Galt GEOTECHNICS

Report on:

SITE AND SOIL EVALUATION PROPOSED WORKERS CAMP DEVELOPMENT LOT 192 HYDEN MOUNT WALKER ROAD HYDEN, WA

WAE240126-01 002 R Rev0

Submitted to:

BBB Remote Site Services
55 to 58 Stebbing Road
MADDINGTON WA

5 February 2025

CONTENTS

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics' (Galt's) general site and soil evaluation (SSE) for the proposed accommodation development, at Lot 192 Hyden Mount Walker Road, Hyden WA ("the site", refer Figure 1).

This report is to be read in conjunction with the appended "Requirements and Limitations" found at the back of this report.

2. DEFINITIONS

Site and Soil Evaluation (SSE): an assessment of all relevant constraints and the risks to public health and the environment in accordance with AS1547-2012 "On-site domestic wastewater management". This SSE is a general assessment SSE, with the purpose being to undertake a site suitability assessment for onsite wastewater management and to recommend the type of onsite wastewater system for the proposed development.

A specific assessment is required to support an "application to install" an onsite wastewater system. This is for when a particular type of system/model is proposed, and a detailed design, including management recommendations and operation requirements. This document is not a specific assessment.

Land Application Area (LAA): The unencumbered plan area to which treated sewage from an on-site sewage system is distributed for further in-soil treatment and absorption or evaporation. This area is restricted to the distribution of treated sewage and may not be developed for other purposes.

Land Application System (LAS): The system used to apply effluent from a wastewater treatment unit into or onto the soil for further in-soil treatment and absorption or evaporation.

Effluent: The liquid discharged from a wastewater treatment unit.

Primary Treatment: The separation of suspended material from sewage in septic tanks, primary settling chambers or other structures before discharge to either a LAS or secondary treatment process.

Secondary Treatment: Microbiological digestions and physical settling and filtering processes and decomposition of sewage constituents following primary treatment.

Sewage: Any kind of sewage, faecal matter or urine, and any waste composed wholly or in part of liquid.

Infiltrative Area: Is the area within an LAA that has treated effluent directly discharged onto, and does not include setback areas. I.e., the base of leach drains, evapotranspiration beds etc.

3. GOVERNING STANDARDS, REGULATIONS AND POLICIES

SSEs are governed by various National and State Standards, Regulations and Policies, including:

- AS/NZS 1547:2012, On-site domestic wastewater management.
- Western Australia Government Sewerage Policy (2019)
- Western Australia Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations (1974)
- Western Australia State Planning Policy 2.9, Water Resources (2005)

Other regulatory requirements may become relevant depending on the outcomes of any SSE.

SSEs can be rejected on the basis of not meeting the regulatory requirements of the above. This report is intended to address all these various requirements.

4. SITE DESCRIPTION

Table 1: Summary of Site

Item	Comment
Site Extent	Refer Figure 1
Site Area	About 4 Ha camp with 1.25 Ha spray field (refer Figure 1)
Current Site Surface Levels[1]	About RL 295 m AHD to RL 296 m AHD (about RL 295 m AHD in proposed spray field)
Current Land Use	Agricultural land, vegetated with trees and shrubs along field boundaries and adjacent tracks / roads.
Site History[2]	Site has been agricultural land since prior to 1999. Site is relatively unchanged since.

NOTES:
1. *Site levels based on information provided.*
2. *Site history based on aerial imagery (Landgate).*

5. PROPOSED DEVELOPMENT

Table 2: Summary of Proposed Development

Item	Comment
Proposed Development	189 room workers camp with associated access roads and services.
Proposed Cut/Fill	Typically less than ± 0.5 m
Assumed Foundation Type	Shallow footings
Assumed Retaining Walls	Possible some gravity walls up to about 1 m high.
Assumed Stormwater Disposal	Offsite via drainage swales.
Assumed Sewage Disposal	Treated effluent disposed of via 12,500 m^2 spray field (refer Figure 1)

6. HYDRAULIC LOADING

We have been provided with a hydraulic loading of **34,020 L/day** (180 L per person x 189 rooms), which is in accordance with Health Regulations 29. A larger hydraulic loading will be possible, subject to the LAA being appropriately sized in accordance with the loading rates discussed in this report.

We have assumed that any industrial liquid waste is to be disposed off site.

7. FIELDWORK

7.1. Summary

Fieldwork was carried out in the presence of a representative from Galt on 13 and 14 January 2025 as summarised below.

Table 3: Summary of Field Data

Type	Results Appendix	Summary	Equipment Used	No. Tests	Depth Range (m)
Site Plan	Figure 1	-	Hand held GPS[1]	-	-
Photographs	A	-	-	-	-
Test Pits (TP)	B	Section 10	Kobelco SK350 LC	9	2.50 to 3.20
Guelph Permeameter Tests (Perm)	C	Section 7.2	Guelph permeameter	9	0.37 to 0.45
Dynamic Cone Penetrometer (DCP)	D	N/A	Hand operated DCP	9	0.80 to 1.00

NOTES: *1. Hand held GPS is accurate to ±5 m.*

2. DCP Tests carried out adjacent to test pits.

7.2. Guelph Permeameter Test Results

Table 4: Guelph Permeameter Test Results

Test Location	Depth (m)	Minimum Hydraulic Conductivity k (m/day)	AS1547 (2012) Soil Category
Perm01[1]	0.39	**0.01[1]**	**6[1]**
Perm02[1]	0.44	**0.04[1]**	**6[1]**
Perm03[1]	0.37	**0.47[1]**	**4[1]**
Perm04[1]	0.45	**0.23[1]**	**4[1]**
Perm05[1]	0.38	**0.04[1]**	**6[1]**
Perm06	0.44	0.14	4
Perm07	0.45	0.05	6
Perm08	0.40	0.38	4
Perm09	0.44	0.17	4

NOTES: *Constant head Guelph Permeameter tests were carried out in hand-auger boreholes in accordance with Appendix G of AS1547 (2012) "On-site domestic wastewater management".* [1]Test locations within proposed dripper field.

8. LABORATORY TESTING

Laboratory test results are presented in Appendix E and summarised in Attached Tables 1 and 2.

9. SITE CONDITIONS

9.1. Geology

Table 5: Summary of Geology Mapping

Map Sheet	Map Scale	Mapped Soils	Site Findings
Hyden	1:250,000	**Within proposed dripper field:** Czg – remnant sandplain – yellow and white sand containing locally abundant limonite pebbles: derived from laterite.	Typically Surficial Topsoil over Clayey SAND, over Sandy CLAY

NOTE: Thin surficial topsoil layers generally present over the site.

9.2. Groundwater and Surface Water

Groundwater was encountered during our investigation at the locations summarised in Table 6. Water was observed in a turkeys nest about 700 m east of the site (refer Photograph 6, Appendix A) . Groundwater could perch on / near the ground surface during / following rain periods. The client has advised that groundwater is saline.

Table 6: Summary of Encountered Groundwater Depths on 13 and 14 January 2025

Test Pit	Depth to Groundwater (m)
TP01	2.5
TP02	2.7
TP03	2.9
TP04	2.8
TP05	2.3
TP06	2.3
TP07[1]	**2.9[1]**
TP08[1]	**2.9[1]**
TP09[1]	**2.3[1]**

NOTE: [1]Test locations within proposed dripper field.

10. GROUND MODEL

The encountered subsurface conditions **within the proposed dripper field only (TP07 to TP09)** can be summarised as comprising:

- **Surficial TOPSOIL** up to about 0.1 m thick; overlying
- **Clayey SAND / Sandy CLAY (SC/CI)**[1], fine to medium grained, sub-rounded to sub-angular, typically brown, with red mottle at depth, medium plasticity fines, trace gravel, ***Sandy CLAY in some zones,*** typically dense to very dense, typically extends to depths of about 1.0 m to 1.5 m; overlying
- **CLAY / Sandy CLAY (CI/CH**), medium to high plasticity, pale grey mottled red brown, sand is fine to medium grained, trace gravel, **generally stiff**, **clay is erodible at steeper slope angles**[2] **(refer Photographs 5 and 7, Appendix A),** extends beyond target depths of 2.5 m to 3.0 m.

Notes:

- [1] In TP08, layer of Clayey GRAVEL encountered from 0.5 m to 1.0 m depth.
- [2] Laboratory results indicate clay soils are somewhat erodible. Based on our site visit, slopes of no steeper than about 1V:10H show no significant signs of erosion. Slopes near the site over 10 years old at about 1V:1.5H and about 2 m to 3 m high (refer Photographs 5 and 7, Appendix A) show signs of rilling. Some maintenance of steeper slopes is anticipated (i.e. gravel erosion protection).

11. SITE ASSESSMENT

11.1. General

The results of our site assessment are presented in Attached Table 3.

11.2. Horizontal Setbacks

Table 7: Required Horizontal Setback Distances (AS1547)

Feature	Sub-Type	Horizontal Setback Distances (m)
Treatment tanks to buildings, property boundaries, driveways, paths and other tanks	-	1.2
Trenches, beds and soak wells to boundary, building, tanks and other land application systems	-	1.8
Trenches, beds and soak wells to trafficable areas	-	1.2
Any land application system to wells, streams, private bores or underground source of water intended for human consumption	-	30.0
Trenches, beds and soak wells to subsoil drains or open drainage channels	-	6.0
Spray irrigation	Boundaries, buildings, driveways etc.	1.8
	Subsoil and open drains	6.0
	Swimming pools	3.0
	Treatment tanks	1.2
Subsurface Drippers	Boundaries, buildings, driveways etc.	0.5
	Subsoil and open drains	3.0
	Swimming pools	2.0
	Garden bore	10.0
On-site waste system to water resources (river, stream etc.)	-	100.0

11.3. Land Application Areas

11.3.1. Government Sewerage Policy (GSP, 2019)

The minimum LAA size in accordance with the GSP (2019) has been calculated and is shown below. The GSP minimum sizing does not govern the required spray area in this instance, it is governed by the water balance. The LAA may need to be resized if the hydraulic loading changes.

Table 8: GSP LAA Calculation

Soil Category (AS1547)	Conversion Factor (Table 2 of GSP)	Hydraulic Loading (L/day, Section 6)	Minimum LAA (m^2)
6	0.5	34,020	17,010

11.3.2. Water Balance

Water balance calculations are presented in Appendix G.

The proposed dripper disposal field must have a greater infiltrative area than the minimum required to meet the infiltrative area requirements (in accordance with the WA Health Regulations Method). The dripper disposal field must be installed to meet the horizontal setback requirements outlined in Section 11.2. The LAA must be clearly shown on drawings including setbacks to meet the required area.

11.3.3. Summary

The minimum dripper disposal field infiltrative area for the proposed loading is 18,423 m^2, which governs the minimum LAA sizing in this instance. This may need to be resized if the hydraulic loading changes.

A detailed plan will be required with the application to install that shows that the required setbacks are met.

12. SOIL ASSESSMENT

Details of our soil assessment are presented in Attached Table 4.

13. SITE SUITABILITY AND RECOMMENDATIONS

Based on our assessment, the site is suitable for disposal of wastewater. Wastewater must have secondary treatment (i.e., an ATU). Although the WA Health Regulations method indicates a minimum LAA of 17,100 m^2 is required for wastewater disposal, based on the water balance calculation, a minimum wastewater disposal area of 18,423 m^2 is required (which will govern the LAA sizing), with the LAA appropriately set back from drains, driveways, site boundaries, buildings etc.. This will need to be resized if the hydraulic loading changes.

LAA Location and Setbacks

The proposed LAA is shown on Figure 1. This area will need to be increased to the area above, and will need to satisfy the setback requirements, including meeting the appropriate distances from site boundaries, buildings, trafficable areas and driveways etc…

Disposal Method

We recommend the use of a dripper disposal field for wastewater disposal.

Separation to Groundwater and LAA Surface Level

The base of the disposal area (i.e. ground surface onto which drippers will dispose effluent) must be minimum 0.6 m above maximum groundwater levels. Based on the measured groundwater levels during our investigation, the required minimum separation will be met.

Treatment Units

As per AS1547 for Category 6 soils, the wastewater shall be treated using an ATU (secondary treatment), also known as aerated wastewater treatment systems (AWTS). ATU's use the processes of aeration followed by clarification to achieve biological treatment of wastewater.

