



strata
geoscience and environmental

**Limited Scope Reconnaissance Land Capability Assessment and Onsite
Wastewater System Concept Design for**

**Proposed Staged Subdivision
Maffra Briagolong Road
Maffra**

June 2026

**APPROVED DEVELOPMENT PLAN
PLANNING AND ENVIRONMENT ACT 1987
WELLINGTON PLANNING SCHEME
Clause 43.04 Schedule 1**

DP NAME: DPO1 - Maffra North

DATE: 15 June 2026

SIGNED: Caragh Button

OFFICER TITLE: Strategic Planner

(Page: 1 of 85)

Report Details

Table 1: Site, Client, Author and Report Details	
Address	Maffra-Briagolong Road Maffra
Nature of Proposed Development	Proposed Staged Subdivision
Client	Beveridge Williams
Author	MEngSc CPSS
Report Number	SR04901v2
Report Date	4/06/2026

Table 2: Copies Recipient	
1 PDF	
1 PDF	Strata Geoscience and Environmental Project File

Table of Contents

Executive Summary	4
1. Introduction, Guidelines and Standards Referenced	6
2. Description of the Development.....	6
3. Site Plans and Key Site Features	7
4. Soil Assessment and Constraints	15
4.1 Site Geology.....	15
4.2 Field Investigation	16
5. Land Capability Assessment Matrix.....	20
5.1 Assessment Matrix.....	20
5.2 LCA Conclusions	26
5.3 Risk Mitigation and Design Implications	26
6. Proposed Onsite Wastewater System Design	27
6.1 General System Recommendations	27
6.2 Onsite Wastewater Flow and Land Application Area Modelling.....	27
6.2.1 Water Balance and Land Application Area Modelling.....	27
6.2.2 Nutrient Balance and Land Application Area Modelling	27
6.2.3 Alternative Land Application Area Modelling	28
6.3 System Concept Design	28
6.3.1 Treatment System	28
6.3.2 Land Application Areas	28
6.3.3 Provision of Adequate Setback Distances and Relevance of Reserve Provision	29
6.4 System Risk Management.....	29
6.5 System Management and Maintenance	31
6.5.1 Servicing	32
6.5.2 Monitoring	32
6.5.3 Effluent Quality Objectives	33
6.5.4 Contingency Planning	33
7. Conclusions and Further Recommendations	35
8. References.....	37

Executive Summary

Beveridge Williams contracted Strata Geoscience and Environmental Pty Ltd to conduct a Reconnaissance Land Capability Assessment and Onsite Wastewater System Concept Design at a proposed subdivision on Maffra-Briagolong Road Maffra.

This report addresses the phased development of land located on Briagolong Road, Maffra, which will proceed in stages. The land identified within the Maffra Structure Plan as appropriate for increased density rural living development, subject to further investigation and preparation of technical reports.

The Site is currently zoned to facilitate subdivision into 23 rural living zoned lots with a nominated schedule of 2.0 hectares and is proposed to be developed through a coordinated three-phase planning process (staged):

- Phase 1: Preparation and approval of a Development Plan to establish the overall subdivision and servicing framework to address the requirements of the Development Plan Overlay Schedule 1.
- Phase 2: A planning permit application for the creation of 22 lots generally 6,000 m² in size, together with a balance lot, addressing the current requirements of the Rural Living Zone (Schedule 2).
- Phase 3: A Planning Scheme Amendment to the Wellington Planning Scheme to change the Zone Schedule and planning permit application to facilitate the subdivision of the balance land into 40 additional lots, also generally 6,000 m² in size. The stage proposes to delete the Development Plan Overlay applying to the land.

This report addresses all three phases (stages) of the development and considers both interim and ultimate development outcomes for the subject land.

The investigation consisted of desktop and field reconnaissance, laboratory testing, risk analysis, modelling and reporting.

