CIVIL TEST PTY LTD
ABN 91 006 855 689
SOIL TESTING & GEOTECHNICAL CONSULTANTS
ACN 006 855 689

LAND CAPABILITY ASSESSMENT REPORT

FOR THE PROPERTY AT LYSTERFIELD LAKE COLLEGE 19-23 HORSWOOD ROAD

NARRE WARREN NORTH

REPORT NUMBER: 1191040-4 Issue 3

TABLE OF CONTENTS

CLIENT	**:**	Pared Victoria T/A Lysterfield Lake College C/- HWL Ebsworth Lawyers Level 8, 447 Collins Street MELBOURNE VIC 3000
PROJECT ADDRESS	**:**	Lysterfield Lake College 19-23 Horswood Road NARRE WARREN NORTH
REPORT NUMBER	**:**	1191040-4 Issue 3
TESTING DATE	**:**	11 October 2019

1. INTRODUCTION:

Civiltest Pty Ltd (Civiltest) have been engaged to undertake a Land Capability Assessment (LCA) for an approximately 8ha site at Lysterfield Lake College, 19-23 Horswood Road NARRE WARRE NORTH. It has been proposed to construct a school on this site with the wastewater to be treated and disposed of onsite. The proposed school is predicted to have 150 students and 11 staff by the year 2024. These numbers are expected to increase over time. For this assessment it has been assumed 200 pupils and 20 teachers.

This report will address:

- The capability of the site to sustainably manage wastewater within the allotment boundaries;
- A management program that should be put into place to minimise health and environmental impacts of on-site wastewater management, including the impact on surface water and groundwater; and
- Information about the site and soil conditions.

2. SITE KEY FEATURES:

Site Address	Lysterfield Lake College, 19-23 Horswood Road NARRE WARREN NORTH
Owner/Applicant	Pared Vic T/A Harkaway Hills College
Local Council	City of Casey
Total Land Area	Approximately 8ha
Domestic Water Supply	Reticulated/Tank
Anticipated wastewater loads (Litres/day)	Assumed 200 pupils and 20 teachers. EPA Table 4 minimum daily wastewater flow rates and organic loading rates Pupils 20L/person/day x 200 = 4000L/day Teachers 20L/person/day x 20 = 400L/day **Total 4400L/day**
Organic Material Loading Design Rates	BOD / 20g per person, therefore 220 x 20g = 4400g BOD/day
Availability of sewer	Sewer is not available to this site and is not expected to become available in the near future.
Groundwater Quality	Groundwater is classified as category B TDS = 1000 - 3500 mg/L, which is suitable for portable mineral water supply or agriculture and irrigation. http://www.vvg.org.au/

