gravel up to 5 mm in size	
0.5						SM	**CLAYEY SILTY SAND-** fine grained, yellow, slightly moist, dense, silt fines, low plasticity clay	
0.6								
1.0								
1.2							**Terminated at a depth of 1.2 m due to hand auger refusal on gravel**	
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

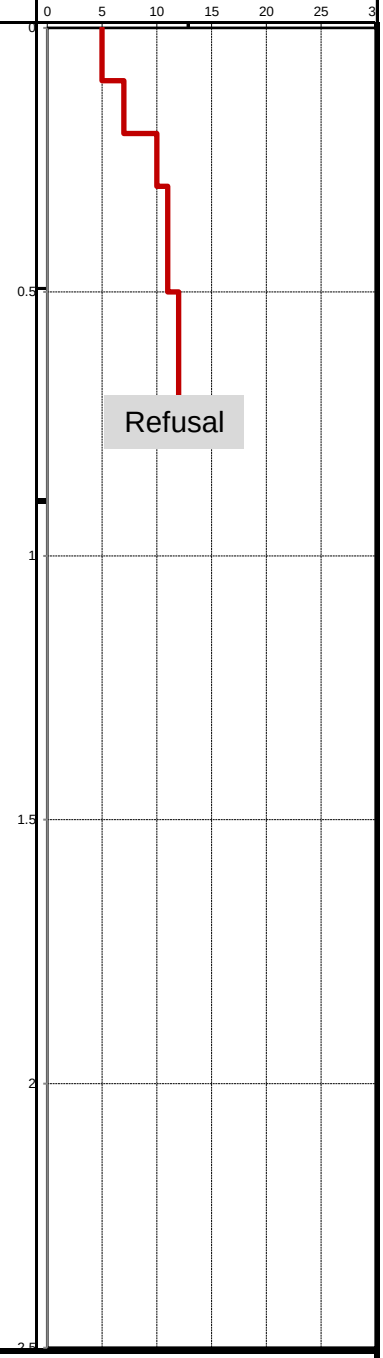
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**03**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 668** **Easting: 419 467**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, slightly moist, dense, silt fines	
0.2						SM	**SILTY SAND-** fine grained, light brown, slightly moist, dense, silt fines	
0.4							**Terminated at a depth of 0.4 m due to hand auger refusal on boulder**	
0.5								
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

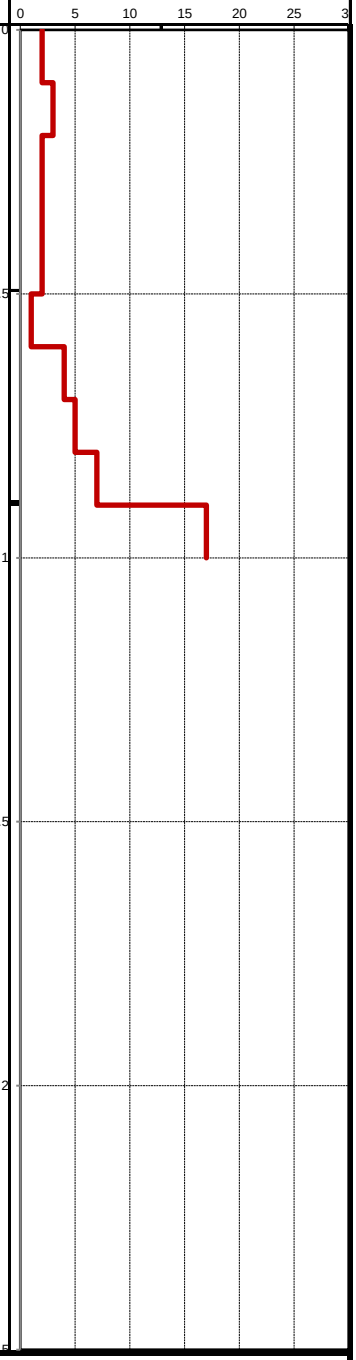
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**04**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 680** **Easting: 419 470**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, dry, medium dense, silt fines	
0.2						SM	**SILTY SAND-** fine grained, grey, dry, medium dense, silt fines	
0.5						SM	**CLAYEY SILTY SAND-** fine grained, brown-grey, slightly moist, dense, silt fines, low plasticity clay	
1.0							**Terminated at a depth of 1.0 m due to hand auger refusal on gravel**	
1.2								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

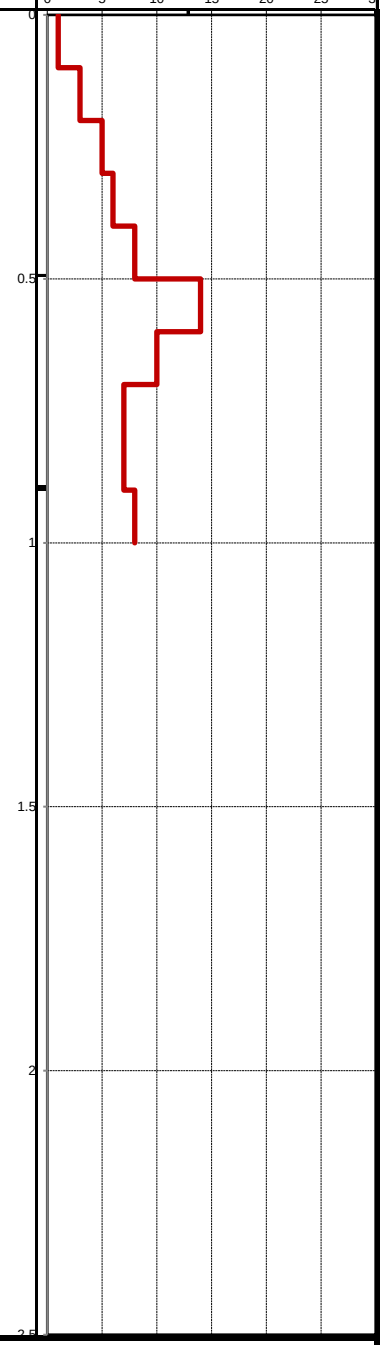
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**05**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 725** **Easting: 419 468**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, dry, loose, with silt fines	
0.2						SM	**SILTY SAND-** fine grained, light grey, slightly moist, dense, silt fines	
0.5						SM	**SILTY SAND-** fine grained, brown, slightly moist, dense, silt fines, with coffee rock	
0.6						SM	**CLAYEY SILTY SAND-** fine grained, brown-grey, slightly moist, dense, silt fines, low plasticity clay	
0.8						SM	**CLAYEY SILTY SAND-** fine grained, brown-grey, slightly moist, dense, silt fines, low plasticity clay, trace sub rounded gravel up to 25 mm in size	
1.0							**Terminated at a depth of 1.4 m due to hand auger refusal on gravel**	
1.2								
1.4								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

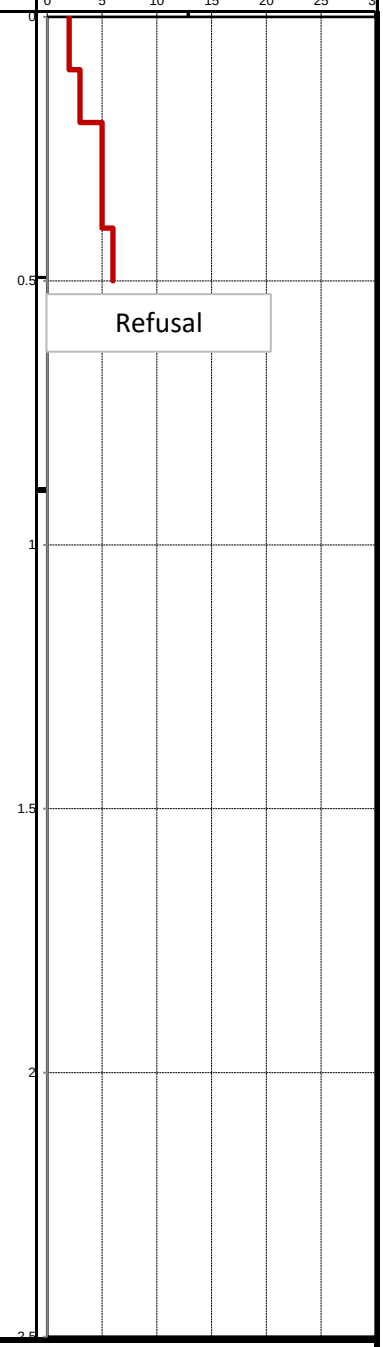
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**06**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 713** **Easting: 419 455**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, dry, medium dense, silt fines	
0.2						SM	**SILTY SAND-** fine grained, light grey, slightly moist, dense, silt fines	
0.4						SM	**SILTY SAND-** fine grained, brown, slightly moist, dense, silt fines, with coffee rock	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on coffee rock**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

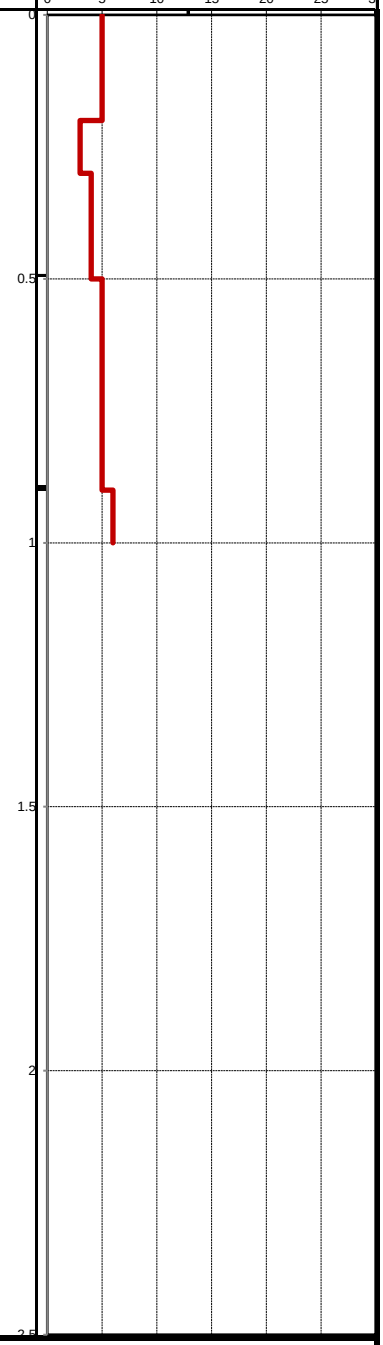
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**07**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 735** **Easting: 419 436**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, dry, dense, silt fines	
0.2						SM	**SILTY SAND-** fine grained, light grey, slightly moist, medium dense, silt fines	
0.4						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, dense, silt fines	
0.5								
1.0								
1.2						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, dense, silt fines, trace sub rounded gravel up to 25 mm in size	
1.4								
1.5							**Terminated at a depth of 1.4 m due to hand auger refusal on gravel**	
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