ATU's (or any other proposed system) must be certified to AS1546.3 (2008) and require approval by the Chief Health Officer. A list of approved ATU's is presented in Table 2 on the Department of Health website. The selected ATU must meet the hydraulic loading for the site and must treat sewage to achieve the following nutrient targets:

- Phosphorous: <1 mg/L
- Nitrogen: <10 mg/L

Soil Improvement

PRI testing indicates insitu soils have sufficient nutrient stripping capacity, and therefore no soil improvement is required.

Appendix M1 of AS1547-2012 notes that irrigation systems are to distribute effluent into the topsoil layers to provide in-soil treatment, nutrient uptake and evapotranspiration by grass, shrubs or other plantings. Topsoil is to be of good quality, rich in humus, and free of non-topsoil material. Drippers are to be installed 100-150 mm into this topsoil.

14. CLOSURE

GALT GEOTECHNICS

[redacted]

[redacted]

https://galtgeo.sharepoint.com/sites/wae240126/shared documents/01 bbbrs si/03 correspondence/wae240126-01 002 r rev0 sse.docx

Attached Table 1: Summary of Geotechnical Index Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	Gravel (%)	Sand (%)	Fines (%)	LL (%)	PI (%)	LS (%)	MMDD (t/m^3)	OMC (%)	CBR (%)	CBR Swell (%)
TP06	2.0 to 2.5	CLAY (CI)	0	27	73	46	29	11.0	-	-	-	-
TP07	0.2 to 0.5	Sandy CLAY (CI)	9	49	42	35	21	9.5	2.03	9.0	11	0.5
Combined Sample: TP01 TP05 TP06	0.2 to 0.5 0.1 to 0.5 0.2 to 0.5	Clayey SAND (SC)	5	67	28	35	20	9.0	2.08	7.0	9	0.5

Notes

1. *Particle size distribution (by mass)*
   - *Gravel: 2.36 mm – 63 mm*
   - *Sand: 0.075 mm – 2.36 mm*
   - *Fines: <0.075 mm*
2. *Atterberg Limits*
   - *LL: Liquid limit*
   - *PI: Plasticity index*
   - *LS: Linear shrinkage*
   - *NO: Not obtainable*
   - *NP: Non-plastic*
3. *Modified compaction*
   - *MMDD: Modified maximum dry density*
   - *OMC: Optimum moisture content*
4. *CBR: California bearing ratio*
   - *Remoulding dry density ratio: 95% MMDD*
   - *Surcharge: 4.5 kg*
   - *Soaking: 4-day soaked*

Attached Table 2: Summary of Chemical Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	pH	Phosphorus Retention Index	Exchangeable Sodium Percentage (%)
Combined Sample: TP01 TP05 TP06	0.2 to 0.5 0.1 to 0.5 0.2 to 0.5	Clayey SAND (SC)	9.1	16	21
TP07	0.2 to 0.5	Sandy CLAY (CI)	9.3	17	20

Attached Table 3: Site Assessment

Consideration	Assessment / Discussion	Reference	Level of Constraint	Mitigation Measures
Geology	**Within proposed dripper Field:** Czg – remnant sandplain – yellow and white sand containing locally abundant limonite pebbles: derived from laterite.	Hyden Sheet of the 1:50,000 Environmental Geology Series Map	Nil	-
Climate	To satisfy zero storage requirements, minimum LAA's to be sized as required for hydraulic loading.	Appendix F, Water Balance Calculation	Low	LAA to be greater than area required to meet zero storage requirement.
Exposure	Site will be cleared and broadly levelled - minimal/no tree cover or significant site aspect.	-	Low	-
Vegetation	As per Appendix M1 of AS1547-2012, we assume irrigation systems distribute effluent into the topsoil layers to provide in-soil treatment, nutrient uptake and evapotranspiration by grass, shrubs or other plantings. Topsoil should be of good quality, rich in humus, and free of non-topsoil material.	-	Low	LAA designed to accommodate water balance and have nutrient stripping capabilities.
Landform and Drainage	The proposed dripper field and surrounding area is relatively flat, with a minor slope towards the north. The Site generally drains towards the playa lake systems about 500 m north of the site.	-	Moderate	Civil design to minimise rainfall run-on and run-off (using bunds/curbs etc.).
Slope	The site has a gentle slope down to the north.	-	Low	Slope is <5% grade.
Fill (Imported)	No filling anticipated	-	Low	-
PDWSAs	The site is **not** mapped as being within a public drinking water source area.	Department of water (DoW) mapping service	-	-
SSAs	The site is **not** mapped as a Sewage Sensitive Area.	Department of lands and heritage (DPLH) mapping service	-	-

Attached Table 3: Site Assessment CONTINUED (Page 2 of 2)

Consideration	Assessment / Discussion	Reference	Level of Constraint	Mitigation Measures
Groundwater Level	Encountered groundwater depths of 2.3 m to 2.9 m within proposed dripper field (TP07 to TP09).	Table 6	Moderate	The underside of any disposal area (i.e. dripper field) must be at least 0.6 m above maximum known groundwater levels.
Groundwater Separation	A minimum separation of 0.6 m is required from the base of the disposal area to the maximum known groundwater level.	Government Sewerage Policy (2019)	Moderate	Civil design is required as part of the development to ensure groundwater levels are controlled in the vicinity of the LAA.
Rainfall Run-on/Seepage	There is a gentle slope down towards the north. Some rainfall run-on and run-off may occur	-	Low	Incident rainfall must be diverted away from LAA's using curbs or diversion bunds. Similarly, any run-off must be prevented by either having a level LAA, or by using retention bunds.
Surface Water/Water Resources	Surface water could occur in the table drains along Mount Walker-Hyden Road (about 300 m west of the dripper field), and any proposed table drains to divert stormwater from the proposed workers camp (possibly about 100 m south west of the dripper field).	-	Low	The required minimum setbacks to water resources must be met for the proposed LAA configuration. This will require a 6 m set back from any drainage channels.
Flood Potential	The site is **not** mapped as a Floodplain.	DWER floodplain mapping	-	-
Setbacks	All setbacks to be met.	Section 11.2	Low	LAA to meet setback requirements.
LAA	Within the LAA, minimum 18,423 m^2 is required to meet the minimum infiltrative area for the dripper disposal field, based on provided hydraulic loading. This exceeds the minimum total LAA area by the GSP 2019 method is 17,010 m^2. The LAA should not be dual use. This will need to be resized as required if a different hydraulic loading applies.	Section 11.3.3	High	LAA to be sized to meet the minimum required infiltrative area and setbacks. Design Loading Rate to be confirmed.

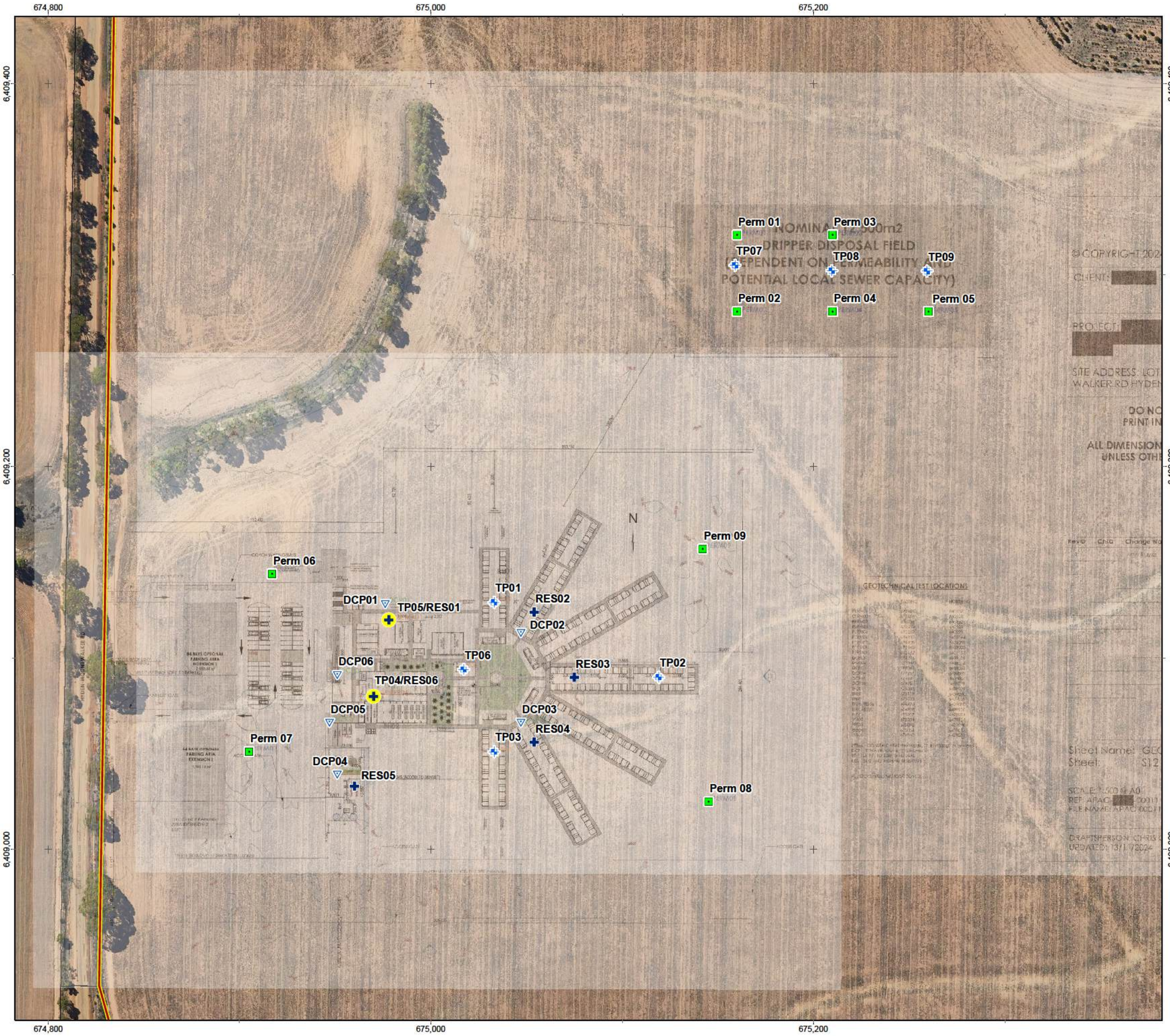
Attached Table 4: Soil Assessment

Consideration	Assessment / Discussion				Reference	Level of Constraint	Mitigation Measures
Subsurface Soil Conditions	Soil conditions within proposed dripper field (TP07 to TP09) generally comprise Clayey SAND / Sandy CLAY (Category 6 soil).				Appendix B / Sections 7.2 and 10	Low	Civil Design must consider presence of underlying clay layers.
Acid Sulfate Soils	Site soils are mapped as "moderate to low" risk of ASS. No indicators of ASS are noted, and the LAA will be above groundwater.				Department of Environmental Regulation (DER) mapping	Low	-
Soil Category	Existing soil is Category 6.				AS1547-2012	Moderate	Shallow subsurface drip systems shall be installed at a 100 mm to 150 mm depth into 150 mm to 250 mm of topsoil. Topsoil should be of good quality, rich in humus, and free of non-topsoil material.
Design Loading Rates	2 mm/day				Table L1, AS1547-2012	-	Secondary treated effluent
Laboratory Testing	**Level of Constraint**				-		
	Result	**Low**	**Medium**	**High**			
Coarse Fragments[1]	<10	<10%	10-40%	>40%	-	Low	Laboratory results indicate clay soils are erodible. Based on our site visit, slopes of no steeper than about 1V:10H show no significant signs of erosion. Slopes over 10 years old at about 1V:1.5H and about 2 m to 3 m high (refer Photographs 5 and 7, Appendix A) show signs of rilling. Some maintenance of steeper slopes is anticipated (i.e. gravelling). No issues anticipated for LAA.
pH[1]	9.1 – 9.3	6-8	4.5-6	<4.5,>8		Medium to high	
Exchangeable Sodium Percentage[1]	21 - 20	<10	10-20	>20		Medium to high	
Phosphorous Retention Index (PRI)[2]	16 - 17	>20	5-20	<5	-	Medium	Insitu soil has marginally adequate nutrient stripping capacity

Notes

1. *Level of constraint based on our interpretation of AS1547 description of "non-dispersive soils".*
2. *Phosphorus retention index requirements are based on our interpretation of The Department of Primary Industries and Regional Development Standards for Land Resource Mapping (2005), as this is not specified in AS1547.*

Figures



Legend

- Site Boundary
- Test Pit / Resistivity Test
- Resistivity Test
- Dynamic Cone Penetration
- Permeability Test
- Test Pit

N

0 30 60 90 120 150
Meters

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:2,000 (A3)
DRAWN	
DATE DRAWN	22/1/2025
CHECKED	–
DATE CHECKED	–
PROJECTION	GDA 1994 MGA Zone 50

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CLIENT	**BBB REMOTE SITE SERVICES**
PROJECT	HYDEN CAMP BASELINE ENVIRO & PAVEMENT
LOCATION	LOT 192 HYDEN-MOUNT WALKER ROAD HYDEN
TITLE	SITE & LOCATION PLAN
Job No	WAE240126-01
Fig No	FIGURE 1
Rev	**A**

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Appendices

Appendix A: Site Photographs

Photograph 1: Typical Site Photo

Photograph 2: Site photo

Photograph 3: Site photo

Photograph 4: Vegetated area about 300 m north of site

Photograph 5: Table drain about 700 m east of site traversing north south, note erosion gullies

Photograph 6: Turkeys nest about 700 m east of site

Photograph 7: Turkeys nest about 700 m east of site

Appendix B: Test Pit Logs

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HE	Hand Excavation	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

TCR = Total Core Recovery (%) $= \frac{CRL}{TCL} \times 100$

RQD = Rock Quality Designation (%) $= \frac{ALC>100}{TCL} \times 100$

TCL	Length of Core Run
CRL	Length of Core Recovered
ALC>100	Total Length of Axial Lengths of Core Greater than 100 mm Long

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES / BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	GM	Silty GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

NOTE: Dual classification given for soils with a fines content between 5% and 12%.