2.1 Locality Plan

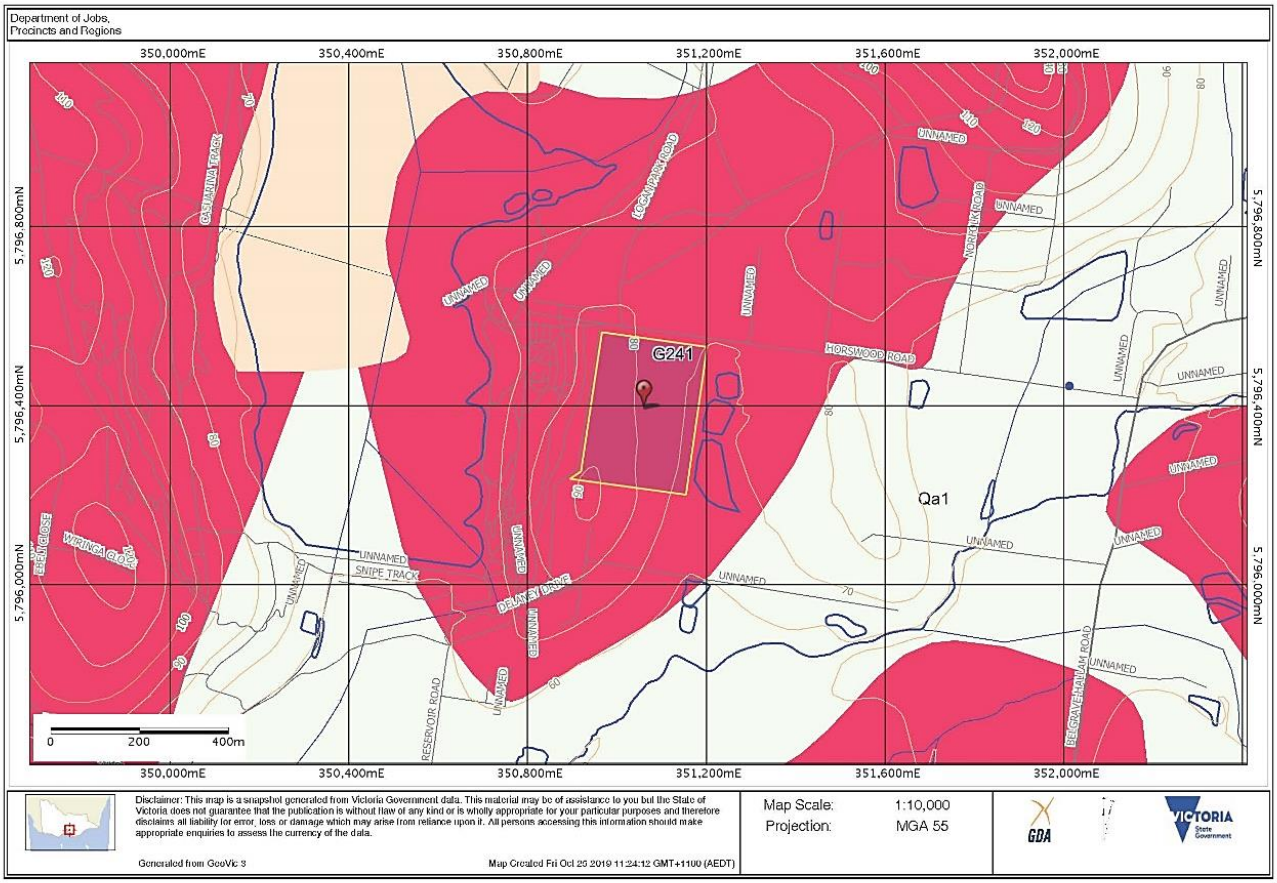


Figure 1 – Site Locality (Including local geology) www.dpi.vic.gov.au

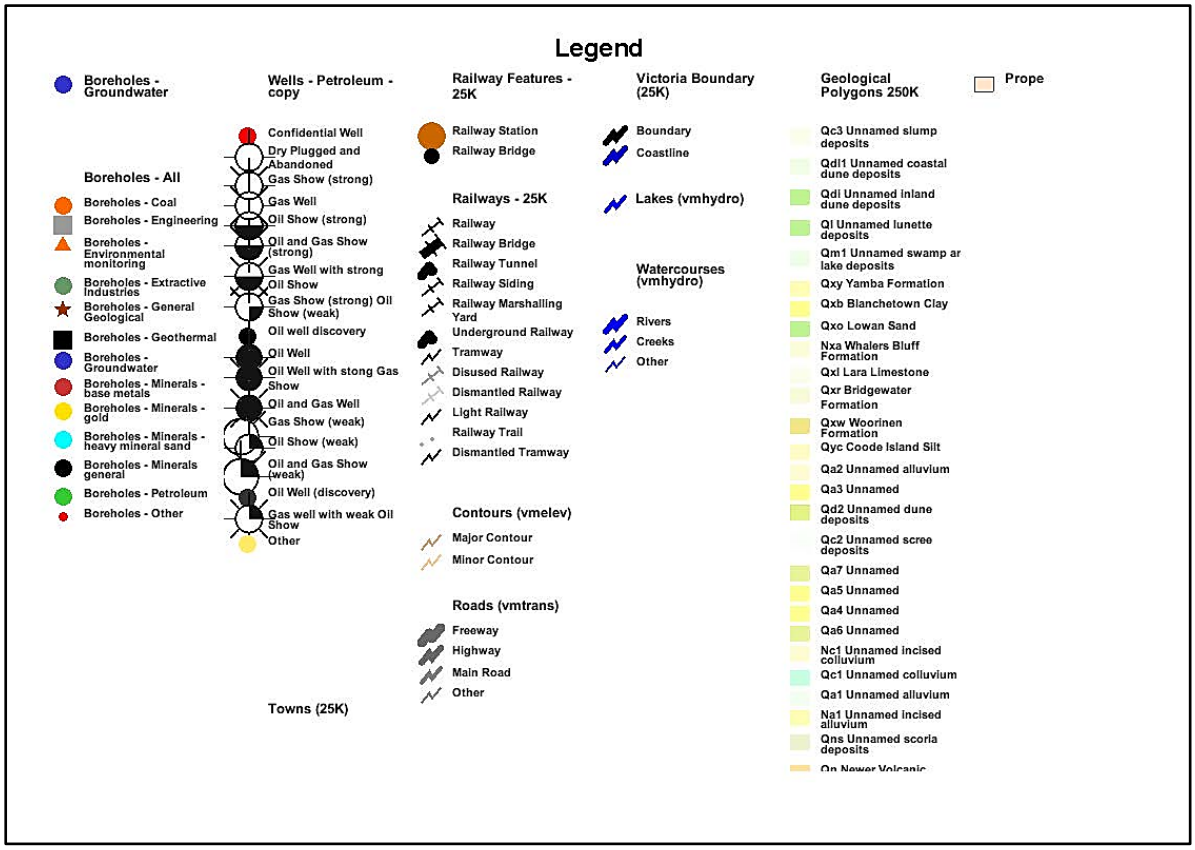
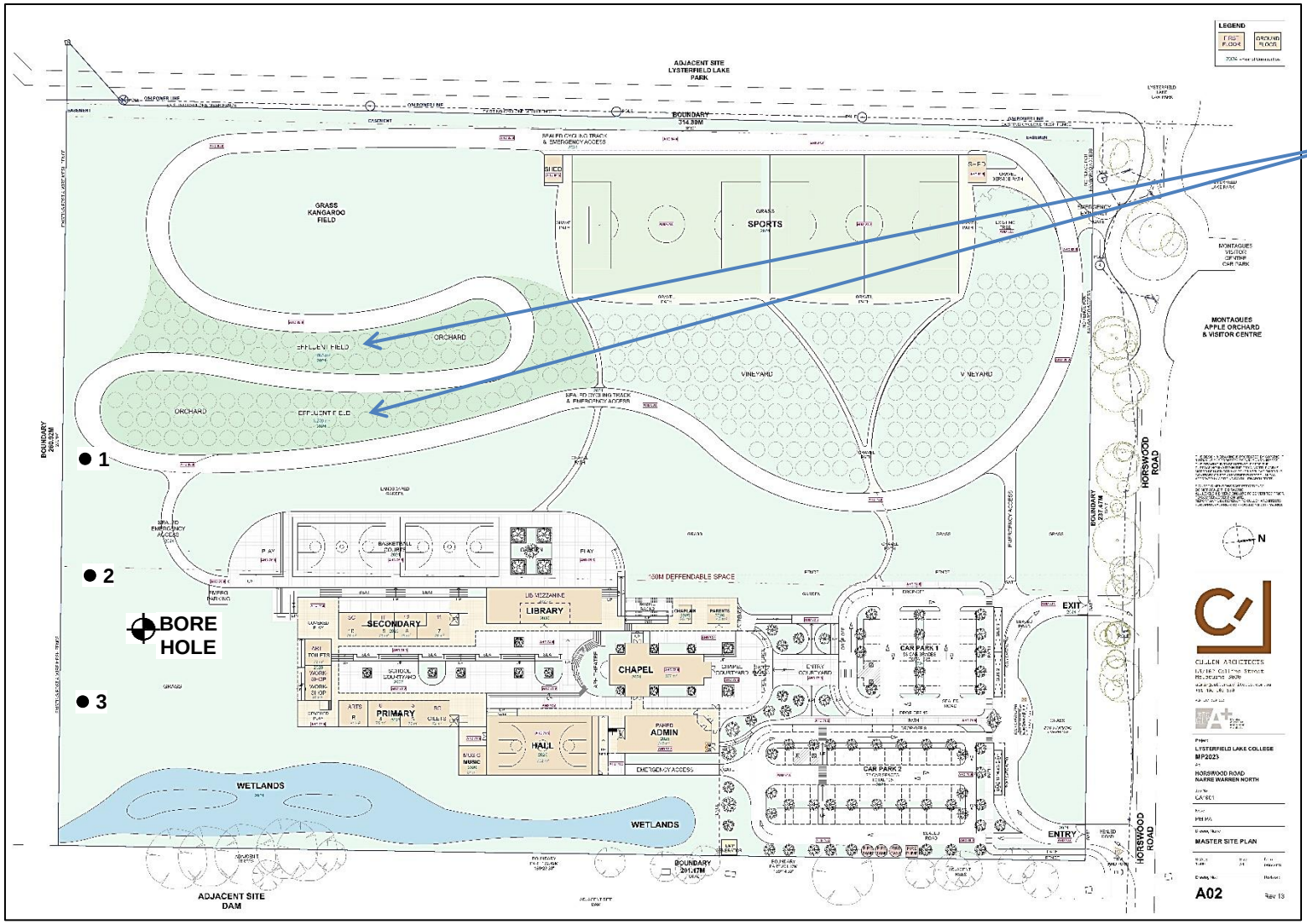