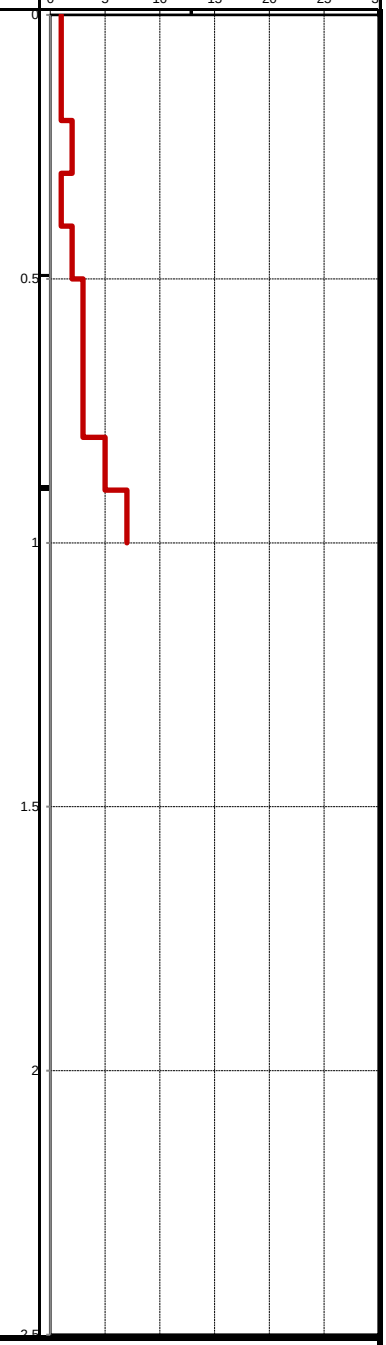
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**08**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 757** **Easting: 419 523**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, loose, silt fines	
0.5						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, medium dense, silt fines, with sub rounded gravel up to 25 mm in size	
0.6								
1.0							**Terminated at a depth of 1.0 m due to hand auger refusal on gravel**	
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

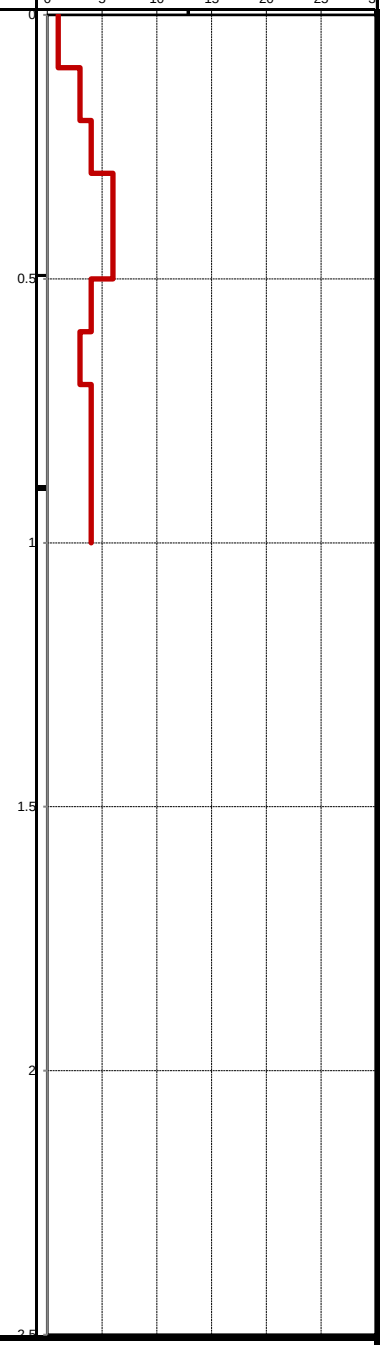
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**09**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 740** **Easting: 419 517**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, dense, silt fines	
0.5								
0.6						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, medium dense, silt fines, with sub rounded gravel up to 25 mm in size	
1.0							**Terminated at a depth of 1.0 m due to hand auger refusal on gravel**	
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

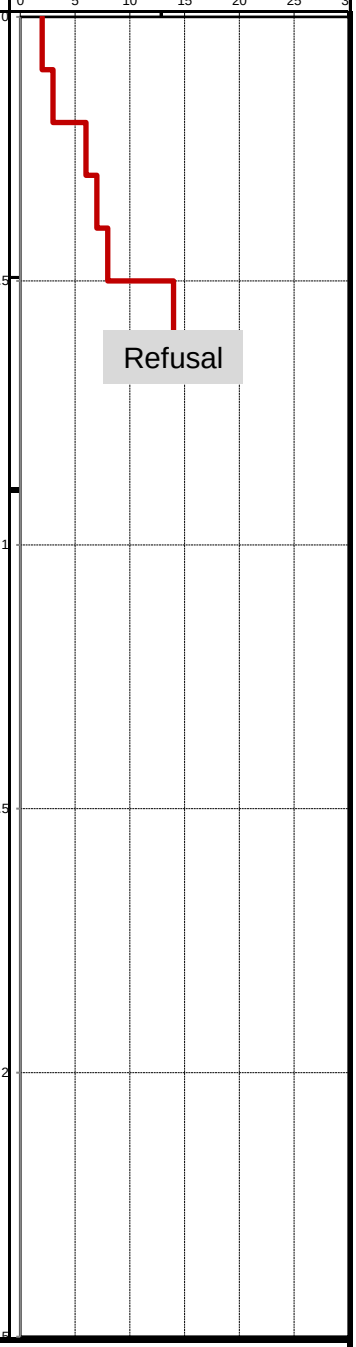
ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**10**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 723** **Easting: 419 499**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, slightly moist, medium dense, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, grey, slightly moist, dense, silt fines	
0.5						SM	**SILTY SAND-** fine grained, brown, slightly moist, dense, silt fines, with coffee rock	
0.8							**Terminated at a depth of 0.8 m due to hand auger refusal on coffee rock**	
1.0								
1.5								
2.0								
2.5								