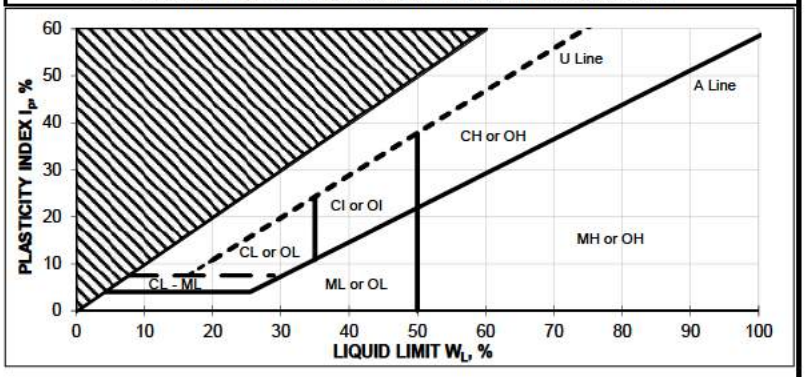
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE		
Soil Name		**Particle Size (mm)**
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



RESISTANCE TO EXCAVATION		
Symbol	**Term**	**Description**
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION	
Symbol	**Term**
D	Dry
M	Moist
W	Wet

CEMENTATION	
Cementation	**Description**
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY		
Symbol	**Term**	**Undrained Shear Strength (kPa)**
VS	Very Soft	0 to 12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very Stiff	100 to 200
H	Hard	>200

ORGANIC SOILS	
Material	**Organic Content % of dry mass**
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY		
Symbol	**Term**	**Density Index (%)**
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

TEST PIT: TP01

Sheet 1 OF 1

Job Number: WAE240126-01
Client: BBB Remote Services
Project: Proposed Workers Camp
Location: Hyden

Contractor: RJD Contracting
Machine: Kobelco SK350 LC
Operator: [redacted]
Bucket: Toothed
Width: 1.6 m **Length:** 5 m

Date: 13/01/2025
Logged: PF
Checked Date: 04/02/2024
Checked By: [redacted]

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E	▼	0.0		B(TP01-01)			SP	TOPSOIL: SAND, fine to medium grained, sub-angular to sub-rounded, brown, with low plasticity fines, trace gravel, trace organics	D	VD	Wheat crops
			0.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low plasticity fines, trace gravel	D - M	D	
			1.0						Clayey SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey-brown mottled red, low to medium plasticity fines	M		
			1.5									
			2.0					SC				
			2.5							W		
			3.0						Hole terminated at 3.10 m Target depth Groundwater encountered at 2.5 m			
			3.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP02

Job Number:	WAE240126-01	**Contractor:**	RJD Contracting	**Date:**	13/01/2025
Client:	BBB Remote Services	**Machine:**	Kobelco SK350 LC	**Logged:**	PF
Project:	Proposed Workers Camp	**Operator:**	[redacted]	**Checked Date:**	04/02/2024
Location:	Hyden	**Bucket:**	Toothed	**Checked By:**	[redacted]
		Width:	1.6 m **Length:** 5 m		

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel, trace organics	D	VD	Wheat crops
			0.5						Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel	D - M	D	
			1.0		B(TP02-01)			SC	Fine to coarse grained sand, becoming pale grey-brown mottled red	M		
			1.5									
			2.0		B(TP02-02)				Sandy CLAY: medium to high plasticity, pale grey mottled red-brown, fine to medium grained, sub-angular to sub-rounded sand			
		▼	2.5					CI-CH		W		
			3.0						Hole terminated at 3.00 m Target depth Groundwater encountered at 2.7 m			
			3.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP03

Sheet 1 OF 1

Job Number:	WAE240126-01	**Contractor:**	RJD Contracting	**Date:**	13/01/2025
Client:	BBB Remote Services	**Machine:**	Kobelco SK350 LC	**Logged:**	PF
Project:	Proposed Workers Camp	**Operator:**	[redacted]	**Checked Date:**	04/02/2024
Location:	Hyden	**Bucket:**	Toothed	**Checked By:**	[redacted]
		Width:	1.6 m **Length:** 5 m		

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E	▼	0.0					SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel, trace organics	D	VD	
									Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel	D - M	D	
			0.5								VD	Thin layer of black soil
			1.0					SC	Fine to coarse grained sand, becoming pale grey-brown mottled red			
			1.5							M		
			2.0						Sandy CLAY: medium to high plasticity, pale grey mottled red-brown, fine to medium grained, sub-angular to sub-rounded sand			
			2.5					CI-CH				
			3.0							W		
									Hole terminated at 3.10 m Target depth Groundwater encountered at 2.9 m			
			3.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP04

Sheet 1 OF 1

Job Number:	WAE240126-01	**Contractor:**	RJD Contracting	**Date:**	13/01/2025
Client:	BBB Remote Services	**Machine:**	Kobelco SK350 LC	**Logged:**	PF
Project:	Proposed Workers Camp	**Operator:**	[redacted]	**Checked Date:**	04/02/2024
Location:	Hyden	**Bucket:**	Toothed	**Checked By:**	[redacted]
		Width:	1.6 m **Length:** 5 m		

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E	▼	0.0					SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, low to medium plasticity fines, trace gravel, trace organics	D	VD	
									Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low to medium plasticity fines, trace gravel		D	
			0.5							D - M	VD	
			1.0					SC				
			1.5						Thin layer of black soils Fine to coarse grained sand, becoming pale grey-brown mottled red			
			2.0						Sandy CLAY: medium to high plasticity, pale grey mottled red-brown, fine to medium grained, sub-angular to sub-rounded sand	M		
			2.5					CI-CH				
			3.0							W		
			3.5						Hole terminated at 3.10 m Target depth Groundwater encountered at 2.8 m			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

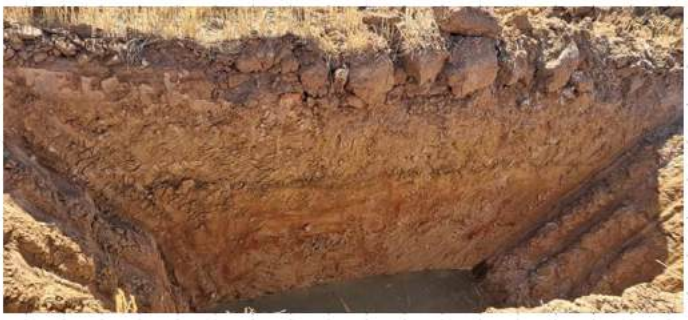
TEST PIT: TP05

Sheet 1 OF 1

Job Number:	WAE240126-01	**Contractor:**	RJD Contracting	**Date:**	13/01/2025
Client:	BBB Remote Services	**Machine:**	Kobelco SK350 LC	**Logged:**	PF
Project:	Proposed Workers Camp	**Operator:**	[redacted]	**Checked Date:**	04/02/2024
Location:	Hyden	**Bucket:**	Toothed	**Checked By:**	[redacted]
		Width:	1.6 m **Length:** 5 m		

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E	▼	0.0		B(TP05-01)			SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, low to medium plasticity fines, trace gravel, trace organics	D	VD	Wheat crops
			0.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low to medium plasticity fines, trace gravel	D - M	D	
			1.0									
			1.5		B(TP05-02)				Thin layer of black soils			
									Sandy CLAY: medium to high plasticity, pale grey mottled red-brown, fine to coarse grained, sub-angular to sub-rounded sand	M		
			2.0					CI-CH				
			2.5							W		
			3.0						Hole terminated at 3.00 m Target depth Groundwater encountered at 2.3 m			
			3.5									

Sketch & Other Observations



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP06

Job Number: WAE240126-01
Client: BBB Remote Services
Project: Proposed Workers Camp
Location: Hyden

Contractor: RJD Contracting
Machine: Kobelco SK350 LC
Operator: [redacted]
Bucket: Toothed
Width: 1.6 m **Length:** 5 m

Date: 13/01/2025
Logged: PF
Checked Date: 04/02/2024
Checked By: [redacted]

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E	▼	0.0		B(TP06-01)			SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, low to medium plasticity fines, trace gravel, trace organics	D		Wheat crops
			0.5						Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, low to medium plasticity fines, trace gravel	D - M	VD	
			1.0					SC	Fine to coarse grained sand, becoming pale grey-brown mottled red			
			1.5		B(TP06-02)					M		
			2.0		B(TP06-03)				CLAY: medium plasticity, pale grey mottled red brown, with fine to medium grained sand			
			2.5					CI		W		
			3.0									
			3.5						Hole terminated at 3.20 m Target depth Groundwater encountered at 2.3 m			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP07

Sheet 1 OF 1

Job Number:	WAE240126-01	**Contractor:**	RJD Contracting	**Date:**	13/01/2025
Client:	BBB Remote Services	**Machine:**	Kobelco SK350 LC	**Logged:**	PF
Project:	Proposed Workers Camp	**Operator:**	[redacted]	**Checked Date:**	04/02/2024
Location:	Hyden	**Bucket:**	Toothed	**Checked By:**	[redacted]
		Width:	1.6 m **Length:** 5 m		

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E	▼	0.0		B(TP07-01)			SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel, trace organics	D	VD	Wheat crops
			0.5					CI	Clayey SAND/Sandy CLAY, medium plasticyt, brown, sand is fine to medium grained, trace gravel	D - M	D	
			1.0						Sandy CLAY: medium to high plasticity, pale grey mottled red-brown, fine to medium grained, sub-angular to sub-rounded sand			
			1.5						Thin layer of black soils			
			2.0		B(TP07-02)			CI-CH		M		
			2.5									
			3.0						Hole terminated at 3.00 m Target depth Groundwater encountered at 2.9 m	W		
			3.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP08

Sheet 1 OF 1

Job Number:	WAE240126-01	**Contractor:**	RJD Contracting	**Date:**	13/01/2025
Client:	BBB Remote Services	**Machine:**	Kobelco SK350 LC	**Logged:**	PF
Project:	Proposed Workers Camp	**Operator:**	[redacted]	**Checked Date:**	04/02/2024
Location:	Hyden	**Bucket:**	Toothed	**Checked By:**	[redacted]
		Width:	1.6 m **Length:** 5 m		

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel	D	VD	Wheat crops
								SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace organics, trace gravel			
			0.5		B(TP08-01)			GC	Clayey GRAVEL: medium to coarse grained, sub-angular to sub-rounded, white and brown, medium plasticity fines, fine to medium grained, sub-angular to sub-rounded sand	D - M	D	White gravel appear to be limestone or calcarenite
			1.0						Sandy CLAY: medium to high plasticity, pale brown-grey mottled red, fine to medium grained, sub-angular to sub-rounded sand			
			1.5						Thin layer of black soils			
			2.0					CI-CH		M		
			2.5									
			3.0						Hole terminated at 3.00 m Target depth Groundwater encountered at 2.9 m	W		
			3.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP09