Figure 2 – Site Plan



Denotes Bore Hole

Denotes Test Holes

Proposed Wastewater Envelope Location and Treatment System to be Determined by Applicant/Developer Prior to Authority Approval

NOT TO SCALE

SITE FEATURES	
Climate	Average annual rainfall 921.4mm
Flood Potential	The site is not prone to flooding and is located outside of the floodway and land subject to inundation overlay
Vegetation	Pasture grasses. Surrounding areas contained native trees.
Water Table	No free groundwater table was encountered in the investigation. Groundwater maps of the area suggest the groundwater is 5 to 50 metres depth.
Exposure	Open
Slope	Gentle slope down to the east (2-8%)
Landform	Low hills 30-90m
Approximation to water course	>60m to existing dams located on the south and east side neighbouring properties >60m to proposed wetlands located on the east side of the site >200m to Lysterfield Lake situated to the west.
Erosion Potential	Low due to gentle slope and good ground cover
Surface Drainage	Moderately well drained due to sandy upper soils
Land Area	Approximately 8ha
Rocks and Rock Outcrop	Nil
Geology	Devonian Granodiorite & Granite - CLAYS

2.2 Table - Site Features

There are no critical issues identified above however required setback distances from existing water bodies needs to be considered..

3. SOIL ASSESSMENT AND CONSTRAINTS:

3.1 Published Soils Information

These soils are best described as yellow duplex soils using the Australian Soil Classification. They have derived from the weathering of Granodiorite.

3.2 Site Exposure

A general assessment of the site exposure is as follows:

The site is exposed to prevailing winds. The proposed effluent disposal area is generally exposed to sun and wind all year round.