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

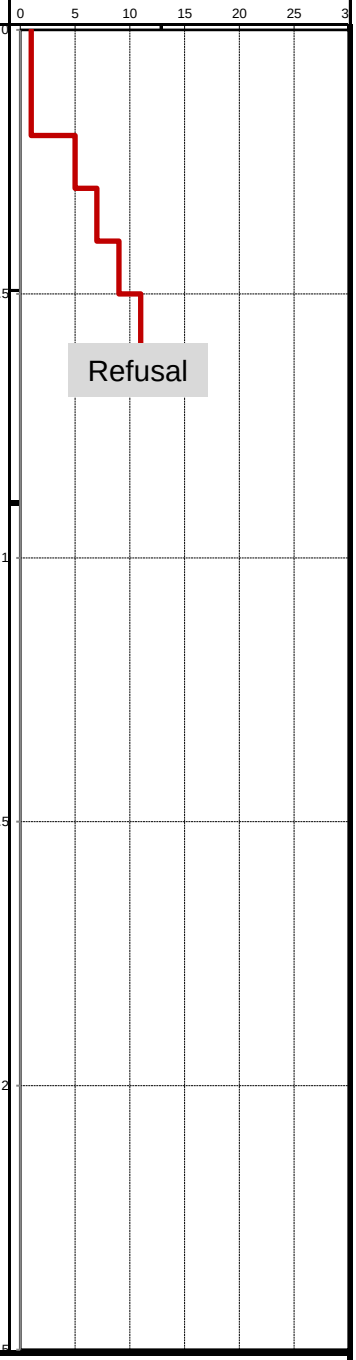
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**11**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 742** **Easting: 419 488**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, grey, slightly moist, dense, silt fines	
0.5						SM	**SILTY SAND-** fine grained, brown, slightly moist, dense, silt fines, with coffee rock	
0.8							**Terminated at a depth of 0.8 m due to hand auger refusal on coffee rock**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
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12/8 Production Road, Canning Vale WA 6155
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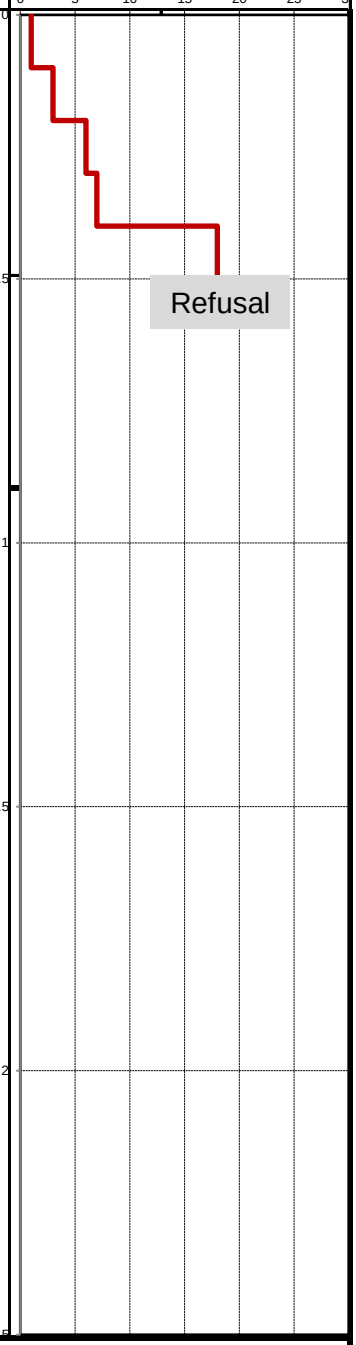
Reference	: **LG0862020GI**	Test Pit/BH No.:	**12**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 769** **Easting: 419 484**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, grey, slightly moist, dense, silt fines	
0.3						SM	**SILTY SAND-** fine grained, brown, slightly moist, dense, silt fines, with coffee rock	
0.5							**Terminated at a depth of 0.5 m due to auger refusal on coffee rock**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
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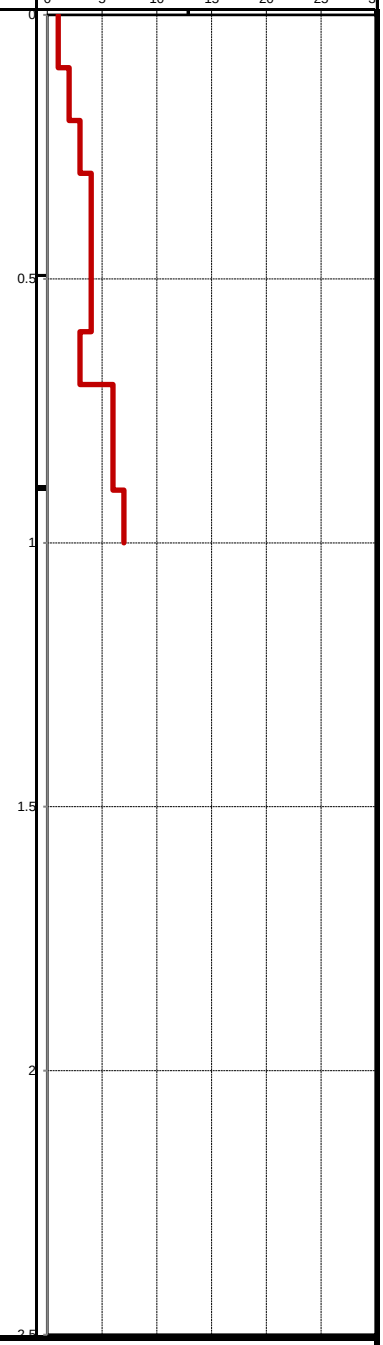
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**13**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 748** **Easting: 419 457**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, medium dense, silt fines	
0.5						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, dense, silt fines, trace sub rounded gravel up to 25 mm in size	
0.8								
1.0								
1.5								
1.6							**Terminated at a depth of 1.6 m due to hand auger refusal on gravel**	
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
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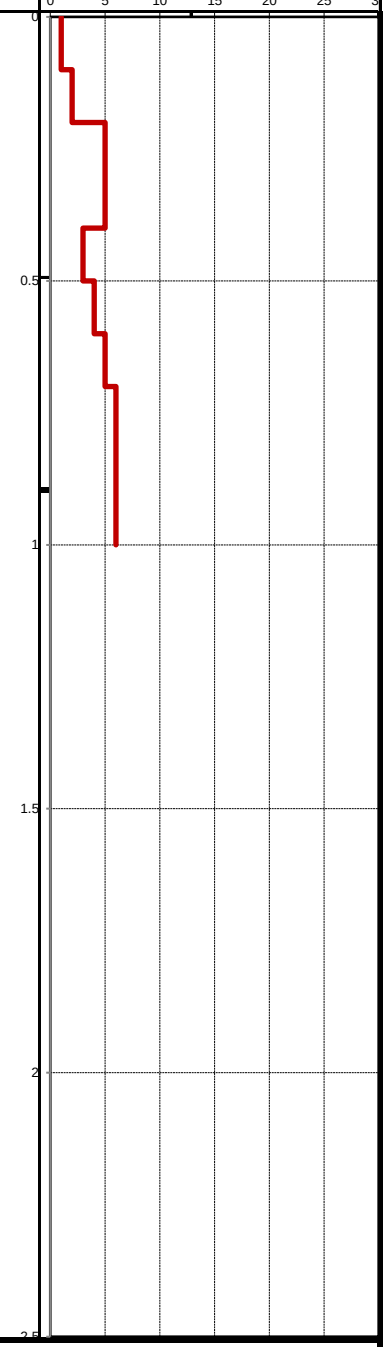
Reference	: **LG0862020GI**	Test Pit/BH No.:	**14**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 764** **Easting: 419 444**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, medium dense, silt fines	
0.5						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, dense, silt fines, trace sub rounded gravel up to 25 mm in size	
0.8								
1.0								
1.5								
1.6							**Terminated at a depth of 1.6 m due to hand auger refusal on gravel**	
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
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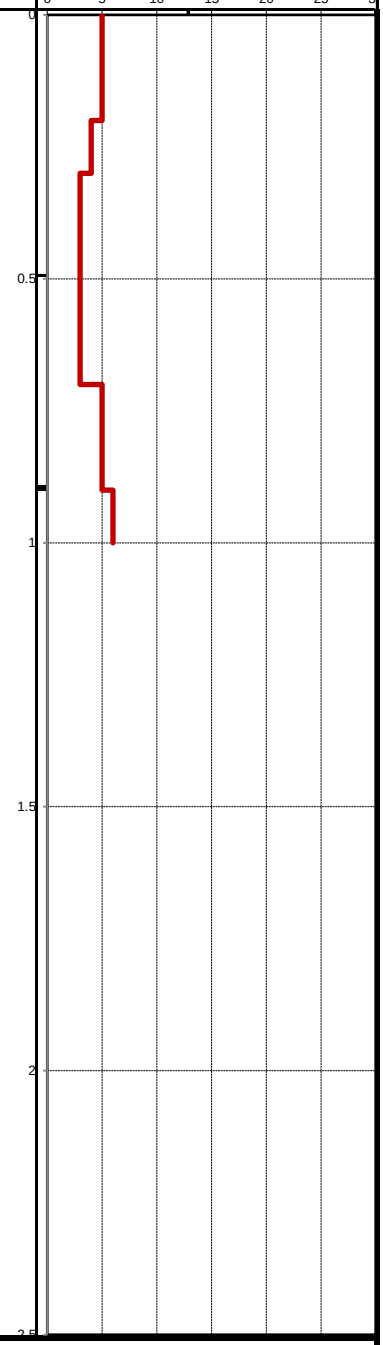
Reference	: **LG0862020GI**	Test Pit/BH No.:	**15**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 746** **Easting: 419 536**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, dense, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light brown, slightly moist, medium dense, silt fines	
0.5								
0.6						SM	**SILTY SAND-** fine grained, yellow, slightly moist, medium dense, silt fines	
0.8						SM	**SILTY SAND-** fine grained, yellow, slightly moist, dense, silt fines, trace sub rounded gravel up to 25 mm in size	
1.0							**Terminated at a depth of 1.0 m due to hand auger refusal on gravel**	
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
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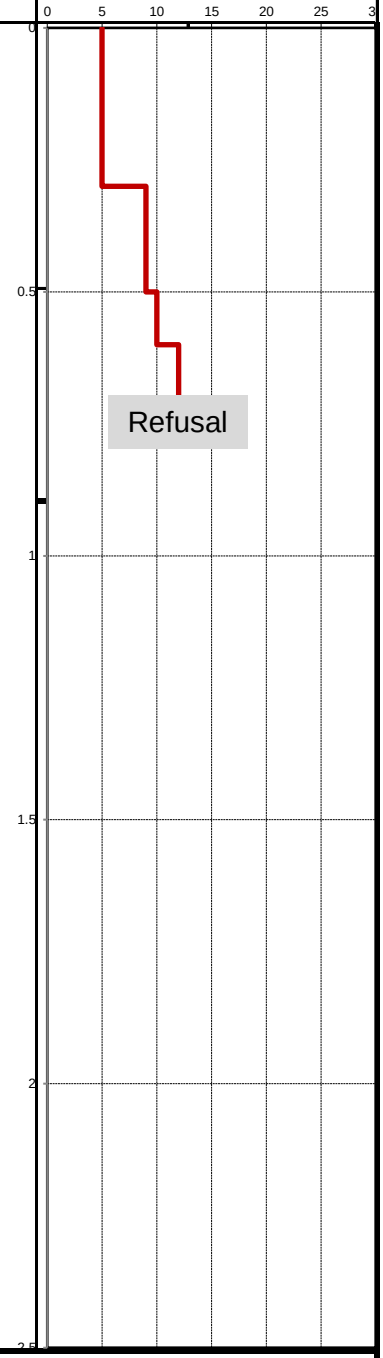
Reference	: **LG0862020GI**	Test Pit/BH No.:	**16**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 626** **Easting: 419 662**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, dense, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, dense, silt fines	
0.4						SC	**CLAYEY SAND-** fine grained, yellow, slightly moist, dense, low plasticity clay, trace sub rounded gravel up to 25 mm in size	
0.5								
0.8							**Terminated at a depth of 0.8 m due to hand auger refusal on gravel**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

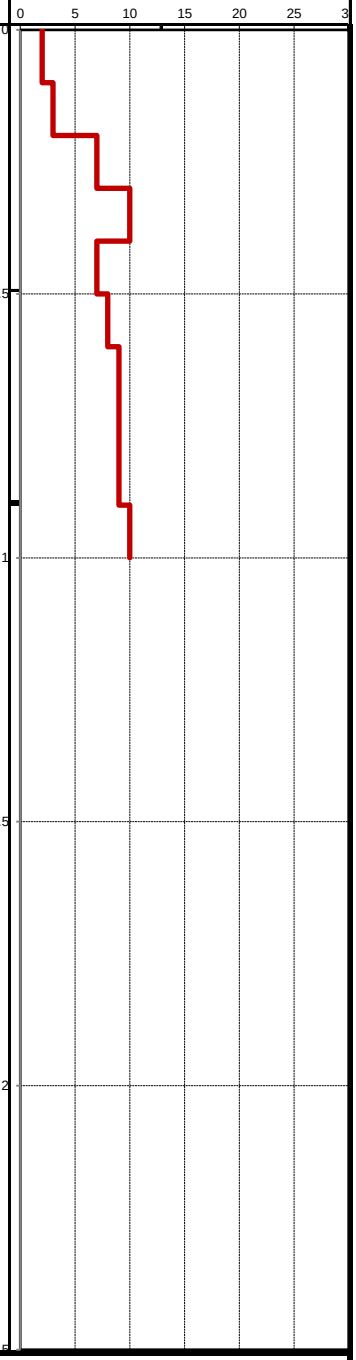
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**17**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 597** **Easting: 419 484**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light brown, slightly moist, medium dense, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light brown, slightly moist, dense, silt fines	
0.5								
0.8							**Terminated at a depth of 0.8 m due to hand auger refusal on gravel**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
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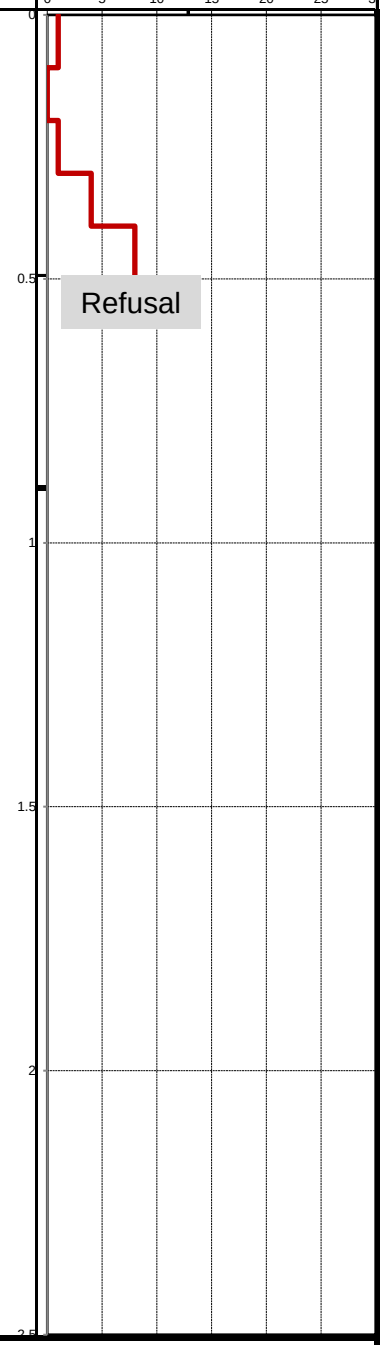
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**18**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 622** **Easting: 419 542**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light brown, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light brown, slightly moist, loose, silt fines	
0.4						SM	**SILTY SAND-** fine grained, light brown, slightly moist, dense, silt fines, with sub rounded gravel up to 25 mm in size	
0.5							**Terminated at a depth of 0.8 m due to hand auger refusal on gravel**	
0.6								
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
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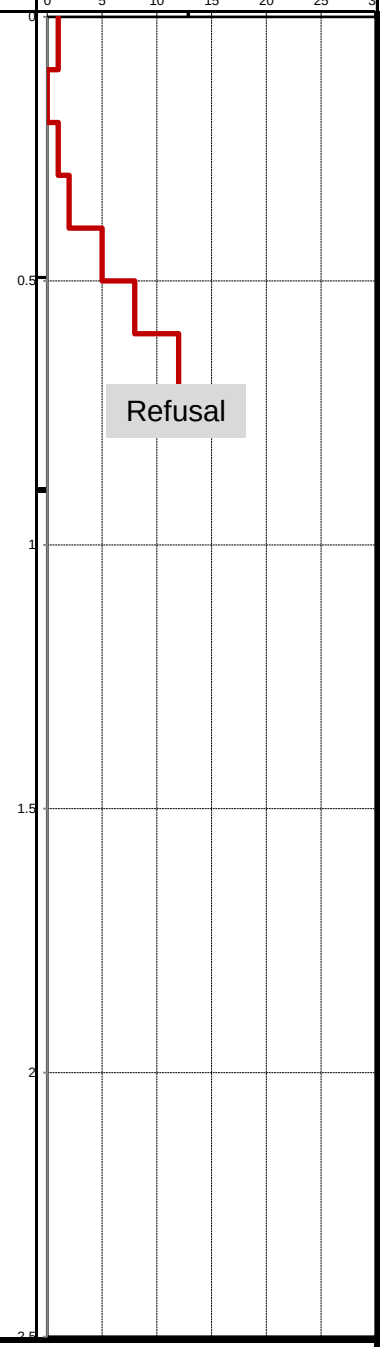
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**19**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 590** **Easting: 419 556**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light brown, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light brown, slightly moist, loose, silt fines	
0.4						SM	**SILTY SAND-** fine grained, light brown, slightly moist, dense, silt fines, with sub rounded gravel up to 25 mm in size	
0.5								
0.8							**Terminated at a depth of 0.8 m due to hand auger refusal on very dense layer**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