Desktop and field investigation, combined with risk modelling found that the site has constraints associated with:

- Aspect
- Erosion
- Climate
- Vegetation Cover
- Soil Texture
- Emmerson
- Sodidity
- Soil Drainage

Given these findings, the following concept design recommendations are made:

- Treatment of all effluent generated onsite to a minimum of secondary levels
- Land application via subsurface irrigation scaled via water and nutrient balancing.
- Appropriate setbacks from all site boundaries, surface waters and bores.

Furthermore, all installed treatment plants should have a regular servicing contract in place between a qualified servicing agent and the property owner to further limit risk.

1. Introduction, Guidelines and Standards Referenced

Strata Geoscience and Environmental Pty Ltd was commissioned to perform a limited scope Land Capability Assessment for:

Table 3: Site and Client Details	
Client/Agent	Beveridge Williams
Site Address	Maffra-Briagolong Road Maffra (see Site Plan)
Nature of Development	Proposed staged Subdivision

The investigation was conducted based upon specific development plans supplied by the client (Figure 2) and with reference to the following documents:

1. EPA Victoria (2024) Code of Practice for Onsite Wastewater Management
2. Australian Standard AS1547-2012 Onsite Wastewater Management

The investigation also follows the principles outlined in:

1. 2006 MAV & DSE Model LCA Report
2. EPA Publication 746.4 Guidelines for Land Capability Assessment
3. MAV DEPI & EPA 2014 Land Capability Assessment Framework
4. AS1726-1993 Geotechnical Site Investigations.

2. Description of the Development

Table 4: Site Description	
Site Address	Maffra-Briagolong Road Maffra
Owner/Developer/Agent	Beveridge Williams
Address	As above
Council Area	Wellington
Zoning	RLZ
Min Proposed Allotment Size	6000 m ² approx.
Anticipated Wastewater Load	Up to 1080 L/D (See Section 6)
Availability of Sewer	Unsewered and likely to be unsewered in mid term

3. Site Plans and Key Site Features

A range of soil and landscape features were assessed for their potential to impact upon land application area siting and level of wastewater treatment required over the site. Figures 1-2 give locality and proposed site plans respectively whilst Table 5 summarises key features as in relation to effluent management over the site.

Figure 1 Locality Plan, Site Survey Plan (if available), Surface Water and Groundwater Bore Feature Plan

PROPERTY REPORT



Environment,
Land, Water
and Planning

From www.planning.vic.gov.au at 16 August 2022 10:01 AM

PROPERTY DETAILS

Address: **MAFFRA-BRIAGOLONG ROAD MAFFRA 3860**

Lot and Plan Number: **This property has 2 parcels. See table below**

Standard Parcel Identifier (SPI): **See table below**

Local Government Area (Council): **WELLINGTON** www.wellington.vic.gov.au

Council Property Number: **361360**

Directory Reference: **Vicroads 82 H8**

This property is in a designated bushfire prone area. Special bushfire construction requirements apply. Planning provisions may apply.

Further information about the building control system and building in bushfire prone areas can be found on the Victorian Building Authority website <https://www.vba.vic.gov.au>

SITE DIMENSIONS

All dimensions and areas are approximate. They may not agree with those shown on a title or plan.



Area: 478967 sq. m (47.90 ha)

Perimeter: 2822 m

For this property:

- Site boundaries
- Road frontages

Dimensions for individual parcels require a separate search, but dimensions for individual units are generally not available.