3.3 Soil Assessment

BORE HOLE	**SAMPLE DEPTH:** 300mm	
SOIL ASSESSMENT (AS1547-2012)	**SOIL HORIZON:** A	
Soil Colour	Grey mottled orange	
Soil Texture	Sandy clay loam	
Coarse Fragments (%)	-	
Soil Structure	High/moderate structured	
Soil Dispersion	Class 2	
Soil Permeability	0.5-1.5m/day	
Soil Category	4	
Design Irrigation Rate	3.5 mm/day	
pH 1:5 Ratio Electronic Method	7.7	
Electrical Conductivity	019µS/cm	/1000 = 0.019dS/m
Salinity Hazard	Non saline – Class 1	

BORE HOLE	**SAMPLE DEPTH:** 600mm	
SOIL ASSESSMENT (AS1547-2012)	**SOIL HORIZON:** B	
Soil Colour	Grey mottled brown orange	
Soil Texture	Sandy clay	
Coarse Fragments (%)	-	
Soil Structure	High/moderate structured	
Soil Dispersion	Class 2	
Soil Permeability	0.12 – 0.5m/day	
Soil Category	4	
Design Loading Rate	5.0 mm/day	
pH 1:5 Ratio Electronic Method	8.0	
Electrical Conductivity	016µS/cm	/1000 = 0.016dS/m
Salinity Hazard	Non saline – Class 1	

4. FIELD ASSESSED PERMEABILITY:

An investigation on the soil profile was assessed in-situ and permeability testing conducted as outlined in AS 1547-2012 using the constant-head test method. The constant-head test was conducted in four locations across the site (see plan, Figure 2). The field assessed permeability was calculated using the Talsma-Hallam constantly maintained head of water equation identified in AS 1547-2012.

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

Where:
K_{sat} = saturated hydraulic conductivity of the soil in cm/min
4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation
Q = rate of loss of water from the reservoir in cm^3/min
H = depth of water in the test hole in cm
r = radius of the test hole in cm.

CONSTANT HEAD PERMEABILITY	
Rate of loss of water from reservoir (Q)	23.01 cm^3/min
Saturated hydraulic conductivity (K_{sat})	0.0125 cm/min
Indicative permeability (K_{sat})	0.18 m/day

Note: The results in the table above are based on average readings taken from the test holes.

Based on the soil assessment and field assessed permeability, category 5a (strongly structured light clay) in accordance to EPA Onsite Wastewater Management – Code of Practice Publication No. 891.4 July 2016 Appendix A Table 9 has been adopted at this site. Therefore a maximum Design Irrigation Rate of 3.0mm/day has been adopted.

The silty and sandy clay soils will control effluent seepage rates with respect to determining a sustainable hydraulic loading rate. Specifically, modelled peak deep seepage is taken as being less than 12% of the indicative permeability. Seepage Loss – Peak of 20mm/day has been adopted.

5. LAND CAPABILITY ASSESSMENT MATRIX:

The table below is a Land Capability Assessment (LCA) matrix. The LCA has been developed for the whole site, however soils information relates to soils within the vicinity of the building envelope.

Table 3: Risk Assessment of Site Characteristics

Characteristic	Level of Constraint			Assessed Level of Constraint for Site
	Nil or Minor	**Moderate**	**Major**	
Aspect (affects solar radiation received)	North / North-East / North-West	East / West / South-East / South-West	South	Minor
Climate (difference between annual rainfall and pan evaporation)	Excess of evaporation over rainfall in the wettest months	Rainfall approximates to evaporation	Excess of rainfall over evaporation in the wettest months	Major
Erosion (or potential for erosion)	Nil or minor	Moderate	Severe	Minor
Exposure to sun and wind	Full sun and/or high wind or minimal shading	Dappled light	Limited patches of light and little wind to heavily shaded all day	Minor
Fill (imported)	No fill or minimal fill, or fill is good quality topsoil	Moderate coverage and fill is good quality	Extensive poor quality fill and variable quality fill	Ni
Flood frequency (ARI)	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	Nil
Groundwater bores	No bores onsite or on neighbouring properties	Setback distance from bore complies with requirements in EPA Code of Practice 891.4 (as amended)	Setback distance from bore does not comply with requirements in EPA Code of Practice 891.4 (as amended)	Nil
Land area available for LAA	Exceeds LAA and duplicate LAA and buffer distance requirements	Meets LAA and duplicate LAA and buffer distance requirements	Insufficient area for LAA	Nil
Landslip (or landslip potential)	Nil	Minor to moderate	High or Severe	Nil
Rock outcrops (% of surface)	<10%	10-20%	>20%	Nil
Slope Form (affects water shedding ability)	Convex or divergent side-slopes	Straight side-slopes	Concave or convergent side-slopes	Nil
Slope gradient (%)				
(a) for absorption trenches and beds	<6%	6-15%	>15%	Moderate
(b) for surface irrigation	<6%	6-10%	>10%	Moderate
(c) for subsurface irrigation	<10%	10-30%	>30%	Minor