LOCAL GEOTECHNICS
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admin@localgeotechnics.com.au

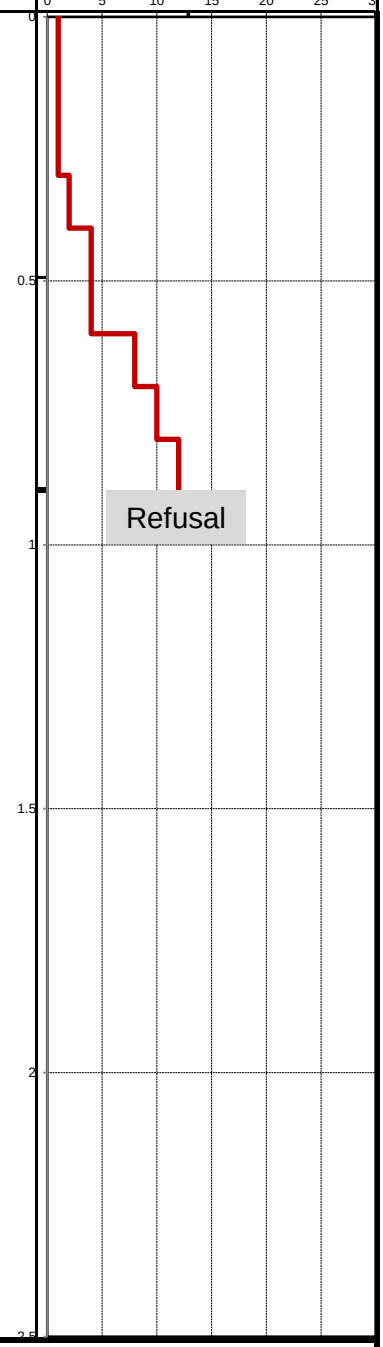
ENGINEERING LOG

RESULT OF TEST HOLES/PITS

Reference	: **LG0862020GI**	Test Pit/BH No.:	**20**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 575** **Easting: 419 579**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light brown, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, light grey, slightly moist, loose, silt fines	
0.4						SM	**SILTY SAND-** fine grained, light grey, slightly moist, dense, silt fines	
0.5								
0.8								
1.0							**Terminated at a depth of 1.0 m due to hand auger refusal on very dense layer**	
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

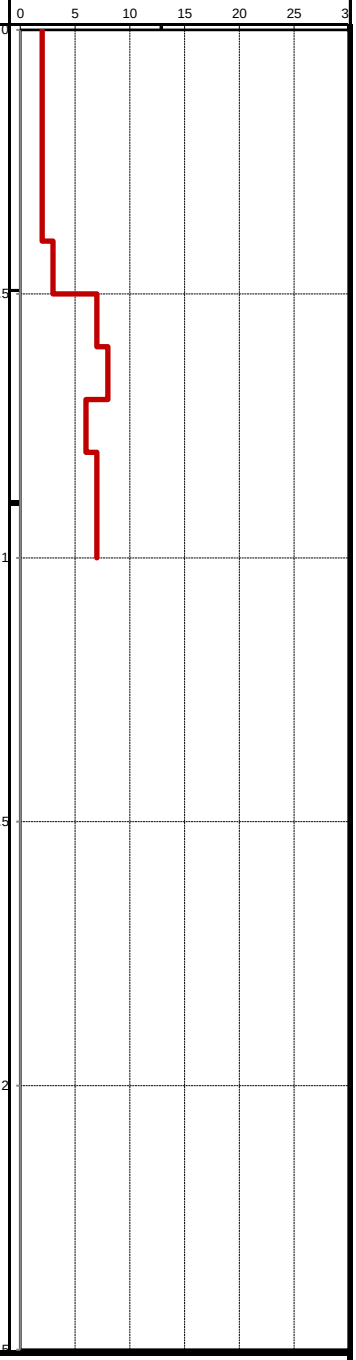
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**21**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 603** **Easting: 420 946**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, medium dense, silt fines	
0.2						SM	**SILTY SAND-** fine grained, yellow, slightly moist, medium dense, silt fines	
0.4						SM	**SILTY SAND-** fine grained, yellow, slightly moist, medium dense, silt fines, with sub rounded gravel up to 25 mm in size	
0.5								
0.9							**Terminated at a depth of 0.9 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
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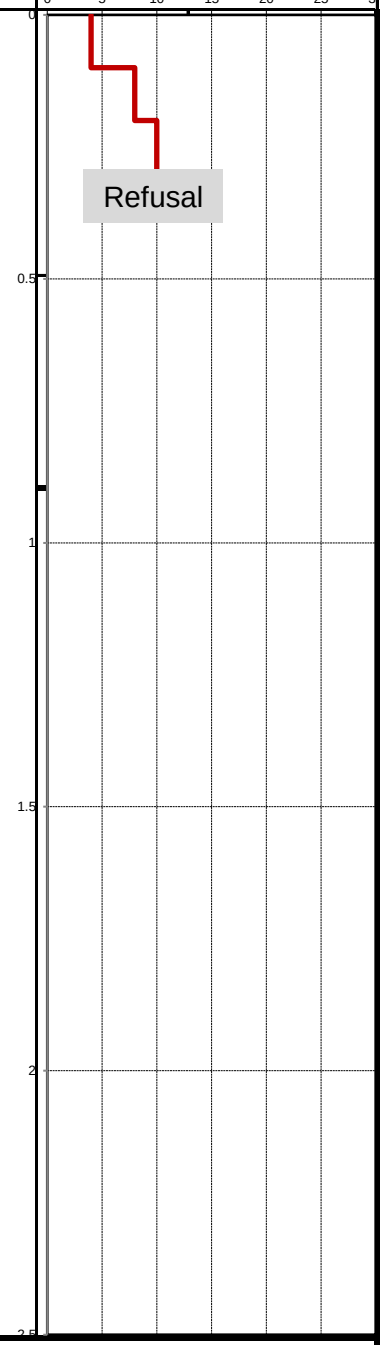
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**22**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 625** **Easting: 420 936**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, dense, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, yellow, slightly moist, dense, silt fines	
0.4						SM	**SILTY SAND-** fine grained, light yellow, slightly moist, dense, silt fines, with sub rounded gravel up to 15 mm in size	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on gravel**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

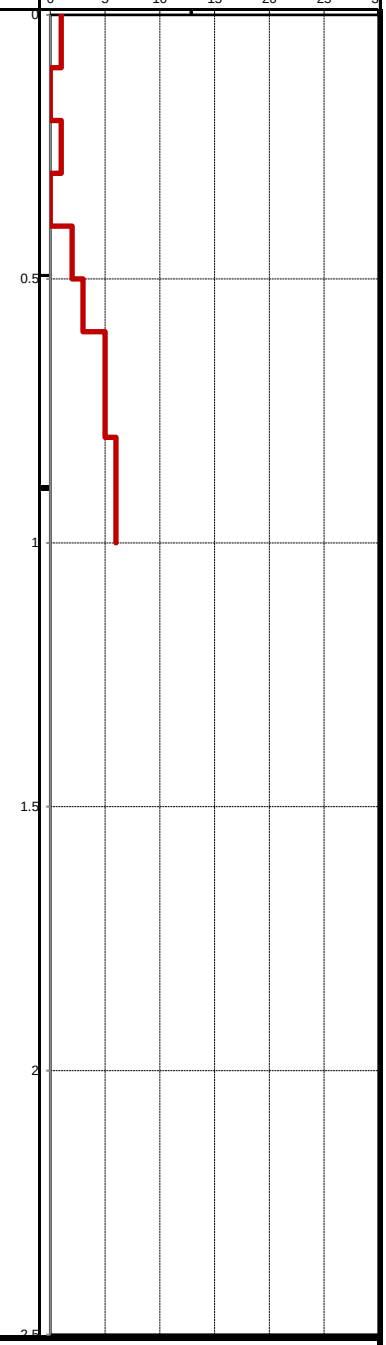
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**23**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 603** **Easting: 420 946**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, yellow, slightly moist, loose, silt fines, trace sub rounded gravel up to 15 mm in size	
0.5								
0.6						SM	**SILTY SAND-** fine grained, yellow, slightly moist, dense, silt fines, trace sub rounded gravel up to 15 mm in size	
1.0								
1.5								
2.0								
2.5							**Terminated at a target depth of 2.5 m**	