Sheet 1 OF 1

Job Number:	WAE240126-01	**Contractor:**	RJD Contracting	**Date:**	13/01/2025
Client:	BBB Remote Services	**Machine:**	Kobelco SK350 LC	**Logged:**	PF
Project:	Proposed Workers Camp	**Operator:**	[redacted]	**Checked Date:**	04/02/2024
Location:	Hyden	**Bucket:**	Toothed	**Checked By:**	[redacted]
		Width:	1.6 m **Length:** 5 m		

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
E	E		0.0					SC	TOPSOIL: Clayey SAND, fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel, trace organics	D		Wheat crops
			0.5					SC	Clayey SAND: fine to medium grained, sub-angular to sub-rounded, brown, medium plasticity fines, trace gravel	D - M	D	
			1.0									
			1.5						Thin layer of black soils			
								CI-CH	Sandy CLAY: medium to high plasticity, pale grey mottled red-brown, fine to coarse grained, sub-angular to sub-rounded sand	M		
			2.0							W		
			2.5						Hole terminated at 2.50 m Target depth Groundwater encountered at 2.3 m			
			3.0									
			3.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Appendix C: Guelph Permeameter Test Results

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 01

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\ \pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

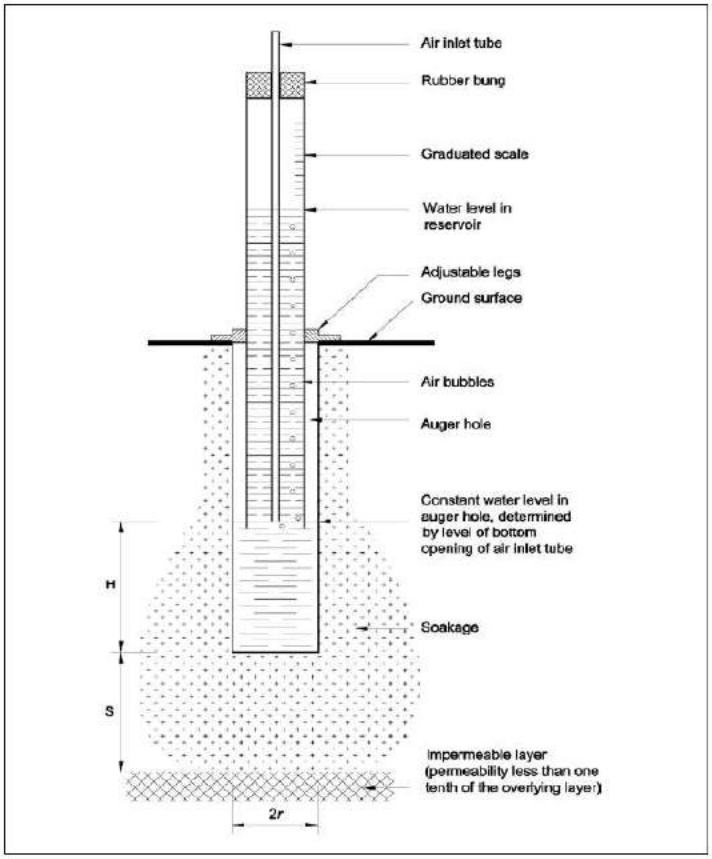
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	39	cm
H	Head of water above base	24.5	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	76.9		
19.5	76.5	0.40	0.02
24	76.3	0.20	0.04
36	75.4	0.90	0.07
45.5	74.8	0.60	0.06
68.5	73.3	1.50	0.07
90	72	1.30	0.06
119	70.8	1.20	0.04
142	70	0.80	0.03
164	69.2	0.80	0.04
183	68.5	0.70	0.04
243	66.8	1.70	0.03
357	64	2.80	0.02
397	63	1.00	0.03
AVERAGE - LAST 5 READINGS			0.03

Calculation

Steady State Flow	0.03	cm/min
Flow from reservoir (Q)	1.10	cm^3/min
K_{sat}	0.001	cm/min
K_{sat}	1.097E-07	m/s
K_{sat}	**0.01**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 02

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

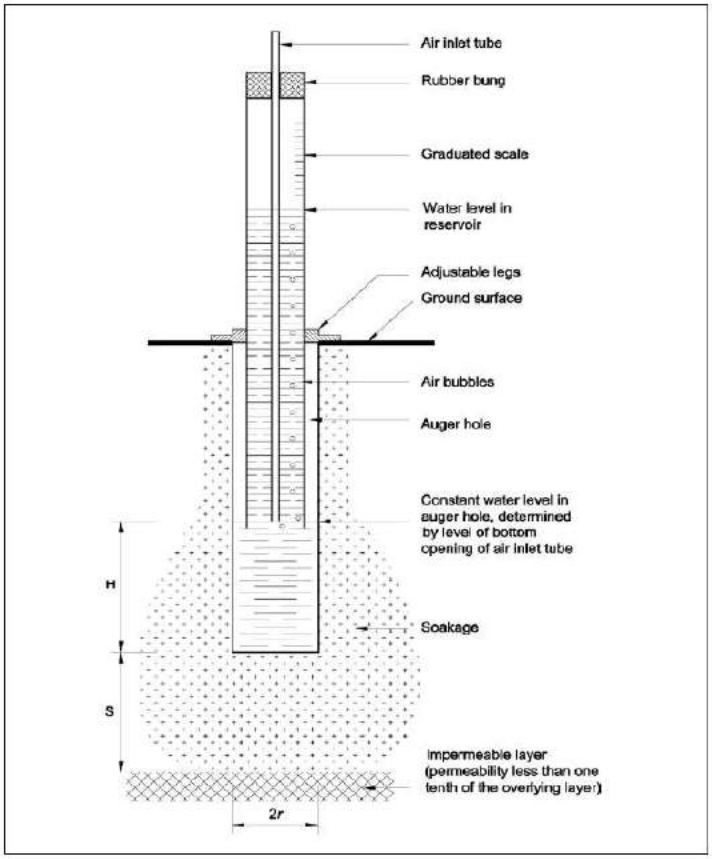
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	44	cm
H	Head of water above base	31	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	78.4		
14	77.8	0.60	0.04
26	75.4	2.40	0.20
34	74	1.40	0.18
50	71.5	2.50	0.16
62.5	69.3	2.20	0.18
72	67.4	1.90	0.20
AVERAGE - LAST 5 READINGS			0.18

Calculation

Steady State Flow	0.18	cm/min
Flow from reservoir (Q)	6.59	cm^3/min
K_{sat}	0.003	cm/min
K_{sat}	4.797E-07	m/s
K_{sat}	**0.04**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 03

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

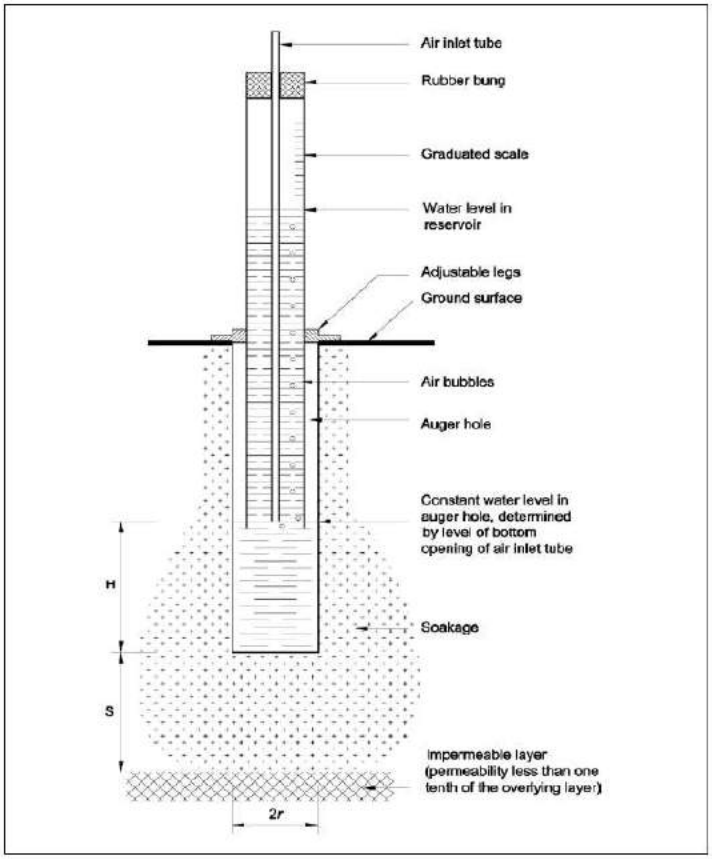
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	37	cm
H	Head of water above base	21	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	76.8		
4.833333	69.8	7.00	1.45
7.5	65.6	4.20	1.58
13	57.7	7.90	1.44
21.5	46.4	11.30	1.33
27	40	6.40	1.16
31.5	33.2	6.80	1.51
46	15	18.20	1.26
48.5	12.5	2.50	1.00
55.5	4.5	8.00	1.14
57.5	2	2.50	1.25
AVERAGE - LAST 5 READINGS			1.23

Calculation

Steady State Flow	1.23	cm/min
Flow from reservoir (Q)	44.72	cm^3/min
K_{sat}	0.033	cm/min
K_{sat}	5.468E-06	m/s
K_{sat}	**0.47**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 04

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

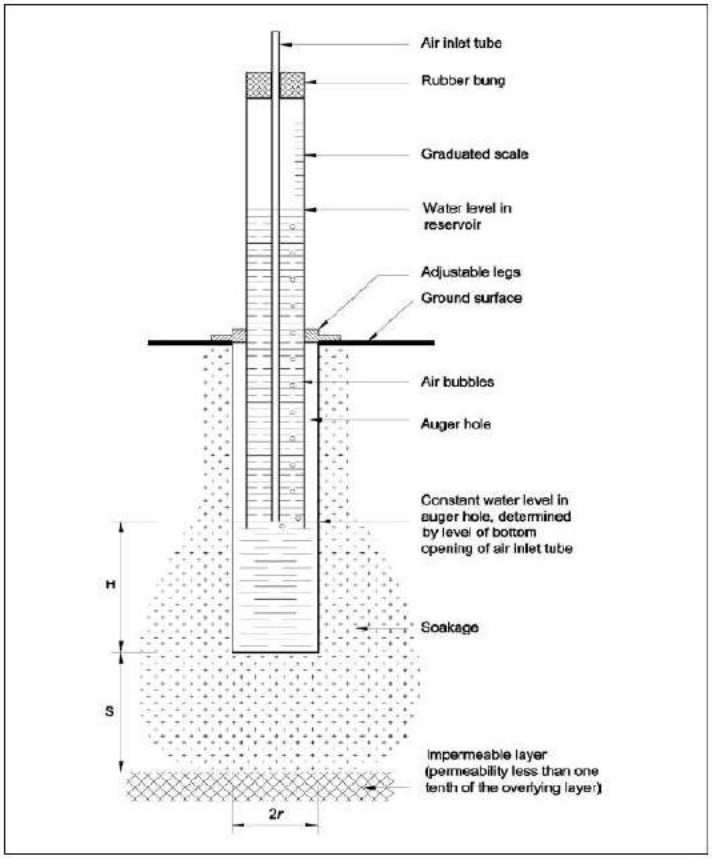
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	45	cm
H	Head of water above base	28	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	77.5		
11.5	66.2	11.30	0.98
23	55.8	10.40	0.90
40.5	40.3	15.50	0.89
45.5	35.5	4.80	0.96
62.5	20.5	15.00	0.88
83.5	3.8	16.70	0.80
AVERAGE - LAST 5 READINGS			0.89

Calculation

Steady State Flow	0.89	cm/min
Flow from reservoir (Q)	32.14	cm^3/min
K_{sat}	0.016	cm/min
K_{sat}	2.689E-06	m/s
K_{sat}	**0.23**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 05