Table 3: Risk Assessment of Site Characteristics						
Characteristic	**Level of Constraint**					**Assessed Level of Constraint for Site**
	Nil or Minor		**Moderate**	**Major**		
Soil Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season		Some signs or likelihood of dampness	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface, soil pit fills with water		Minor
Stormwater run-on	Low likelihood of stormwater run-on			High likelihood of inundation by stormwater run-on		Nil
Surface waters - setback distance (m)	Setback distance complies with requirements in EPA Code of Practice 891.4 (as amended)			Setback distance does not comply with requirements in EPA Code of Practice 891.4 (as amended)		Nil
Vegetation coverage over the site	Plentiful vegetation with healthy growth and good potential for nutrient uptake		Limited variety of vegetation	Sparse vegetation or no vegetation		Minor
Characteristic	**Level of Constraint**					**Assessed Level of Constraint for Site**
	Nil or Minor		**Moderate**	**Major**		
Soil Drainage (Field Handbook definitions)	Rapidly drained. Water removed from soil rapidly in relation to supply, excess water flows downward rapidly. No horizon remains wet for more than a few hours after addition	Well drained. Water removed from the soil readily, excess flows downward. Some horizons may remain wet for several days after addition	Moderately well drained. Water removed somewhat slowly in relation to supply, some horizons may remain wet for a week or more after addition	Imperfectly drained. Water removed very slowly in relation to supply, seasonal ponding, all horizons wet for periods of several months, some mottling	Poorly/Very poorly drained. Water remains at or near the surface for most of the year, strong greying. All horizons wet for several months	Minor

Legend:

- Nil or Minor: If all constraints are minor, conventional/standard designs are generally satisfactory.
- Moderate: For each moderate constraint an appropriate design modification over and above that of a standard design, should be outlined.
- Major: Any major constraint might prove an impediment to successful on-site wastewater management, or alternatively will require in-depth investigation and incorporation of sophisticated mitigation measures in the design to permit compliant onsite wastewater management.

The above risk assessment indicates conventional/standard designs are satisfactory at this site

The table below is a Land Capability Assessment of general and soil characteristics of the site.

Land Features	Land Capability Class Rating					Site Rating	Comments
	Very Good (1)	**Good (2)**	**Fair (3)**	**Poor (4)**	**Very Poor (5)**		
Groundwater table (m) seasonal watertable depth	>5.0	2.5 – 5.0	2.0 – 2.5	1.5 – 2.0	<1.5	1†	No free groundwater table was encountered in the investigation. Groundwater maps of the area suggest the groundwater is 5 to 50 metres depth.
Exposure	High sun and wind exposure		Moderate	Low sun and wind exposure		1	Open
Vegetation Type (land application area)	Turf or pasture				Dense Forest	1	Pasture grasses. Surrounding areas contained native trees.
Rainfall (mm/yr)[2]	<450	450 - 650	650 – 750	750 - 1000	>1000	4	921.5 mm/year
Pan evaporation (mm/yr)[3]	>1500	1250 - 1500	1000 – 1250	-	<1000	3	1197 mm/year
Profile depth	>2.0m	1.5–2.0m	-	1.0–1.5m	<1.0m	1	Deep soil profile
Shrinkage* (%)	Low <4%	Moderate 4-12%	High 12-20%	Very High >20%		1	Low reactive SAND and silty CLAY
Permeability* (m/d)	0.15–0.30	0.08–0.15 0.30-0.60	0.06-0.08 0.60-1.50	- 1.50-2.00	<0.06 >2.00	1	0.18 m/day
Soil Permeability Category [1]	2 and 3	4		5	1 and 6	4	5a
Emerson Test* (dispersion / slaking)	4,6,8	5	7	2,3	1	4	Class 2 (Some dispersion)
Electrical Conductivity (Ece) (dS/m)	<0.3	0.3-0.8	0.8-2.0	2.0-4.0	>4.0	1	Non saline
pH	6-8		4.5-6		<4.5, >8	3	Slightly alkaline

[1] Source: AS1547-2012
[2] Source BOM station – Cranbourne South
[3] Source BOM station – Cranbourne Botanic Gardens
* Relevant to soil layer(s) associated with wastewater application
† No water table was encountered while drilling the Bore Hole (see engineering log).

6. THE MANAGEMENT PROGRAM:

The following sections provide an overview of our preferred system and the sizing and design considerations that are involved with the system.

6.1 Treatment System

Based on the land capability assessment, the following system is recommended at this site. That is:

6.1.1 Subsurface Drip Irrigation

Primary treatment by septic or vermiculture treatment plus secondary treatment of all wastewaters by either aerated wastewater treatment system, sand filter, reed bed, or similar. Dispose to land via subsurface drip irrigation.

6.2 Land Applications Areas

6.2.1 Suitable Land Application Systems

A daily wastewater output of 4400L/day was assumed.

The following wastewater envelopes are required with regard to the preferred option:

Subsurface Irrigation Based on Design Irrigation Rate (DIR) of up to 3.0mm/day

Primary treatment by septic or vermiculture treatment plus secondary treatment of all wastewater by either aerated wastewater treatment system, sand filter, reed bed, or similar. Dispose to land via subsurface drip irrigation based on the maximum of the DIR and the water and nutrient balance calculation methods (Appendix B):

- Subsurface irrigation field area based on DIR only: 1466.70m^2
- Subsurface irrigation field area based on water and nutrient balance: 1433.9m^2

  Therefore, maximum results of two methods adopted:

- 1466.70m^2 of subsurface irrigation

Pipes and emitters installed generally at a depth of 100mm to 150mm below ground level.