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

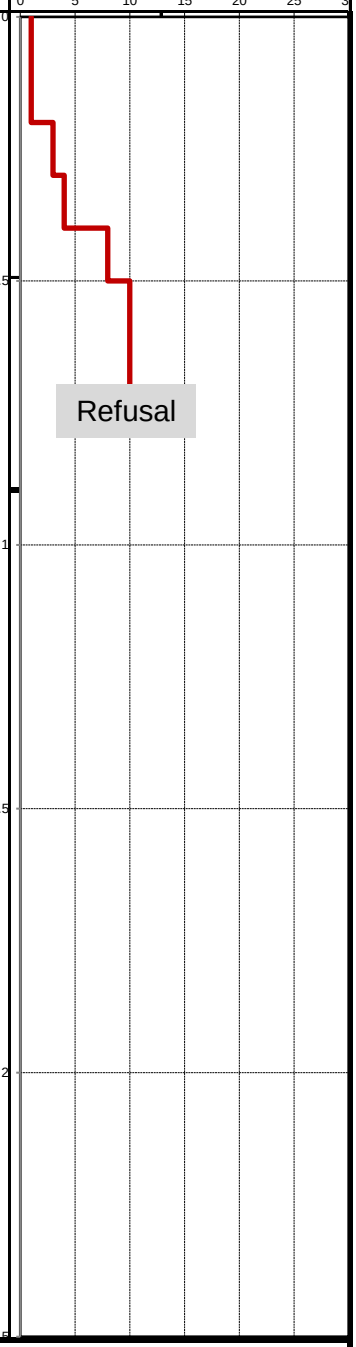
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**24**
Client	: **Shire of Collie**	Date Excavated:	**6-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**6-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 605** **Easting: 420 866**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, light grey, slightly moist, loose, silt fines, with organics	
0.2						SM	**SILTY SAND-** fine grained, grey, slightly moist, medium dense, silt fines	
0.4						SM	**GRAVELLY SILTY SAND-** fine grained, yellow, slightly moist, dense, silt fines, sub rounded gravel up to 15 mm in size	
0.5								
1.0								
1.2							**Terminated at a depth of 1.2 m due to hand auger refusal on gravel**	
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

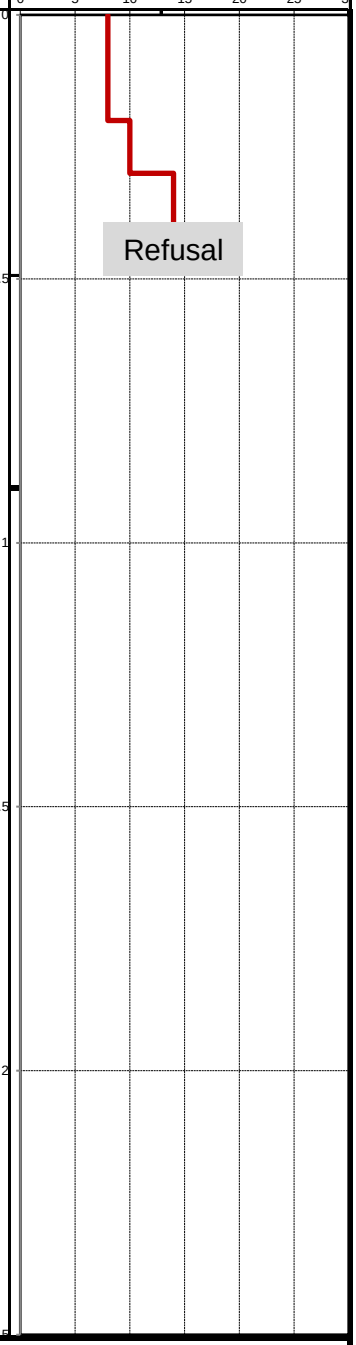
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**25**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 747** **Easting: 420 643**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**FILL, SILTY GRAVELLY SAND-** fine grained, brown, dry, dense, sub rounded gravel up to 20 mm in size, silt fines	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

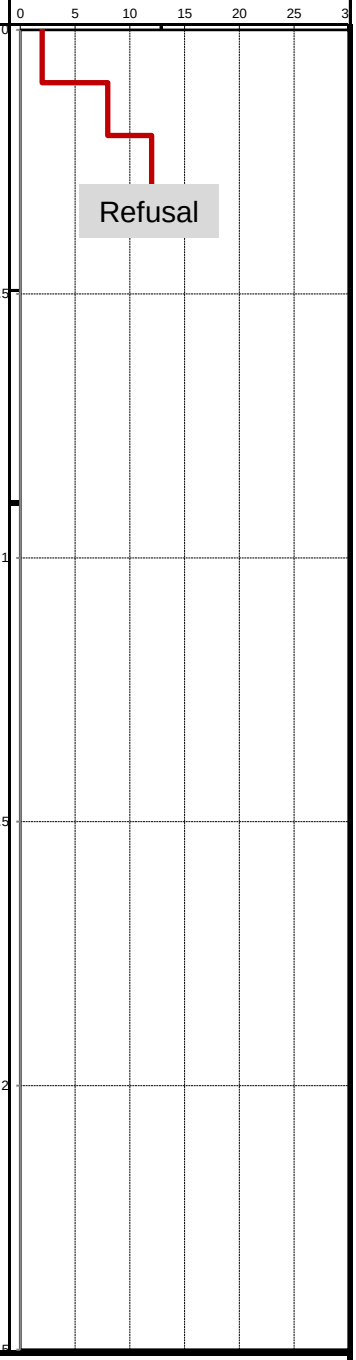
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**26**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 704** **Easting: 420 684**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, dark brown, dry, medium dense, silt fines, with organics	
0.1						SM	**SILTY GRAVELLY SAND-** fine grained, brown, dry, dense, sub angular cobbles up to 70 mm in size, silt fines	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

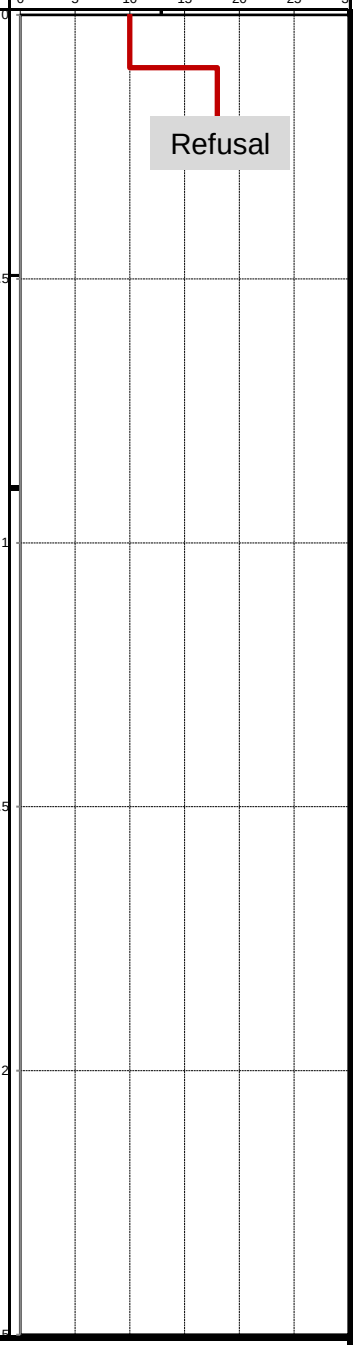
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**27**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 705** **Easting: 420 733**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, dark brown, dry, dense, silt fines, with organics	
0.1						SM	**SILTY GRAVELLY SAND-** fine grained, brown, dry, dense, sub angular cobbles up to 70 mm in size, silt fines	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

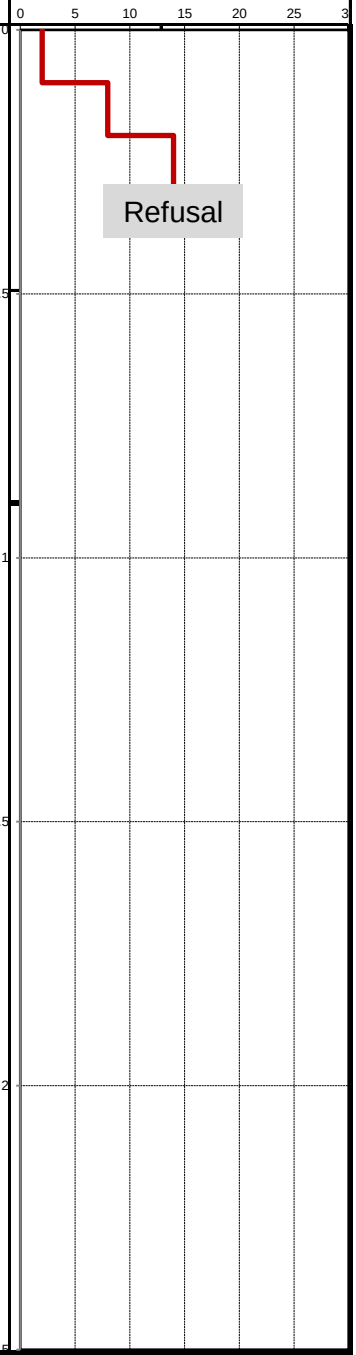
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**28**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 683** **Easting: 420 769**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, dark brown, dry, medium dense, silt fines, with organics	
0.1						SM	**SILTY GRAVELLY SAND-** fine grained, brown, dry, dense, sub angular cobbles up to 70 mm in size, silt fines	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

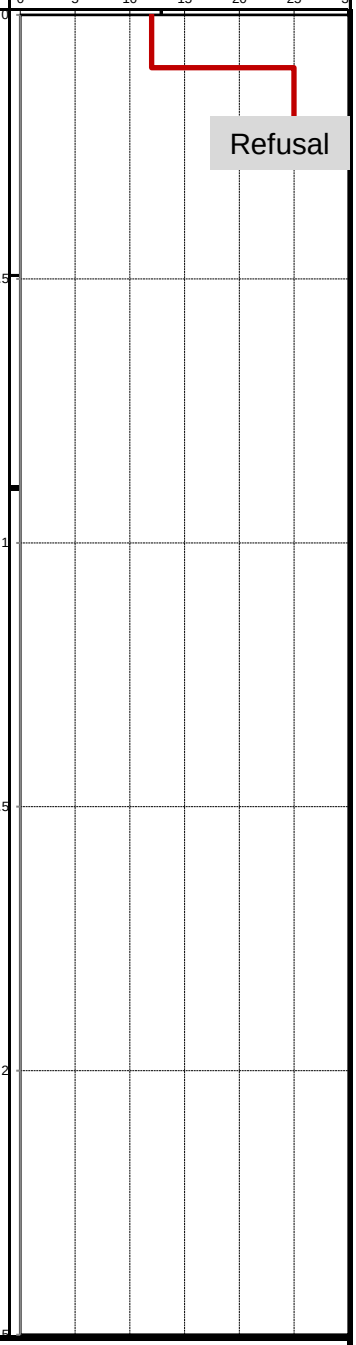
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**29**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 676** **Easting: 420 810**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, dark brown, dry, dense, silt fines, with organics	
0.1						SM	**SILTY GRAVELLY SAND-** fine grained, brown, dry, dense, sub angular cobbles up to 70 mm in size, silt fines	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