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

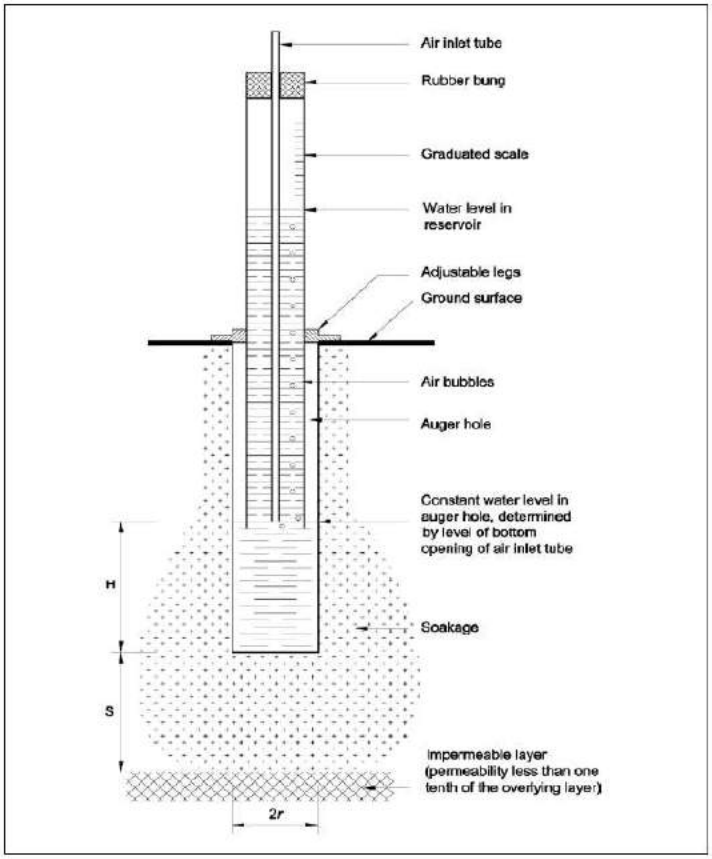
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	38	cm
H	Head of water above base	28	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	66		
33	61	5.00	0.15
53.5	58	3.00	0.15
62.5	56.6	1.40	0.16
73.5	54	2.60	0.24
81.5	53.5	0.50	0.06
AVERAGE - LAST 5 READINGS			0.15

Calculation

Steady State Flow	0.15	cm/min
Flow from reservoir (Q)	5.46	cm^3/min
K_{sat}	0.003	cm/min
K_{sat}	4.570E-07	m/s
K_{sat}	**0.04**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 06

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

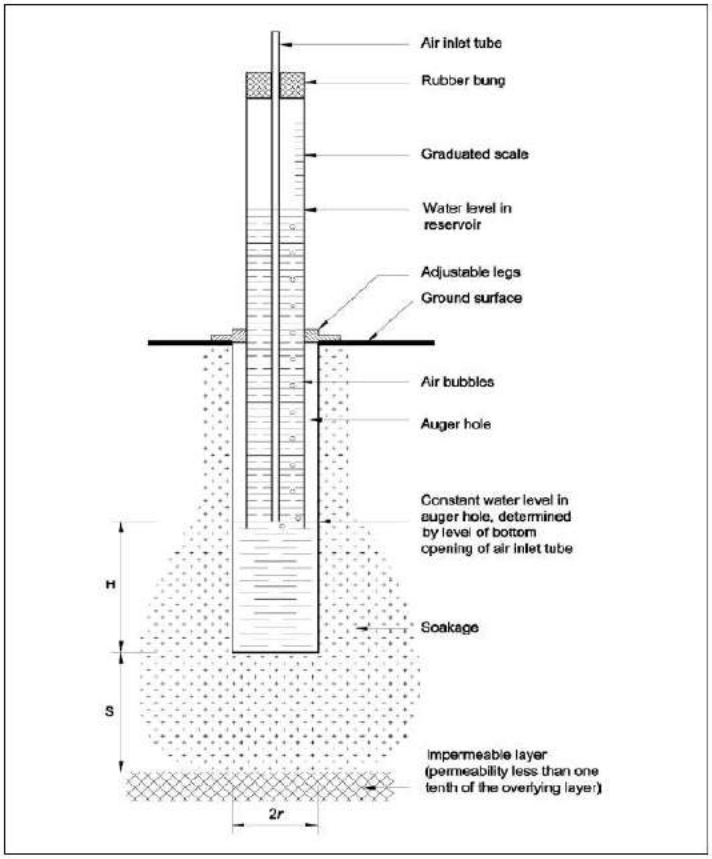
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	44	cm
H	Head of water above base	36.5	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	77.3		
7.5	71.7	5.60	0.75
22	62.3	9.40	0.65
32	56	6.30	0.63
44.5	44.8	11.20	0.90
54	38.8	6.00	0.63
64	30.5	8.30	0.83
74	23	7.50	0.75
100	3	20.00	0.77
AVERAGE - LAST 5 READINGS			0.78

Calculation

Steady State Flow	0.78	cm/min
Flow from reservoir (Q)	28.15	cm^3/min
K_{sat}	0.010	cm/min
K_{sat}	1.633E-06	m/s
K_{sat}	**0.14**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 07

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

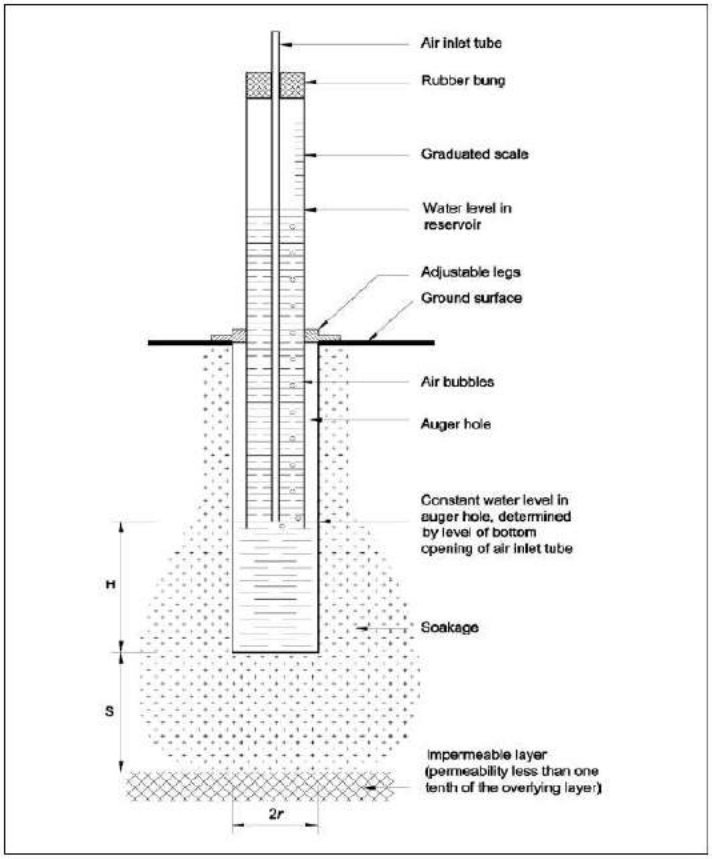
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	45	cm
H	Head of water above base	29	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	78		
8.166667	77.3	0.70	0.09
20.66667	74.7	2.60	0.21
37.66667	71.4	3.30	0.19
54.33333	68	3.40	0.20
80.16667	63.5	4.50	0.17
88.66667	61.8	1.70	0.20
99.66667	60	1.80	0.16
AVERAGE - LAST 5 READINGS			0.19

Calculation

Steady State Flow	0.19	cm/min
Flow from reservoir (Q)	6.79	cm^3/min
K_{sat}	0.003	cm/min
K_{sat}	5.421E-07	m/s
K_{sat}	**0.05**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 08

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

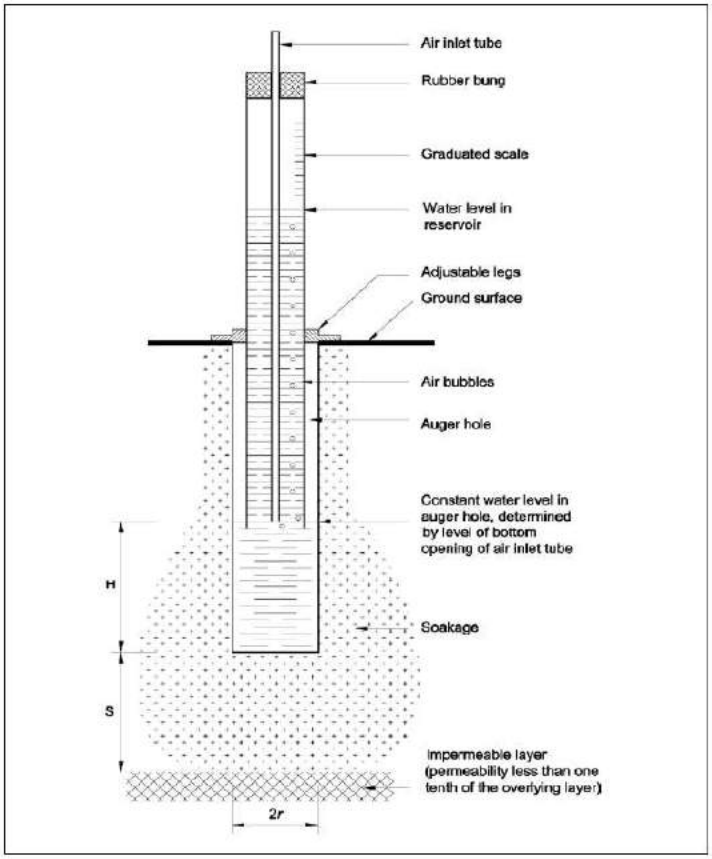
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	40	cm
H	Head of water above base	15	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	46.6		
13	36.8	9.80	0.75
23	30	6.80	0.68
27.5	27.2	2.80	0.62
38	21.8	5.40	0.51
44	16	5.80	0.97
55.5	10.6	5.40	0.47
AVERAGE - LAST 5 READINGS			0.65

Calculation

Steady State Flow	0.65	cm/min
Flow from reservoir (Q)	23.61	cm^3/min
K_{sat}	0.026	cm/min
K_{sat}	4.395E-06	m/s
K_{sat}	**0.38**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics	Spreadsheet author:
Job No:	WAE240126-01
Client:	BBB Remote Services
Project:	Workers Camp
Location:	Hyden
Calc by:	[redacted]
Test Name	Perm 09

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

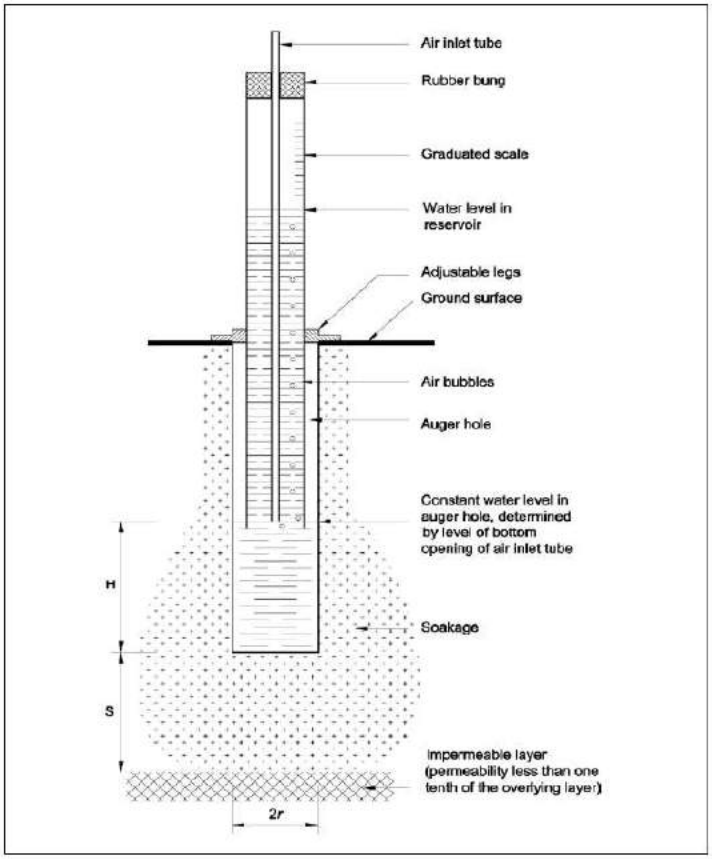
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	44	cm
H	Head of water above base	29	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum	300	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	36.3	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	76.4		
14.25	65.7	10.70	0.75
30.25	55	10.70	0.67
40.75	48	7.00	0.67
57.25	37.2	10.80	0.65
71.25	27.7	9.50	0.68
83.25	19.3	8.40	0.70
98.25	9	10.30	0.69
AVERAGE - LAST 5 READINGS			0.68