6.3 Siting and Configuration

Civiltest Pty. Ltd. considers the wastewater envelope area marked on **Figure 2 - Site Plan** to be suitable for wastewater disposal. Set back requirements (see **Appendix C: Buffer Distances**) must be taken into consideration.

6.4 Monitoring, Operation and Maintenance

The requirements of the permit should be adopted and followed. In addition to any other requirements it is required that:

- The septic tank is de-sludged every 3 years

To ensure the AWTS system functions adequately residents must:

- Have a suitably qualified maintenance contractor service the AWTS every three months, as required by Council under the approval to operate.

The requirements of Standards Australia 2008, AS/NZS 1546.3: *On-site domestic wastewater treatment units - Part 3: Aerated wastewater treatment systems.*

This requires:

- The wastewater quality meets:
- BOD 20mg/L
- Suspended Solids 30mg/L
- Faecal Coliforms organisms /100ml <10
- Free residual chlorine <2mg/L
- The irrigation area must be a permanent dedicated area within the premises
- The dedicated irrigation area must be cultivated to a depth 100mm, either planted with grasses or salt tolerant plants or mulched.

The irrigation lines may be laid around existing vegetation however, lines must be covered a minimum of 150mm with quality topsoil.

To ensure the treatment systems function adequately, residents must:

- Use household cleaning products sparingly and check that they are suitable for septic tanks.
- Keep as much fat and oil out of the system as possible; and
- Conserve water.

6.5 Storm Water Management

All stormwater must be disposed of to the legal point of discharge.

Note: An agricultural (AG) drain must be installed on the high side of the wastewater envelope. The drain is to be installed a minimum of 100mm into the naturally occurring CLAY soils and allow sufficient fall to intercept and drain all overland and subsurface run-off to a legal point of discharge. If a legal point of discharge cannot be obtained, the drainage line may discharge directly to the surface soils, a minimum distance of 10 metres beyond the wastewater disposal area.

7. CONCLUSIONS:

From this investigation it is concluded that the use of an on-site wastewater treatment and disposal system is environmentally sustainable if the recommendations made in this report are followed.

The following should also be noted:

- Installation of 3 star rated water fixtures to reduce water use and wastewater loadings.
- Use of low phosphorus and low sodium (liquid) detergents to improve effluent quality and maintain beneficial uses of groundwater.
- Operation and maintenance of treatment and disposal systems in accordance with the manufacturer's recommendations and the recommendations made in this report.

8. REFERENCES:

- Environmental Protection Authority – Guidelines for Environmental Management Code of Practice – Onsite Wastewater Management, July 2016 ~ Publication 891.4
- Municipal Association Victoria (MAV) 2006, Model Land Capability Assessment Report
- The Victorian Land Capability Assessment Framework (2nd Edition 2014)
- Australian/New Zealand Standard AS/NZS 1547-2012 – On-site domestic wastewater management.
- Civiltest Pty Ltd - Field and Laboratory data (where applicable) collected and recorded.
- Environmental Protection Authority - "Code of Practice - Septic Tanks", March 1996" ~ Publication 451.
- Environmental Protection Authority, Information Bulletin- "Land Capability Assessment for onsite Domestic Wastewater Management", March 2003 ~ Publication 746.1.
- Standards Australia 2008, AS/NZS 1546.1: *On-site domestic wastewater treatment units – Part 1: Septic Tanks.*
- Standards Australia 2008, AS/NZS 1546.3: *On-site domestic wastewater treatment units – Part 3: Aerated wastewater treatment systems.*

This report consists of twenty-three pages, including three appendices.

LIAM COX
SENIOR GEOTECHNICAL ENGINEER
CIVILTEST PTY LTD

Ref: MR/DO/SH/*lc*/mg/*sb*

30 May 2023

AMENDMENT: *This report was first issued on 01 November 2019. Sections of this report were amended on 04 May 2023 and 30 May 2023, and consequently this revised report now takes precedence over any previously dated report.*

9. QUALIFICATIONS AND EXPERIENCE:

QUALIFICATIONS AND EXPERIENCE	
Land Capability Assessor	• Liam Cox
Qualifications	• Monash University – BEng (Civil & Env) Hons • Centre for Environmental Training – Land Capability Assessment for On-site Wastewater Management • MIEAust CPEng NER
Experience	• Providing Land Capability Assessments within Victoria and NSW for over 3 years. • Completed approved Land Capability Assessments for the follow Councils: o Albury City Council o Alpine Shire o Ararat Rural City Council o Bass Coast Shire Council o Baw Baw Shire o Benalla Rural City Council o Broken Hill City Council o Buloke Shire o Campaspe Shire Council o Cardinia Shire o Chiltern District Council o City of Casey o City of Greater Dandenong o Colac Otway Shire Council o Corangamite Shire o Federation Council o Golden Plains Shire o Greater Hume Council o Indigo Shire Council o Mansfield Council o Mildura Rural City Council o Mornington Peninsula Shire o Rural City of Wangaratta o South Gippsland Shire Council o Strathbogie Shire o Surf Coast Shire o Swan Hill Rural City Council o Wentworth Shire Council o Yarra Ranges Council
Professional Membership	• Member Engineers Australia (MIEAust) • Chartered Practising Engineer (CPEng) • National Engineering Register (NER) • Australian Geomechanics Society (AGS) • Footings and Foundations Society Victoria (FFSV)
Professional Indemnity Insurance	• Provider: Procover • Cover: Not less than $5.0 million • Expiry: 30/06/23

APPENDIX A: SOIL PROFILE AND CONDITION

The natural soil profile in the borehole consisted of brown silty SAND with clay overlying brown mottled orange grey red silty CLAY with sand, followed by pale grey mottled brown red orange silty CLAY.