ENGINEERING LOG

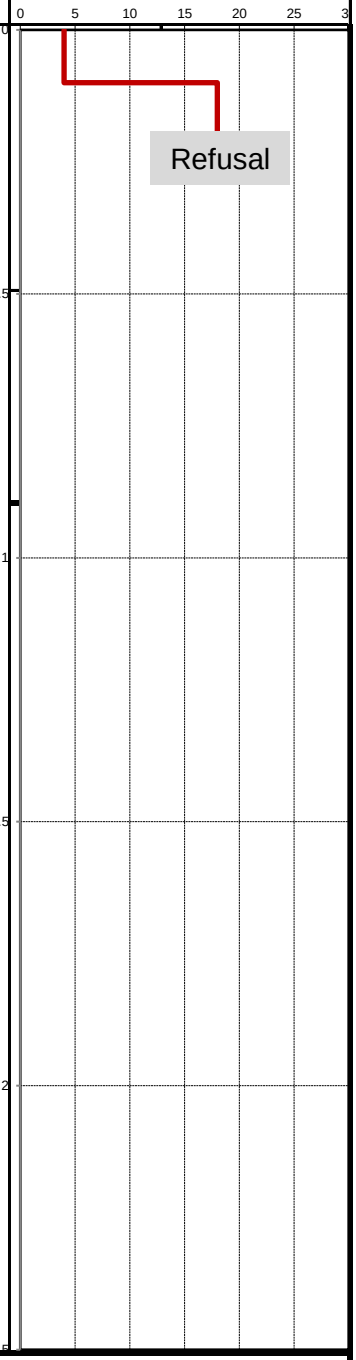
RESULT OF TEST HOLES/PITS

LOCAL GEOTECHNICS
ABN:61 737 984 867
12/8 Production Road, Canning Vale WA 6155
PO Box 5050 Canning Vale South WA 6155
admin@localgeotechnics.com.au

Reference	: **LG0862020GI**	Test Pit/BH No.:	**30**
Client	: **Shire of Collie**	Date Excavated:	**8-Apr-2020**
Project	: **Geotechnical Investigation**	Date completed:	**8-Apr-2020**
Location	: **Minninup Pool Tourism Project, Collie WA**	Equipment Type:	**Hand Auger**
GPS Zone 50	: **Northing: 6 306 630** **Easting: 420 798**	Water Table:	**Not Encountered**

Depth (m)	RL (m)	Method	Penetration resistance	Sampling Type	Graphic Log	Classification Symbol	Description of Soil Strata	Additional observations
0.0						SM	**TOPSOIL, SILTY SAND-** fine grained, dark brown, dry, dense, silt fines, with organics	
0.1						SM	**SILTY GRAVELLY SAND-** fine grained, brown, dry, dense, sub angular cobbles up to 70 mm in size, silt fines	
0.5							**Terminated at a depth of 0.5 m due to hand auger refusal on boulder**	
1.0								
1.5								
2.0								
2.5								

Dynamic Cone Penetrometer Test (Blows/100mm)



Notes:

Sampling Type :
B - Bulk/Disturbed Sample,
UD - Undisturbed Sample

Method:
HA - Hand Auger
E - Excavator
BH - Backhoe Bucket

Moisture:
D - Dry
M - Moist
W - Wet

Logged : AB
Checked: AR

LOCAL GEOTECHNICS

ABN: 61 737 984 867
PO Box 5050
Canning Vale South, WA 6155

DYNAMIC CONE PENETROMETER (DCP) TEST CERTIFICATES

(AS 1289.6.3.2)

Density Correlation - Table 6.4.6.1 (A) & (B) HB 160-2006

Reference	**LG0862020GI**	Test ID	**01 to 10**
Client	**Shire of Collie**	Date Tested	**06-08/04/2020**
Project	**Geotechnical Investigation**	Tested by	**AB**
Site	**Minninup Pool Tourism Project, Collie WA**	Checked by	**AR**

DCP No.	DCP 01		DCP 02		DCP 03		DCP 04		DCP 05	
Depth below ground level (mm)	**Penetration Resistance / Density Classification - Blows/100mm**									
0 – 100	3	MD	5	D	5	D	2	MD	1	L
100 – 200	4	D	5	D	7	D	3	MD	3	MD
200 – 300	3	MD	7	D	10	VD	2	MD	5	D
300 – 400	4	D	5	D	11	VD	2	MD	6	D
400 – 500	5	D	4	D	11	VD	2	MD	8	D
500 – 600	3	MD	4	D	12	VD	1	L	14	VD
600 – 700	20	VD	5	D	12	VD	4	D	10	VD
700 – 800	R	R	8	D	R	R	5	D	7	D
800 – 900			7	D			7	D	7	D
900 – 1000			9	VD			17	VD	8	D

DCP No.	DCP 06		DCP 07		DCP 08		DCP 09		DCP 10	
Depth below ground level (mm)	**Penetration Resistance / Density Classification - Blows/100mm**									
0 – 100	2	MD	5	D	1	L	1	L	2	MD
100 – 200	3	MD	5	D	1	L	3	MD	3	MD
200 – 300	5	D	3	MD	2	MD	4	D	6	D
300 – 400	5	D	4	D	1	L	6	D	7	D
400 – 500	6	D	4	D	2	MD	6	D	8	D
500 – 600	R	R	5	D	3	MD	4	D	14	VD
600 – 700			5	D	3	MD	3	MD	R	R
700 – 800			5	D	3	MD	4	D		
800 – 900			5	D	5	D	4	D		
900 – 1000			6	D	7	D	4	D		

VS=Very **S**oft **to S**oft	**F=F**irm	**St=St**iff	**VSt=V**ery **S**tiff	**H=H**ard
< 1	1 - 2	3 - 4	5 - 10	**> 10**

VL=Very **L**oose	**L=L**oose	**MD=M**edium **D**ense	**D=D**ense	**VD=V**ery **D**ense
< 1	1 - 2	2 - 3	4 - 8	> 8

LOCAL GEOTECHNICS

ABN: 61 737 984 867
PO Box 5050
Canning Vale South, WA 6155

DYNAMIC CONE PENETROMETER (DCP) TEST CERTIFICATES

(AS 1289.6.3.2)

Density Correlation - Table 6.4.6.1 (A) & (B) HB 160-2006

Reference	**LG0862020GI**	Test ID	**11 to 20**
Client	**Shire of Collie**	Date Tested	**06-08/04/2020**
Project	**Geotechnical Investigation**	Tested by	**AB**
Site	**Minninup Pool Tourism Project, Collie WA**	Checked by	**AR**

DCP No.	DCP 11		DCP 12		DCP 13		DCP 14		DCP 15	
Depth below ground level (mm)	**Penetration Resistance / Density Classification - Blows/100mm**									
0 – 100	1	L	1	L	1	L	1	L	5	D
100 – 200	1	L	3	MD	2	MD	2	MD	5	D
200 – 300	5	D	6	D	3	MD	5	D	4	D
300 – 400	7	D	7	D	4	D	5	D	3	MD
400 – 500	9	VD	18	VD	4	D	3	MD	3	MD
500 – 600	11	VD	R	R	4	D	4	D	3	MD
600 – 700	R	R			3	MD	5	D	3	MD
700 – 800					6	D	6	D	5	D
800 – 900					6	D	6	D	5	D
900 – 1000					7	D	6	D	6	D

DCP No.	DCP 16		DCP 17		DCP 18		DCP 19		DCP 20	
Depth below ground level (mm)	**Penetration Resistance / Density Classification - Blows/100mm**									
0 – 100	5	D	2	MD	1	L	1	L	1	L
100 – 200	5	D	3	MD	<1	VL	<1	VL	1	L
200 – 300	5	D	7	D	1	L	1	L	1	L
300 – 400	9	VD	10	VD	4	D	2	MD	2	MD
400 – 500	9	VD	7	D	8	D	5	D	4	D
500 – 600	10	VD	8	D	R	R	8	D	4	D
600 – 700	12	VD	9	VD			12	VD	8	D
700 – 800	R	R	9	VD			R	R	10	VD
800 – 900			9	VD					12	VD
900 – 1000			10	VD					R	R

VS=Very Soft to Soft	**F=Firm**	**St=Stiff**	**VSt=Very Stiff**	**H=Hard**
< 1	1 - 2	3 - 4	5 - 10	**> 10**

VL=Very Loose	**L=Loose**	**MD=Medium Dense**	**D=Dense**	**VD=Very Dense**
< 1	1 - 2	2 - 3	4 - 8	> 8

LOCAL GEOTECHNICS

ABN: 61 737 984 867
PO Box 5050
Canning Vale South, WA 6155

DYNAMIC CONE PENETROMETER (DCP) TEST CERTIFICATES

(AS 1289.6.3.2)

Density Correlation - Table 6.4.6.1 (A) & (B) HB 160-2006

Reference	**LG0862020GI**	Test ID	**21 to 30**
Client	**Shire of Collie**	Date Tested	**06-08/04/2020**
Project	**Geotechnical Investigation**	Tested by	**AB**
Site	**Minninup Pool Tourism Project, Collie WA**	Checked by	**AR**

DCP No.	DCP 21		DCP 22		DCP 23		DCP 24		DCP 25	
Depth below ground level (mm)	**Penetration Resistance / Density Classification - Blows/100mm**									
0 – 100	2	MD	4	D	1	L	1	L	8	D
100 – 200	2	MD	8	D	<1	VL	1	L	8	D
200 – 300	2	MD	10	VD	1	L	3	MD	10	VD
300 – 400	2	MD	R	R	<1	VL	4	D	14	VD
400 – 500	3	MD			2	MD	8	D	R	R
500 – 600	7	D			3	MD	10	VD		
600 – 700	8	D			5	D	10	VD		
700 – 800	6	D			5	D	R	R		
800 – 900	7	D			6	D				
900 – 1000	7	D			6	D				

DCP No.	DCP 26		DCP 27		DCP 28		DCP 29		DCP 30	
Depth below ground level (mm)	**Penetration Resistance / Density Classification - Blows/100mm**									
0 – 100	2	MD	10	VD	2	MD	12	VD	4	D
100 – 200	8	D	18	VD	8	D	25	VD	18	VD
200 – 300	12	VD	R	R	14	VD	R	R	R	R
300 – 400	R	R			R	R				
400 – 500										
500 – 600										
600 – 700										
700 – 800										
800 – 900										
900 – 1000										