Calculation

Steady State Flow	0.68	cm/min
Flow from reservoir (Q)	24.59	cm^3/min
K_{sat}	0.012	cm/min
K_{sat}	1.961E-06	m/s
K_{sat}	**0.17**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Appendix D: Dynamic Cone Penetrometer Test Results

DYNAMIC CONE PENETROMETER RECORD SHEET
AS 1298.6.3.2

Client: BBB Remote Site Services
Job No: WAE240126-01
Project: Proposed Workers Camp
Date: 13 to 14 January 2025
Location: Lot 192 Hyden-Mount Walker Road, Hyden WA
Engineer: [redacted]

Location:	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09
Depth (mm)	N° of Penetrometer Blows per 100 mm Depth Interval								
0-100	SET	SET	SET	SET	SET	SET	SET	SET	SET
100-200	12	10	11	8	20	12	12	6	10
200-300	9	6	7	7	17	10	6	6	7
300-400	7	6	5	4	11	7	7	4	6
400-500	5	11	6	4	7	8	9	5	4
500-600	4	8	8	4	8	7	10	6	3
600-700	5	6	10	7	10	7	7	6	6
700-800	7	5	12 + R	5	10	12 + R	8	10	5
800-900	6	7		5	6		12 + R	5	5
900-1000	5	6		5	6			7	5

Dynamic Cone Penetrometer tests done in accordance with AS 1289.6.3.2

R: Refusal HB: Hammer-bounce

Appendix E: Laboratory Test Results

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.792_1_PI
Project:	Proposed Workers Camp	*Sample No.*	WG25.792
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	TP06 (2-2.5)m	*Date Tested:*	28/01/2025

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**46**
AS 1289.3.2.1	**Plastic Limit (%)**	**17**
AS 1289.3.3.1	**Plasticity Index (%)**	**29**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**11.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 29/January/2025

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SOIL | AGGREGATE | CONCRETE | CRUSHING

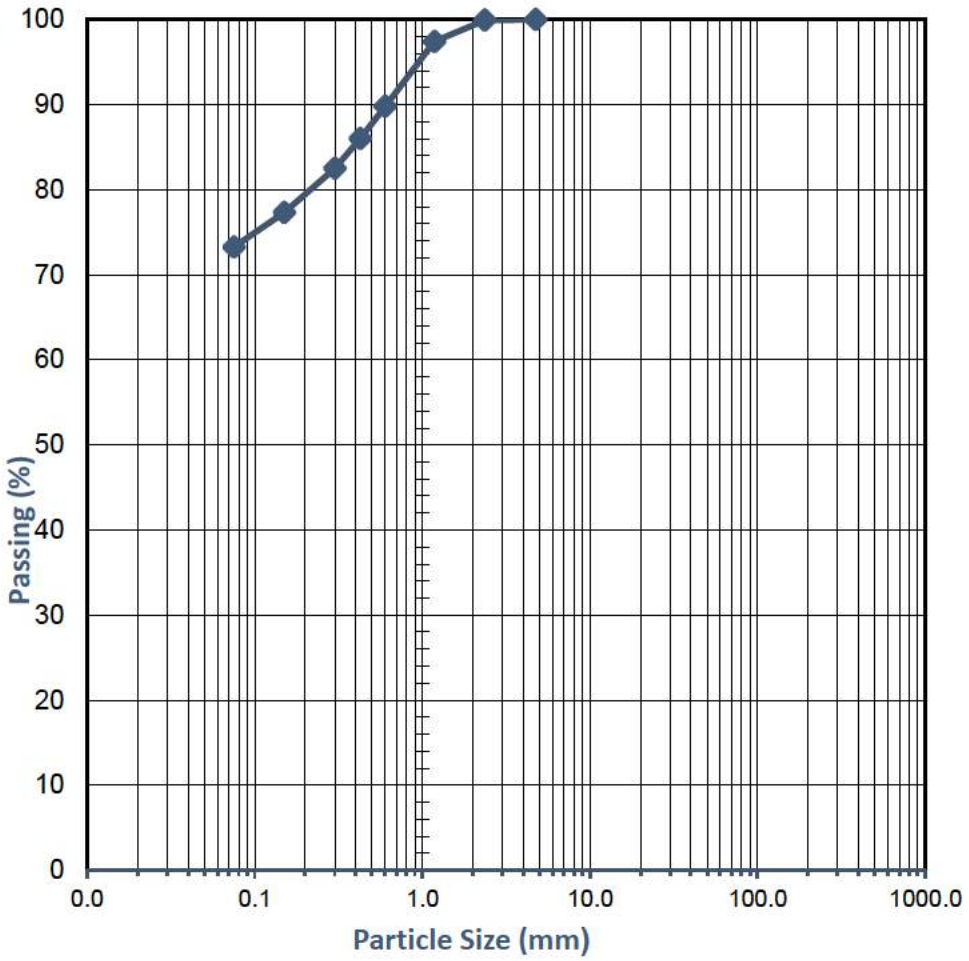
TEST REPORT - AS 1289.3.6.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.792_1_PSD
Project:	Proposed Workers Camp	*Sample No.*	WG25.792
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	TP06 (2-2.5)m	*Date Tested:*	24/01 - 28/01/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	100
2.36	100
1.18	97
0.600	90
0.425	86
0.300	83
0.150	77
0.075	73



Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 28/January/2025

NATA WORLD RECOGNISED ACCREDITATION

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.793_1_MMDD
Project:	Proposed Workers Camp	*Sample No.*	WG25.793
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	TP07 (0.2-0.5)m	*Date Tested:*	23/01/2025

TEST RESULTS - Modified Maximum Dry Density

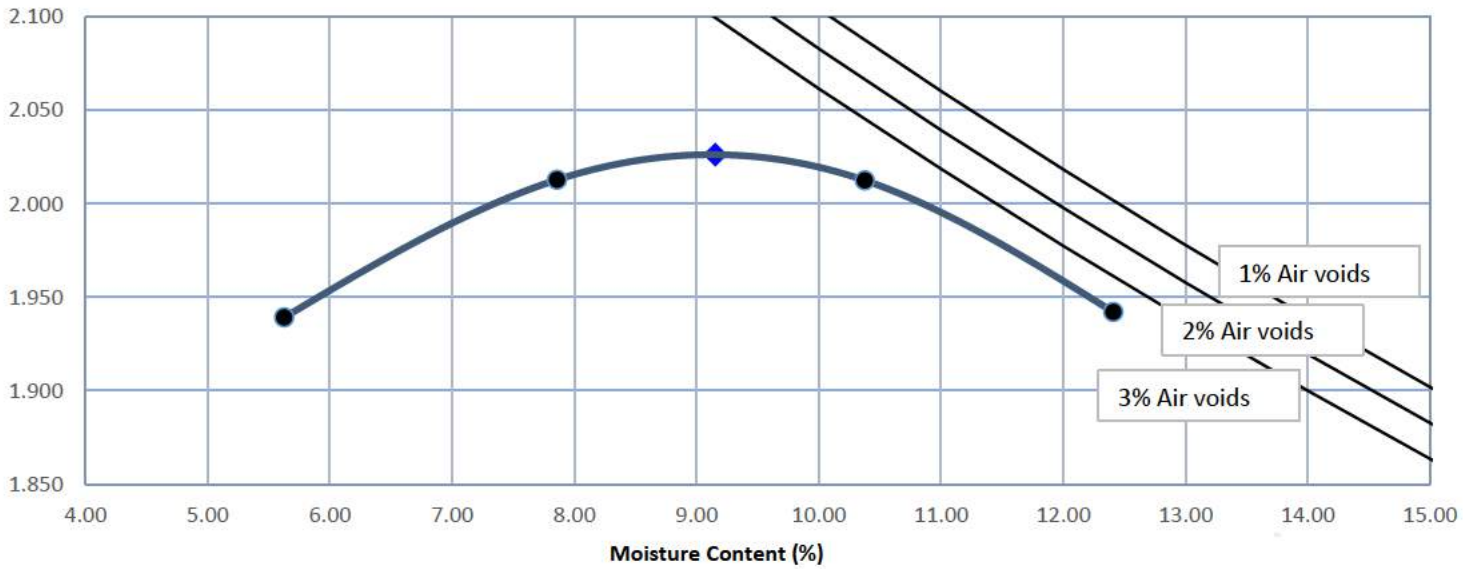
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time (Hours): 2

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 0 **Material + 37.5mm (%)** -

Moisture Content (%)	5.6	7.9	10.4	12.4	
Dry Density (t/m³)	1.939	2.013	2.012	1.942	



Modified Maximum Dry Density (t/m³) **2.03**

Optimum Moisture Content (%) **9.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.699 t/m³*

Approved Signatory: [redacted]

Name: [redacted]

Date: 24/January/2025

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.793_1_PI
Project:	Proposed Workers Camp	*Sample No.*	WG25.793
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	TP07 (0.2-0.5)m	*Date Tested:*	28/01/2025

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**35**
AS 1289.3.2.1	**Plastic Limit (%)**	**14**
AS 1289.3.3.1	**Plasticity Index (%)**	**21**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**9.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 29/January/2025

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

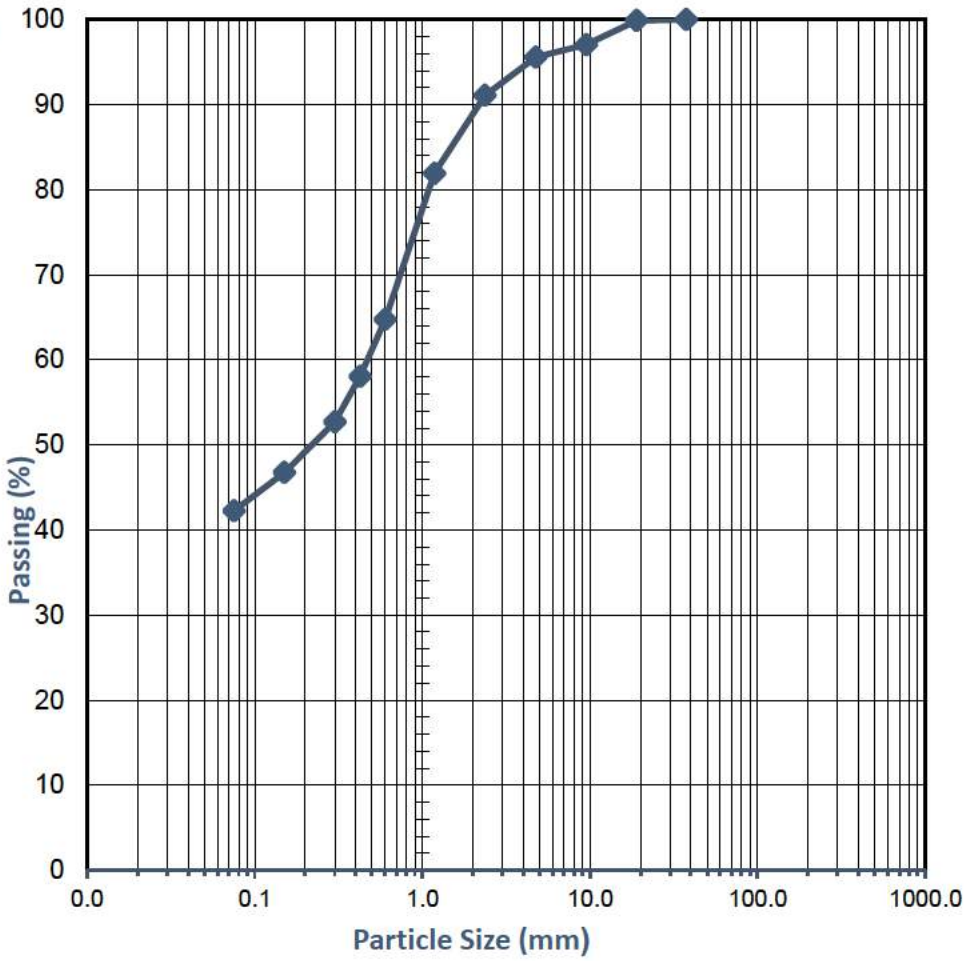
TEST REPORT - AS 1289.3.6.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.793_1_PSD
Project:	Proposed Workers Camp	*Sample No.*	WG25.793
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	TP07 (0.2-0.5)m	*Date Tested:*	24/01 - 28/01/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	100
9.5	97
4.75	96
2.36	91
1.18	82
0.600	65
0.425	58
0.300	53
0.150	47
0.075	42



Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 28/January/2025

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

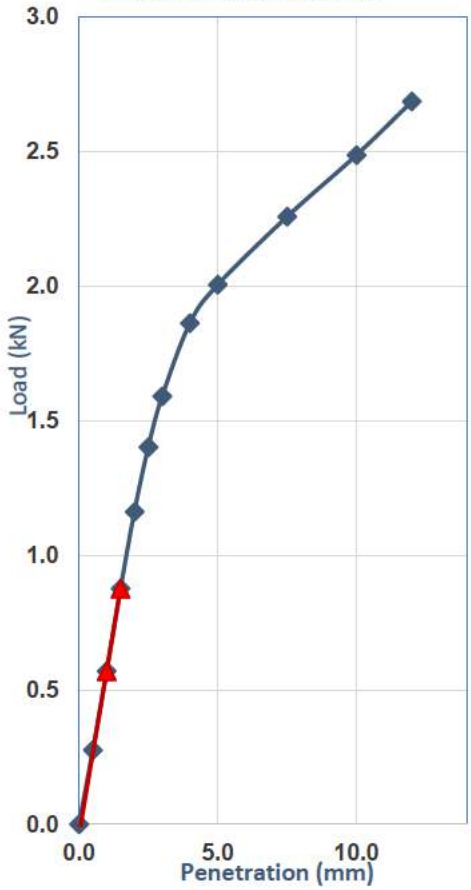
Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.793_1_SCBR
Project:	Proposed Workers Camp	*Sample No.*	WG25.793
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	TP07 (0.2-0.5)m	*Date Tested:*	23/01 - 03/02/2025

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sandy Clay trace Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	144.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.03	Optimum Moisture (%)	9.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.92	Moisture Content (%)	9.4
Density Ratio (%)	95.0	Moisture Ratio (%)	102.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.5
Dry Density (t/m^3)	1.91	Dry Density Ratio (%)	94.5
Moisture Content (%)	14.0	Moisture Ratio (%)	152.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.5	Remaining Depth (%)	12.3

Correction applied to Penetration: 0.1mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 11%

Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 04/February/2025

NATA WORLD RECOGNISED ACCREDITATION

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.794_1_MMDD
Project:	Proposed Workers Camp	*Sample No.*	WG25.794
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	CS01	*Date Tested:*	23/01/2025

TEST RESULTS - Modified Maximum Dry Density

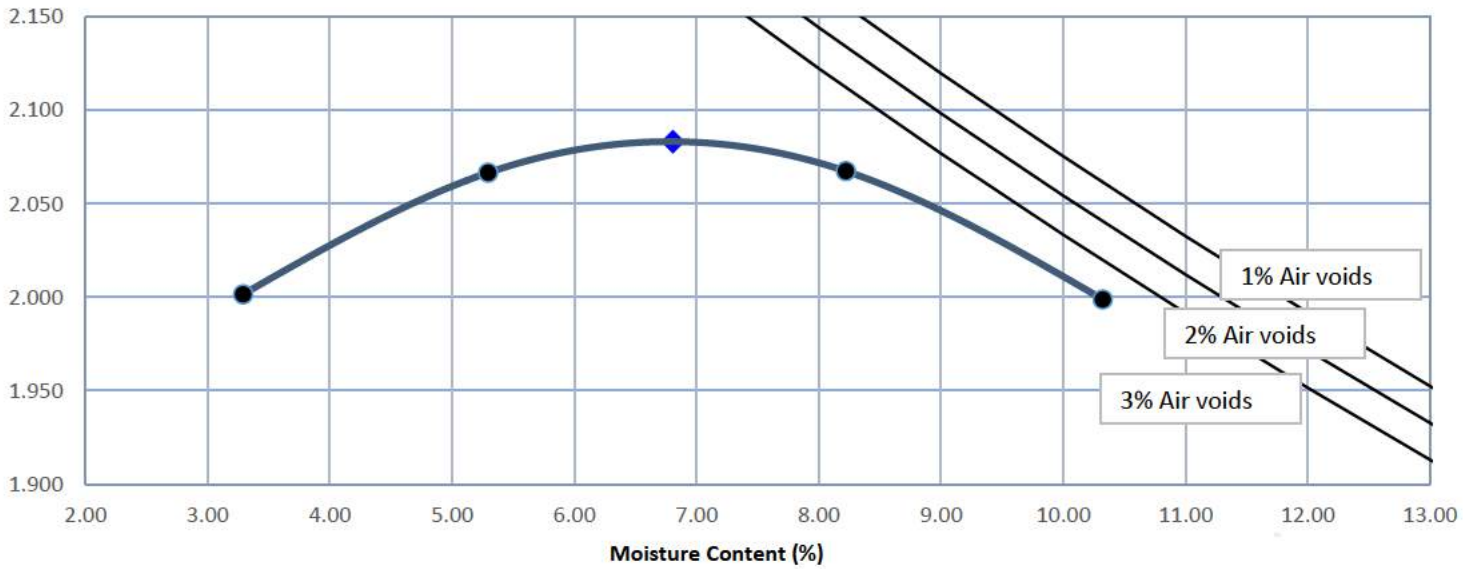
Sampling Method: Sampled by Client, Tested as Received

Sample Curing Time (Hours): 24

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 0 **Material + 37.5mm (%)** -

Moisture Content (%)	3.3	5.3	8.2	10.3	
Dry Density (t/m³)	2.002	2.067	2.067	1.999	



Modified Maximum Dry Density (t/m³) **2.08**

Optimum Moisture Content (%) **7.0**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.652 t/m³*

Approved Signatory: [redacted]

Name: [redacted]

Date: 24/January/2025

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.794_1_PI
Project:	Proposed Workers Camp	*Sample No.*	WG25.794
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	CS01	*Date Tested:*	28/01/2025

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**35**
AS 1289.3.2.1	**Plastic Limit (%)**	**15**
AS 1289.3.3.1	**Plasticity Index (%)**	**20**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**9.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 29/January/2025

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

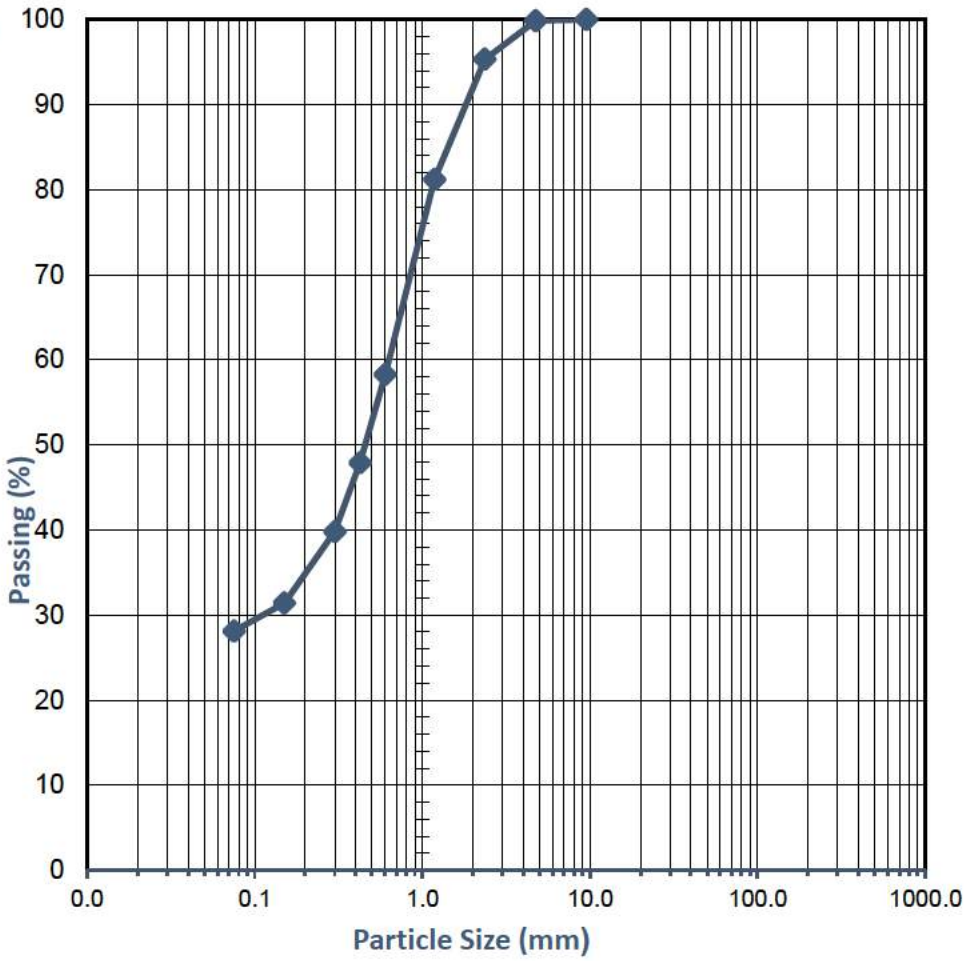
TEST REPORT - AS 1289.3.6.1

Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.794_1_PSD
Project:	Proposed Workers Camp	*Sample No.*	WG25.794
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	CS01	*Date Tested:*	24/01 - 28/01/2025

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	95
1.18	81
0.600	58
0.425	48
0.300	40
0.150	31
0.075	28



Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 28/January/2025

NATA Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

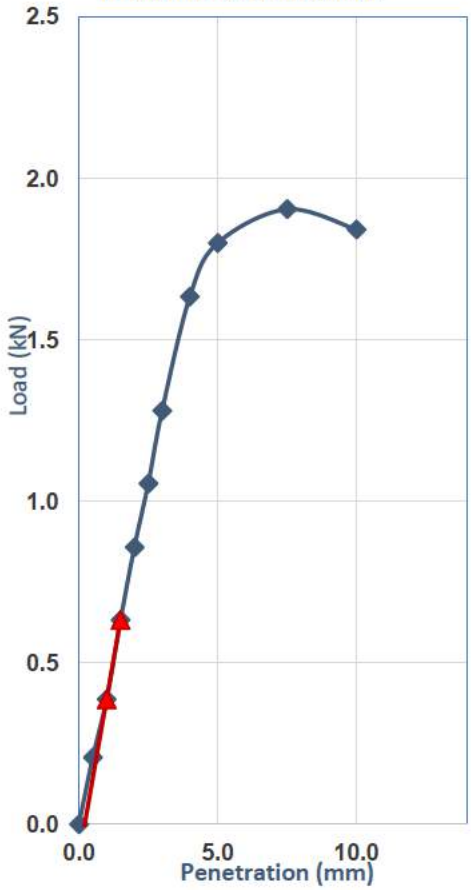
Client:	BBB Remote Services	*Ticket No.*	S15737
Client Address:	-	*Report No.*	WG25.794_1_SCBR
Project:	Proposed Workers Camp	*Sample No.*	WG25.794
Location:	Hyden	*Date Sampled:*	Not Specified
Sample Identification:	CS01	*Date Tested:*	23/01 - 03/02/2025

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sandy Clay trace Gravel

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	144.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	2.08	Optimum Moisture (%)	7.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.97	Moisture Content (%)	7.0
Density Ratio (%)	94.5	Moisture Ratio (%)	103.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.5
Dry Density (t/m^3)	1.96	Dry Density Ratio (%)	94.0
Moisture Content (%)	13.4	Moisture Ratio (%)	196.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.7	Remaining Depth (%)	12.1

Correction applied to Penetration: 0.2mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 9%

Comments:

Approved Signatory: [redacted]

Name: [redacted]

Date: 04/February/2025

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

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ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PGA1188

Client Details

Client	Western Geotechnical & Laboratory Services
Contact	Laboratory
Address	235 Bank Street, WELSHPOOL, WA, 6101

Sample Details

Your Reference	S15737 Proposed Workers Camp
Number of Samples	2 Soil
Date Samples Received	23/01/2025
Date Instructions Received	23/01/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for soils and on an as received basis for other matrices.