The table below represents the engineering log of the bore hole obtained during mechanical augering at the approximate location as shown on the attached plan.

Bore Hole Depth (m)	**Classification**	**Shear Vane Strength kPa**	**Engineering Log**
0.500			SAND, silty with clay Brown Moist Medium dense
1.300			CLAY, silty with sand Brown mottled orange grey red Moist, Firm Becomes stiff at 0.900
3.000			CLAY, silty Pale grey mottled brown red orange Moist Stiff Becoming pale grey red mottled brown at 2.200
			END OF BORE (11/10/19)

APPENDIX B: WATER BALANCE

Irrigation Sizing

Owner/Applicant: **Pared Vic T/A Harkaway Hills College** **Date: 1 May 2023**
Site Address: **Lysterfield Lake College, 19-23 Horswood Road NARRE WARREN NORTH**
Notes:

FORMULA FOR SUBSURFACE IRRIGATION SIZING				**NOTES**
B = Q/DIR				From AS/NZS 1547:2012
Where:	Units			
B = Irrigation area	m^2			
Q = Design Wastewater Flow	L/day			
DIR = Design Irrigaion Rate	mm/day			

INPUT DATA			**NOTES**	
Design Wastewater Flow	Q	4400	L/day	
Design Irrigation Rate	DIR	3	mm/day	

OUTPUT			**NOTES**	
Irrigation area required	B	1466.7	m^2	

WATER/NITROGEN BALANCE (20/30 irrigation): With no wet month storage

Rainfall Station:	Scoresby Research Institute
Evaporation Station:	Scoresby Research Institute
Site Location:	Lysterfield Lake College, 19-23 Horswood Road NARRE WARREN NORTH
Date:	1-May-23
Owner/Applicant:	Pared Vic T/A Harkaway Hills College

ITEM		UNIT	#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YEAR
Days in month		mm	A	31	28	31	30	31	30	31	31	30	31	30	31	365
Evaporation (Daily Mean)		mm	A1	5.6	5.5	4	2.7	1.7	1.3	1.4	1.9	2.6	3.4	4.4	5	3.291667
Evaporation (monthly Mean)		mm	A2	173.6	154	124	81	52.7	39	43.4	58.9	78	105.4	132	155	1197
Rainfall (Mean)		mm	B	53.4	51.7	53.4	69	86.2	69.9	72.1	80	81.5	85	82.1	74.2	858.5
Rainfall (9th Decile)		mm	B1	95.3	107	84.7	113	138	105.6	106.1	115	126.5	148.7	146.1	142.4	1428.4
Effective rainfall		mm	B2	95.3	107	84.7	113	138	105.6	106.1	115	126.5	148.7	146.1	142.4	1428.4
Peak seepage Loss		mm	B3	620	560	620	600	620	600	620	620	600	620	600	620	7300
Evapotranspiration (J x A2)		mm	C1	138.88	123.20	86.80	56.70	31.62	23.40	26.04	35.34	54.60	84.32	105.60	124.00	890.50
Waste Loading (C1+B3-B2)		mm	C2	663.58	576.20	622.10	543.70	513.62	517.80	539.94	540.34	528.10	555.62	559.50	601.60	6762.10
Net evaporation from lagoons		L	D	0	0	0	0	0	0	0	0	0	0	0	0	0
(10(0.8A-B1xlagoon area(ha)))																
Volume of Wastewater		L	E	136400	123200	136400	132000	136400	132000	136400	136400	132000	136400	132000	136400	1606000
Total Irrigation Water (E-D)/G		mm	F	513.62	463.91	513.62	497.05	513.62	497.05	513.62	513.62	497.05	513.62	497.05	513.62	6047.46
Total Irrigation Area (E/C2) annual		m2	G	205.6	213.8	219.3	242.8	265.6	254.9	252.6	252.4	250.0	245.5	235.9	226.7	**265.6**
Surcharge		mm	H	-149.96	-112.29	-108.48	-46.65	0.00	-20.75	-26.32	-26.72	-31.05	-42.00	-62.45	-87.98	-714.639
Actual Seepage Loss		mm	I	470.04	447.71	511.52	553.35	620.00	579.25	593.68	593.28	568.95	578.00	537.55	532.02	6585.361
Direct Crop Coefficient			J	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.8	

Rainfall Retained	100	%	K
Lagoon Area	0	ha	L
Wastewater (Irrigation)	4400	L	M
Seepage Loss (Peak)	**20**	mm	N
Irrigation Area (No storage)	**265.6**	m^2	O
Actual Application Rate	**16.568387**	mm	P
Nitrogen in Effluent	25	mg/L	Q
Denitrification Rate	35	%	R
Plant Uptake	280	kg/ha/yr	S
Mean daily seepage loss	18.042086	mm	T
Annual N load	40.15	kg/yr	U
Area for N uptake	**1433.9**	m^2	V
Actual Application Rate	3.1	mm	W