VS=Very Soft to Soft	**F=Firm**	**St=Stiff**	**VSt=Very Stiff**	**H=Hard**
< 1	1 - 2	3 - 4	5 - 10	**> 10**

VL=Very Loose	**L=Loose**	**MD=Medium Dense**	**D=Dense**	**VD=Very Dense**
< 1	1 - 2	2 - 3	4 - 8	> 8

APPENDIX C

LABORAOTRY TEST CERTIFICATES

LOCAL GEOTECHNICS

TEST CERTIFICATE

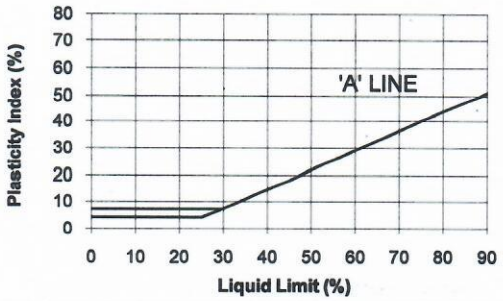
CLIENT	: Local Geotechnics	K&A JOB NO :	191 / 185 / 20
PROJECT	: Geotechnical Investigation	SAMPLE No :	NB48627
LOCATION	: Minninup Pool Tourism - WA	TEST DATE :	14/04/2020
SAMPLE ID	: TH : 2	LG Ref No :	LG0862020GI
DEPTH(m)	: (0.6 - 1.2)		

TEST DATA

ATTERBERG LIMITS		TEST METHODS
LIQUID LIMIT(%)	24	AS 1289 3.1.2
PLASTIC LIMIT(%)	17	AS 1289 3.2.1
PLASTICITY INDEX	7	AS 1289 3.3.1
LINEAR SHRINKAGE(%)	3.0	AS 1289 3.4.1

TESTING INFORMATION	
ATTERBERG LIMITS:	
SAMPLE HISTORY:	Oven Dried
METHOD OF PREPARATION	Dry Sieved
LINEAR SHRINKAGE :	
SIZE OF MOULD (mm)	250
CRUMBLING OR CURLING	Cracking

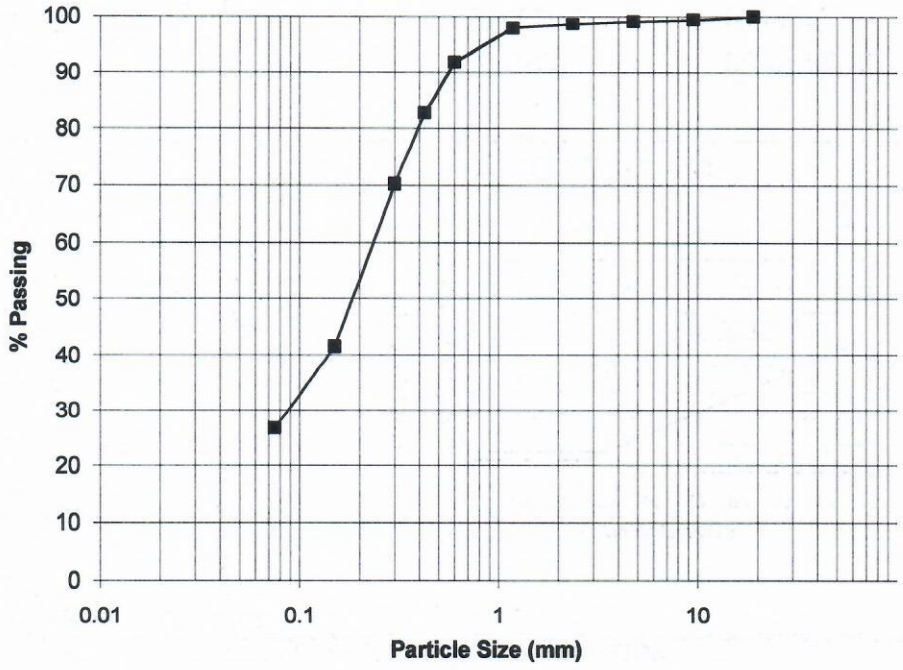
PLASTICITY CHART



AS 1289 3.6.1
PARTICLE SIZE DISTRIBN.

SIEVE SIZE	%PASSING
100.0mm	
75.0mm	
53.0mm	
37.5mm	
26.5mm	
19.0mm	100
9.50mm	99
4.75mm	99
2.36mm	99
1.18mm	98
0.600mm	92
0.425mm	83
0.300mm	70
0.150mm	42
0.075mm	27

AS 1289 3.6.1 - PARTICLE SIZE DISTRIBUTION



Note: Sample spplied by client. Results apply to the sample as received.

DATE: 16/04/2020

APPROVED SIGNATORY: M.Murugesan

M.Murugesan

NATA
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PARTICLE SIZE DISTRIBUTION - TEST CERTIFICATE

CERTIFICATE No: N44357

Kanga & Associates

42Lionel Street, Naval Base-WA 6165

ACCREDITATION No. 2337

TEST CERTIFICATE

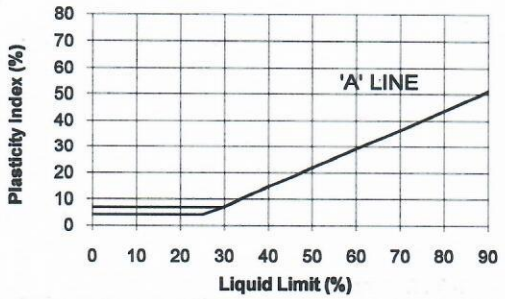
CLIENT	: Local Geotechnics	K&A JOB NO :	191 / 185 / 20
PROJECT	: Geotechnical Investigation	SAMPLE No :	NB48628
LOCATION	: Minninup Pool Tourism - WA	TEST DATE :	14/04/2020
SAMPLE ID	: TH : 16	LG Ref No :	LG0862020GI
DEPTH(m)	: (0.4 - 0.8)		

TEST DATA

ATTERBERG LIMITS		TEST METHODS
LIQUID LIMIT(%)	24	AS 1289 3.1.2
PLASTIC LIMIT(%)	18	AS 1289 3.2.1
PLASTICITY INDEX	6	AS 1289 3.3.1
LINEAR SHRINKAGE(%)	3.0	AS 1289 3.4.1

TESTING INFORMATION	
ATTERBERG LIMITS:	
SAMPLE HISTORY:	Oven Dried
METHOD OF PREPARATION	Dry Sieved
LINEAR SHRINKAGE :	
SIZE OF MOULD (mm)	250
CRUMBLING OR CURLING	Cracking

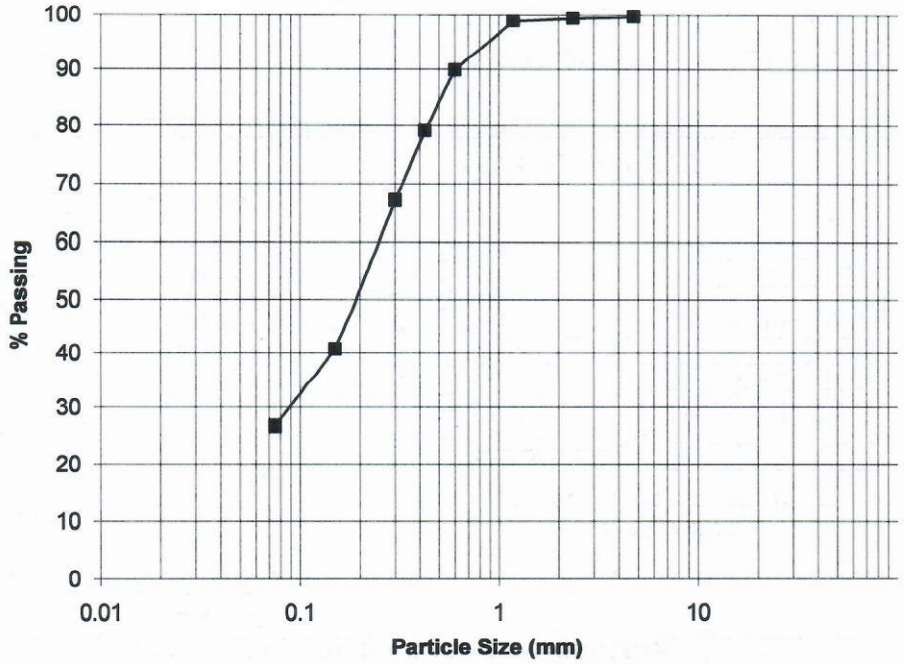
PLASTICITY CHART



AS 1289 3.6.1
PARTICLE SIZE DISTRIBN.

SIEVE SIZE	%PASSING
100.0mm	
75.0mm	
53.0mm	
37.5mm	
26.5mm	
19.0mm	
9.50mm	
4.75mm	100
2.36mm	99
1.18mm	99
0.600mm	90
0.425mm	79
0.300mm	67
0.150mm	41
0.075mm	27

AS 1289 3.6.1 - PARTICLE SIZE DISTRIBUTION



Note: Sample spplied by client. Results apply to the sample as received.

DATE: 16/04/2020

APPROVED SIGNATORY: M.Murugesan

M.Murugesan

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PARTICLE SIZE DISTRIBUTION - TEST CERTIFICATE

CERTIFICATE No: N44358

Kanga & Associates

42Lionel Street, Naval Base-WA 6165

ACCREDITATION No. 2337

TEST CERTIFICATE

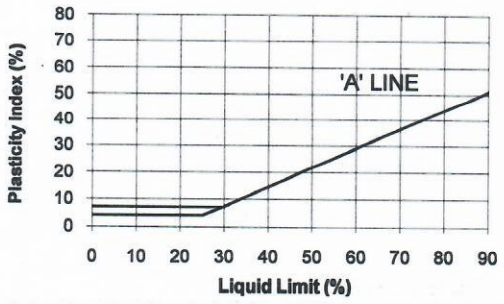
CLIENT	: Local Geotechnics	K&A JOB NO :	191 / 185 / 20
PROJECT	: Geotechnical Investigation	SAMPLE No :	NB48629
LOCATION	: Minninup Pool Tourism - WA	TEST DATE :	14/04/2020
SAMPLE ID	: TH : 21	LG Ref No :	LG0862020GI
DEPTH(m)	: (0.2 - 0.8)		

TEST DATA

ATTERBERG LIMITS		TEST METHODS
LIQUID LIMIT(%)	Not Obtainable	AS 1289 3.1.2
PLASTIC LIMIT(%)	Not Obtainable	AS 1289 3.2.1
PLASTICITY INDEX	Non Plastic	AS 1289 3.3.1
LINEAR SHRINKAGE(%)	Not Obtainable	AS 1289 3.4.1