Report Details

Date Results Requested by	04/02/2025
Date of Issue	04/02/2025

Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	[redacted]
Laboratory Manager	[redacted]

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PGA1188-01	WG25.793 TP07 (0.2-0.5)m	Soil	23/01/2025	23/01/2025
PGA1188-02	WG25.794 CS01	Soil	23/01/2025	23/01/2025

Sample Comments

General Comment	No sampling date(s) was/were provided by client. Therefore the sampling date(s) is/are assigned as the date(s) of sample receipt to the laboratory.

Exchangeable Cations (Soil)

Envirolab ID	Units	PQL	PGA1188-01	PGA1188-02
Your Reference			WG25.793 TP07 (0.2-0.5)m	WG25.794 CS01
Date Sampled			23/01/2025	23/01/2025
Calcium	meq/100g	0.10	1.8	1.0
Potassium	meq/100g	0.10	0.52	0.30
Magnesium	meq/100g	0.10	1.6	0.78
Sodium	meq/100g	0.10	1.0	0.56
Cation Exchange Capacity (CEC)	meq/100g	0.10	4.9	2.6
Exchangeable Sodium Percentage (ESP)	%	1.0	20	21

Certificate of Analysis PGA1188

Inorganics - General Physical Parameters (Soil)

Envirolab ID	Units	PQL	PGA1188-01	PGA1188-02
Your Reference			WG25.793 TP07 (0.2-0.5)m	WG25.794 CS01
Date Sampled			23/01/2025	23/01/2025
pH	pH units		9.3	9.1

PBI/PRI (Soil)

Envirolab ID	Units	PQL	PGA1188-01	PGA1188-02
Your Reference			WG25.793 TP07 (0.2-0.5)m	WG25.794 CS01
Date Sampled			23/01/2025	23/01/2025
Phosphorus Retention Index	-		17	16

Method Summary

Method ID	Methodology Summary
AGRI-003_PRI	Phosphorous Retention index (PRI) is the ratio of adsorbed phosphorus to the equilibrium concentration. Phosphorus is extracted using KCl and determined colourimetrically. Result value is used to calculate PRI as per Allen and Jefferey.
INORG-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis can be completed outside of the recommended holding times. Solids are reported from a 1:5 water extract unless otherwise specified. Alternatively, pH is determined in a 1:5 extract using 0.01M calcium chloride or a solid is extracted at a ratio of 1:2.5 (AS1289.4.3.1), pH is measured in the extract.
METALS-020	Determination of various metals by ICP-OES.
METALS-020_008A	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from the latest "Australian Drinking Water Guidelines", published by NHMRC. No guideline values have been set for Total Coliforms in drinking water. Increased concentrations should be investigated. Total Coliforms are not considered useful as indicators of the presence of faecal contamination.

Where we have provided guideline values eg. ADWG Health Value, it is the responsiblity of the reader to decide if the water is fit for consumption. Please note that the tests we have conducted are just a selection of common tests to give you a general idea of drinking water quality. There are many other tests included in the ADWG that we have not tested for.

Data Quality Assessment Summary PGA1188

Client Details

Client	Western Geotechnical & Laboratory Services
Your Reference	S15737 Proposed Workers Camp
Date Issued	04/02/2025

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PGA1188

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
CEC | Soil	1 2	23/01/2025	29/01/2025	29/01/2025	Yes
ESP | Soil	1-2	23/01/2025	29/01/2025	29/01/2025	Yes
Exchangeable Cations | Soil	1-2	23/01/2025	29/01/2025	29/01/2025	Yes
pH | Soil	1-2	23/01/2025	24/01/2025	29/01/2025	Yes
PRI | Soil	1-2	23/01/2025	24/01/2025	24/01/2025	Yes

No sampling date(s) was/were provided by client. Therefore the sampling date(s) is/are assigned as the date(s) of sample receipt to the laboratory.

Quality Control PGA1188

METALS-020_008A|Exchangeable Cations (Soil) | Batch BGA3844

Analyte	Units	PQL	Blank	DUP1 PGA1188-01 Samp | QC | RPD %	LCS %	Spike % PGA1188-02
Calcium	meq/100g	0.10	<0.10	1.85 | 2.02 | 8.79	75.9	77.2
Potassium	meq/100g	0.10	<0.10	0.520 | 0.540 | 3.77	104	85.7
Magnesium	meq/100g	0.10	<0.10	1.55 | 1.53 | 1.30	70.8	71.3
Sodium	meq/100g	0.10	<0.10	1.00 | 1.00 | 0.00	76.2	81.1
Cation Exchange Capacity (CEC)	meq/100g	0.10	<0.10		[NA]	[NA]
Exchangeable Sodium Percentage (ESP)	%	1.0	<1.0		[NA]	[NA]

INORG-001|Inorganics - General Physical Parameters (Soil) | Batch BGA3320

Analyte	Units	PQL	Blank	DUP1 BGA3320-DUP1# Samp | QC | RPD %	LCS %
pH	pH units		6.0	6.8 | 6.7 | 2.37	103

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

AGRI-003_PRI|PBI/PRI (Soil) | Batch BGA3316

Analyte	Units	PQL	Blank	DUP1 PGA1188-01 Samp | QC | RPD %	LCS %
Phosphorus Retention Index	-		0.00	16.9 | 15.4 | 9.61	121

Appendix F: Water Balance

WA Site & Soil Evaluation
Irrigation area sizing

Please read the attached notes before using this spreadsheet

Water Balance for Zero Storage

Site Address:	**Lot192 Hyden Mount Walker Road**		
Date:	Wednesday, 5 February 2025	**Assessor:**	[redacted]

INPUT DATA

Design Wastewater Flow	Q	34,020	L/day	Based on maximum potential occupancy and derived from the Supplement to Regulation 29 and Schedule 9 - Wastewater system loading rates
Design Irrigation Rate	DIR	2.0	mm/day	Based on soil texture class/permeability and derived from Table M1 of AS/NZS 1547:2012
Nominated Land Application Area	L	12500	m^2	[1]
Crop Factor	C	0.8-1.0	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[2]
Rainfall Runoff Factor	RF	1.0	untiless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Mean Monthly Rainfall Data		Hyden		BoM Station and number
Mean Monthly Pan Evaporation Data		Corrigin		BoM Station and number or data from the Evaporation Data for Western Australia Report (https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1058&context=rmtr

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall	R		mm/month	19.3	20.5	22.4	23.7	38.6	47.8	47.3	41.3	27.1	21.6	19.5	14	**343.1**
Evaporation	E		mm/month	381	301	260	153	91	54	54	73	110	177	243	339	**2236**
Crop Factor	C		unitless	1.00	1.00	0.90	0.90	0.80	0.80	0.80	0.80	0.90	1.00	1.00	1.00	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	381	301	234	138	73	43	43	58	99	177	243	339	**2129.3**
Percolation	B	DIRxD	mm/month	62.0	56	62.0	60.0	62.0	60.0	62.0	62.0	60.0	62.0	60.0	62.0	**730.0**
Outputs		ET+B	mm/month	443.0	357	296.0	197.7	134.8	103.2	105.2	120.4	159.0	239.0	303.0	401.0	**2859.3**
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	19.3	20.5	22.4	23.7	38.6	47.8	47.3	41.3	27.1	21.6	19.5	14	**343.1**
Applied Effluent	W	(QxD)/L	mm/month	84.4	76.2	84.4	81.6	84.4	81.6	84.4	84.4	81.6	84.4	81.6	84.4	**993.4**
Inputs		RR+W	mm/month	103.7	96.7	106.8	105.3	123.0	129.4	131.7	125.7	108.7	106.0	101.1	98.4	**1336.5**
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	26.2	52.7	58.0	7.7	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-339.3	-260.3	-189.2	-92.4	-11.8	26.2	26.5	5.3	-50.3	-133.0	-201.9	-302.6	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	26.2	52.7	58.0	7.7	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	57.99												
	V	NxL	L	724840												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	2489	2831	3855	5866	10963	18422	18215	13333	7738	4851	3600	2725	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 18423 m^2

CELLS

	Please enter data in blue cells
XX	Enter available Land Application Area
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

NOTES

[1] This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage

[2] Values selected are suitable for grass in WA

Understanding your Report

1. EXPECTATIONS OF THE REPORT

The following sections have been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. DATA PROVIDED BY THIRD PARTIES

Where data is provided by third parties, it will be identified as such in our reports. We necessarily rely on the completeness and accuracy of data provided by third parties in order to draw conclusions presented in our reports. We are not responsible for omissions, incomplete or inaccurate data associated with third party data, including where we have been requested to provide advice in relation to field investigation data provided by third parties.

4. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques prepared by Galt. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

5. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

6. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

7. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

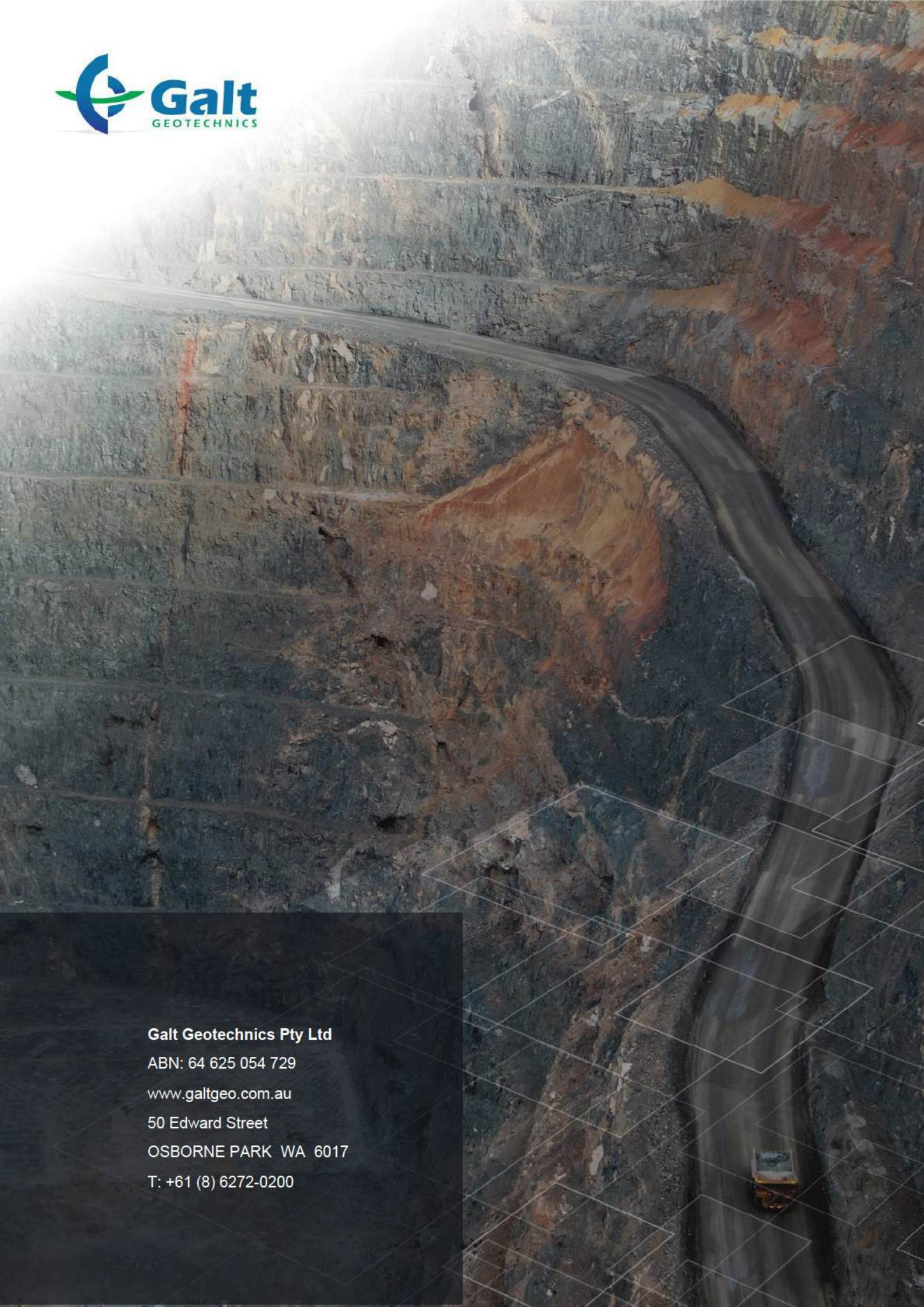
The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

8. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.



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