APPENDIX C: SETBACK DISTANCES

Extract from EPA Code of practice – Onsite Wastewater Management, Table 5:

Landscape feature or structure	Setback distances (m)		
	Primary sewage and greywater systems	Secondary sewage and greywater systems	Advanced secondary greywater systems [3]
Building			
Wastewater field up-slope of building 7	6	3	3
Wastewater field down-slope of building	3	1.5	1.5
Wastewater up-slope of cutting/escarpment 12	15	15	15
Allotment boundary			
Wastewater field up-slope of adjacent lot	6	3	1
Wastewater field down-slope of adjacent lot	3	1.5	0.5
Services			
Water supply pipe	3	1.5	1.5
Wastewater up-slope of potable supply channel	300	150	150
Wastewater field down-slope of potable supply channel	20	10	10
Gas supply pipe	3	1.5	1.5
In-ground water tank 14	15	7.5	3
Stormwater drain	6	3	2
Recreation areas			
Children's grassed playground 15	6	3 16	2 16
In-ground swimming pool	6	3 16	2 16
Surface waters (up-slope of:)			
Dam, lake or reservoir (potable water supply) 8, 13	300	300 4	150
Waterways (potable water supply) 9, 13	100	100 4, 5, 17	50
Waterways, wetlands (continuous or ephemeral, non-potable); estuaries, ocean beach at high-tide mark; dams, reservoirs or lakes (stock and domestic, non-potable) 8, 9	60	30	30
Groundwater bores			
Category 1 and 2a soils	NA11	5019,	20
Category 2b to 6 soils	20	20	20
Watertable			
Vertical depth from base of trench to the highest seasonal water table 18	1.5	1.5	1.5
Vertical depth from irrigation pipes to the highest seasonal water table 18	NA	1.5	1.5

1. Distances must be measured horizontally from the external wall of the treatment system and the boundary of the disposal/irrigation area, except for the 'Watertable' category which is measured vertically through the soil profile. For surface waters, the measuring point shall be from the 'bank-full level'.
2. Primary water-based sewerage systems must only be installed in unsewered areas; secondary sewerage systems must only be installed and managed in sewered areas by Water Corporations; secondary greywater systems can be installed in sewered and unsewered areas.
3. Advanced secondary greywater systems treating effluent to ≤10/10/10 standard.

4. The setback distance in a Special Water Supply Catchment area may be reduced by up to a maximum of 50% conditional on the following requirements (otherwise the setback distances for primary treatment systems apply):

   • effluent is secondary treated to 20/30 standard as a minimum

   • a maintenance and service contract, with a service technician accredited by the manufacturer, is in place to ensure the system is regularly serviced in accordance with Council Septic Tank Permit conditions and

   • Council is satisfied the reduction in set-back distance is necessary to permit the appropriate development of the site and that risks to public health and the environment are minimised.

5. Effluent typically contains high levels of nutrients that may have a negative impact on native vegetation and promote the growth of weeds. When determining setbacks, Council should consider not only the potential impact of nutrients from the proposed onsite wastewater management system, but the cumulative impact of the existing onsite wastewater management systems in the area.
6. Establishing an effluent disposal/irrigation area upslope of a building may have implications for the structural integrity of the building.
7. Does not apply to dams, lakes and reservoirs located above ground-level which cannot receive run-off.
8. Means a waterway as defined in the Water Act 1989.
9. The setback distances for flat land are equivalent to 'down-slope' setback distances.
11. A cutting or escarpment from which water is likely to emanate.
12. Applies to land, adjacent to a dam, lake, reservoir or waterway that provides water for a public potable water supply, which is:

    a. subject to a Planning Scheme Environmental Significant Overlay (ESO) that designates maintenance of water quality as the environmental objective to be achieved (contact the relevant Water Authority to determine whether the ESO is in a potable water supply catchment)

    and/or

    b. within a Special Water Supply Catchment Area listed in Schedule 5 of the Catchment and Land Protection Act 1994.

Note: There is no 13. in source document

14. It is recommended that any primary or secondary treatment system and its associated land application system are installed downslope of an in-ground water tank.
15. Means a school, council, community or other children's grassed playground managed by an organisation which may contain play equipment (but does not mean a sports field).
16. Sub-surface irrigation only.
17. Where an intermittent stream on a topographic or orthographic map is found through ground-truthing to be a drainage line (drainage depression) with no defined banks and the bed is not incised, the setback distance is 40 m (SCA 2010). The topography of the drainage line must be visually inspected and photographed during the LCA site inspection and reported upon in writing and photographs in the LCA report.
18. The highest seasonal watertable occurs when the watertable has risen up through the soil profile and is closest to the ground surface. This usually occurs in the wettest months of the year.
19. The setback distance to a groundwater bore in Category 1 and 2a soils can be reduced to 20m where treated and disinfected greywater or sewage (20/30/10 or better standard) is applied and the property owner has a service contract with an appropriately qualified technician to regularly maintain the treatment system.