TESTING INFORMATION	
ATTERBERG LIMITS:	
SAMPLE HISTORY:	Oven Dried
METHOD OF PREPARATION	Dry Sieved
LINEAR SHRINKAGE :	
SIZE OF MOULD (mm)	N/A
CRUMBLING OR CURLING	N/A

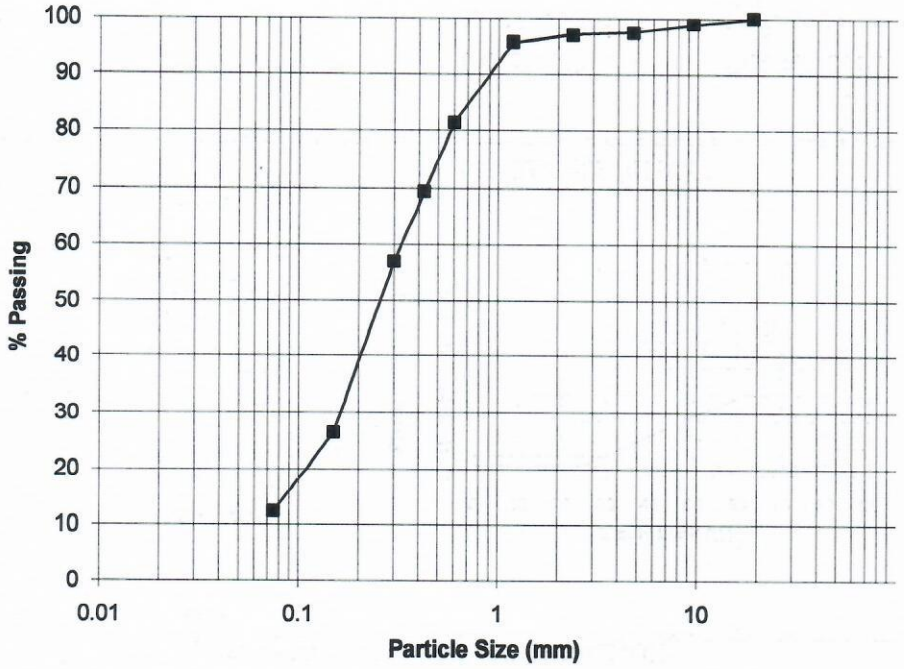
PLASTICITY CHART



AS 1289 3.6.1
PARTICLE SIZE DISTRIBN.

SIEVE SIZE	%PASSING
100.0mm	
75.0mm	
53.0mm	
37.5mm	
26.5mm	
19.0mm	100
9.50mm	99
4.75mm	97
2.36mm	97
1.18mm	96
0.600mm	81
0.425mm	69
0.300mm	57
0.150mm	26
0.075mm	12

AS 1289 3.6.1 - PARTICLE SIZE DISTRIBUTION



Note: Sample spplied by client. Results apply to the sample as received.

DATE: 16/04/2020

APPROVED SIGNATORY: M.Murugesan

M.Murugesan

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PARTICLE SIZE DISTRIBUTION - TEST CERTIFICATE

CERTIFICATE No: N44359

Kanga & Associates

42Lionel Street, Naval Base-WA 6165

ACCREDITATION No. 2337

TEST CERTIFICATE

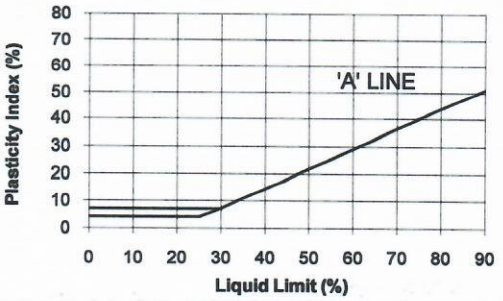
CLIENT	: Local Geotechnics	K&A JOB NO :	191 / 185 / 20
PROJECT	: Geotechnical Investigation	SAMPLE No :	NB48630
LOCATION	: Minninup Pool Tourism - WA	TEST DATE :	14/04/2020
SAMPLE ID	: TH : 30	LG Ref No :	LG0862020GI
DEPTH(m)	: (0.1 - 0.5)		

TEST DATA

ATTERBERG LIMITS		TEST METHODS
LIQUID LIMIT(%)	Not Obtainable	AS 1289 3.1.2
PLASTIC LIMIT(%)	Not Obtainable	AS 1289 3.2.1
PLASTICITY INDEX	Non Plastic	AS 1289 3.3.1
LINEAR SHRINKAGE(%)	Not Obtainable	AS 1289 3.4.1

TESTING INFORMATION	
ATTERBERG LIMITS:	
SAMPLE HISTORY:	Oven Dried
METHOD OF PREPARATION	Dry Sieved
LINEAR SHRINKAGE :	
SIZE OF MOULD (mm)	N/A
CRUMBLING OR CURLING	N/A

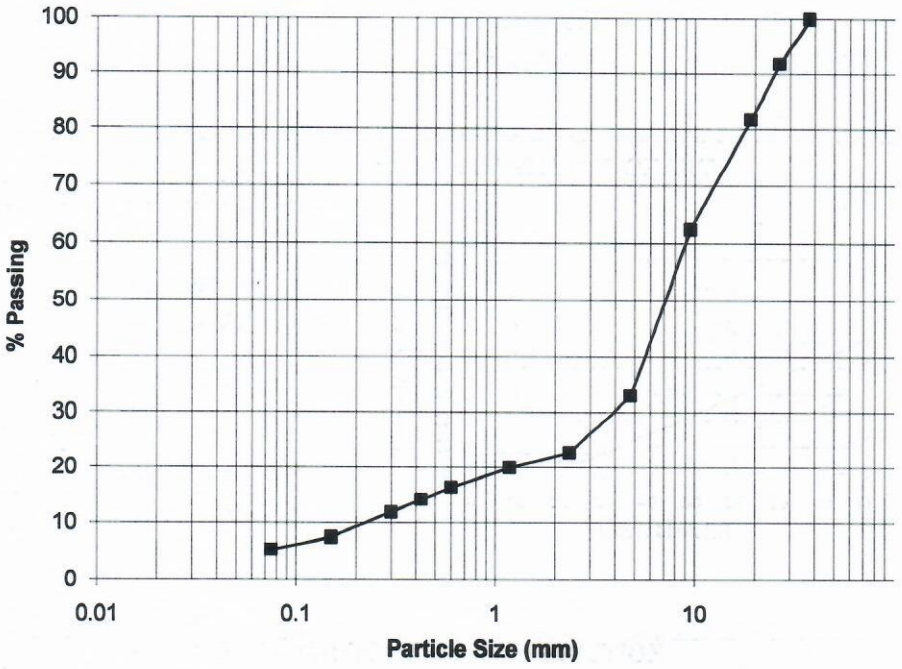
PLASTICITY CHART



AS 1289 3.6.1
PARTICLE SIZE DISTRIBN.

SIEVE SIZE	%PASSING
100.0mm	
75.0mm	
53.0mm	
37.5mm	100
26.5mm	92
19.0mm	82
9.50mm	63
4.75mm	33
2.36mm	23
1.18mm	20
0.600mm	16
0.425mm	14
0.300mm	12
0.150mm	8
0.075mm	5

AS 1289 3.6.1 - PARTICLE SIZE DISTRIBUTION



Note: Sample spplied by client. Results apply to the sample as received.

DATE: 16/04/2020

APPROVED SIGNATORY: M.Murugesan

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

'Accredited for compliance with ISO/IEC 17025'

PARTICLE SIZE DISTRIBUTION - TEST CERTIFICATE

CERTIFICATE No: N44360

Kanga & Associates

42Lionel Street, Naval Base-WA 6165

ACCREDITATION No. 2337

APPENDIX D

SITE PHOTOS

LOCAL GEOTECHNICS

Photo 1. Site, view from the proposed main entrance, facing east

Photo 2. Site, view from the adjoining road outside the proposed main entrance, facing north

Photo 3. Site, view from the south east side access road, facing north west

Photo 4. Site, view from the center, facing north east

Photo 5. Test Location 01 (TH01), Sub-surface probing by using a hand auger

Photo 6. Soil from Test Location 01 (TH01)

Photo 7. Test Location 02 (TH02), Sub-surface probing by using a hand auger

Photo 8. Test Location 03 (DCP03), Testing by a Dynamic Cone Penetrometer

Photo 9. Test Location 04 (TH04), Sub-surface probing by using a hand auger

Photo 10. Test Location 05 (TH05), Sub-surface probing by using a hand auger

Photo 11. Soil from Test Location 06 (TH06)

Photo 12. Test Location 07 (TH07), Sub-surface probing by using a hand auger

Photo 13. Test Location 08 (TH08), Sub-surface probing by using a hand auger

Photo 14. Test Location 09 (TH09), Sub-surface probing by using a hand auger

Photo 15. Test Location 10 (TH10), Sub-surface probing by using a hand auger

Photo 16. Soil from Test Location 11 (TH11)

Photo 17. Test Location 12 (TH12), Sub-surface probing by using a hand auger

Photo 18. Test Location 13 (TH13), Sub-surface probing by using a hand auger

Photo 19. Test Location 14 (DCP14), Testing by a Dynamic Cone Penetrometer

Photo 20. Test Location 15 (DCP15), Testing by a Dynamic Cone Penetrometer

Photo 21. Soil from Test Location 15 (TH15)

Photo 22. Test Location 16 (TH16), Sub-surface probing by using a hand auger

Photo 23. Soil from Test Location 16 (TH16)

Photo 24. Test Location 17 (TH17), Sub-surface probing by using a hand auger

Photo 25. Soil from Test Location 17 (TH17)

Photo 26. Test Location 18 (DCP18), Testing by a Dynamic Cone Penetrometer

Photo 27. Test Location 19 (DCP19), Testing by a Dynamic Cone Penetrometer

Photo 28. Soil from Test Location 20 (TH20)

Photo 29. Test Location 21 (TH21), Sub-surface probing by using a hand auger

Photo 30. Soil from Test Location 22 (TH22)

Photo 31. Test Location 23 (TH23), Sub-surface probing by using a hand auger

Photo 32. Soil from Test Location 24 (TH24)

Photo 33. Site, view from near TH25, facing north

Photo 34. Test Location 25 (DCP25), Testing by a Dynamic Cone Penetrometer

Photo 35. Test Location 26 (TH26), Sub-surface probing by using a hand auger

Photo 36. Test Location 27 (DCP27), Testing by a Dynamic Cone Penetrometer

Photo 37. Test Location 28 (TH28), Sub-surface probing by using a hand auger

Photo 38. Test Location 29 (DCP29), Testing by a Dynamic Cone Penetrometer

Photo 39. Site, view of main access road, facing south towards Test Location 30 (TH30)

Photo 40. Test Location 30 (TH30), Sub-surface probing by using a hand auger