Calculating the area from the dimensions shown may give a different value to the area shown above

For more accurate dimensions get copy of plan at [Title and Property Certificates](#)

PARCEL DETAILS

The letter in the first column identifies the parcel in the diagram above

Lot/Plan or Crown Description	SPI
A Lot 1 TP533434	1\TP533434
B Lot 2 TP533434	2\TP533434

UTILITIES

Rural Water Corporation: **Southern Rural Water**

Urban Water Corporation: **Gippsland Water**

Melbourne Water: **Outside drainage boundary**

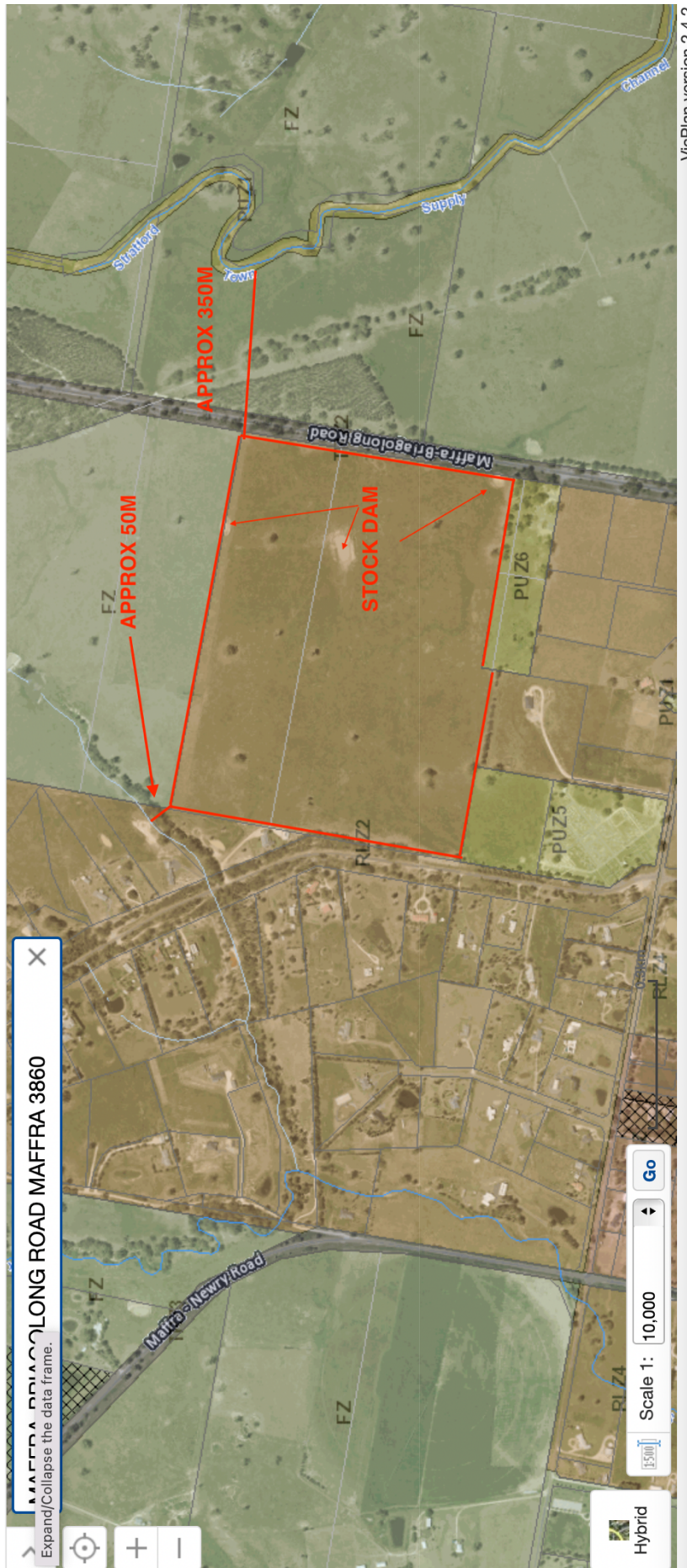
Power Distributor: **AUSNET**

STATE ELECTORATES

Legislative Council: **EASTERN VICTORIA**

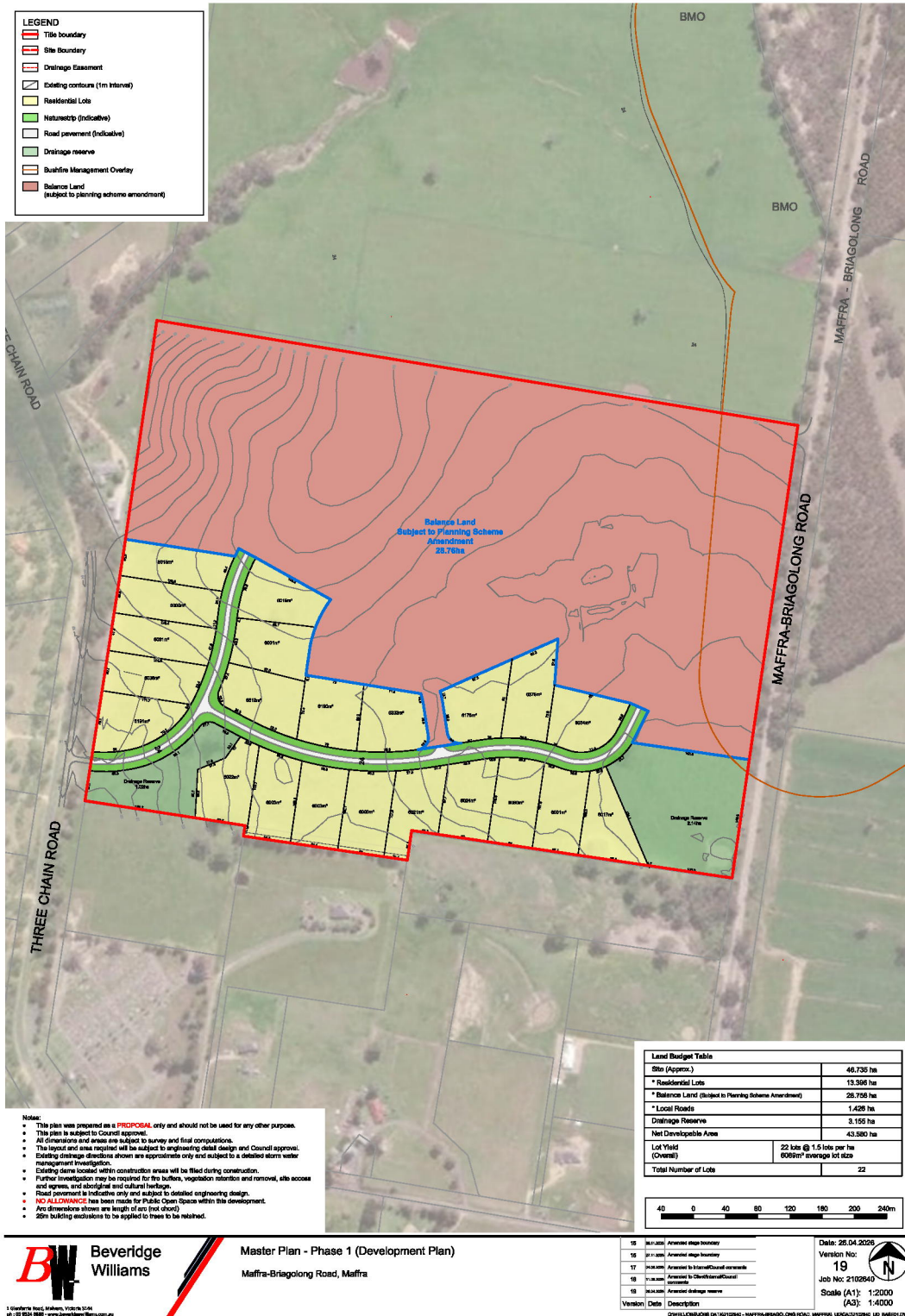
Legislative Assembly: **GIPPSLAND EAST**

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra

Figure 2 Proposed Staged Subdivision Plan



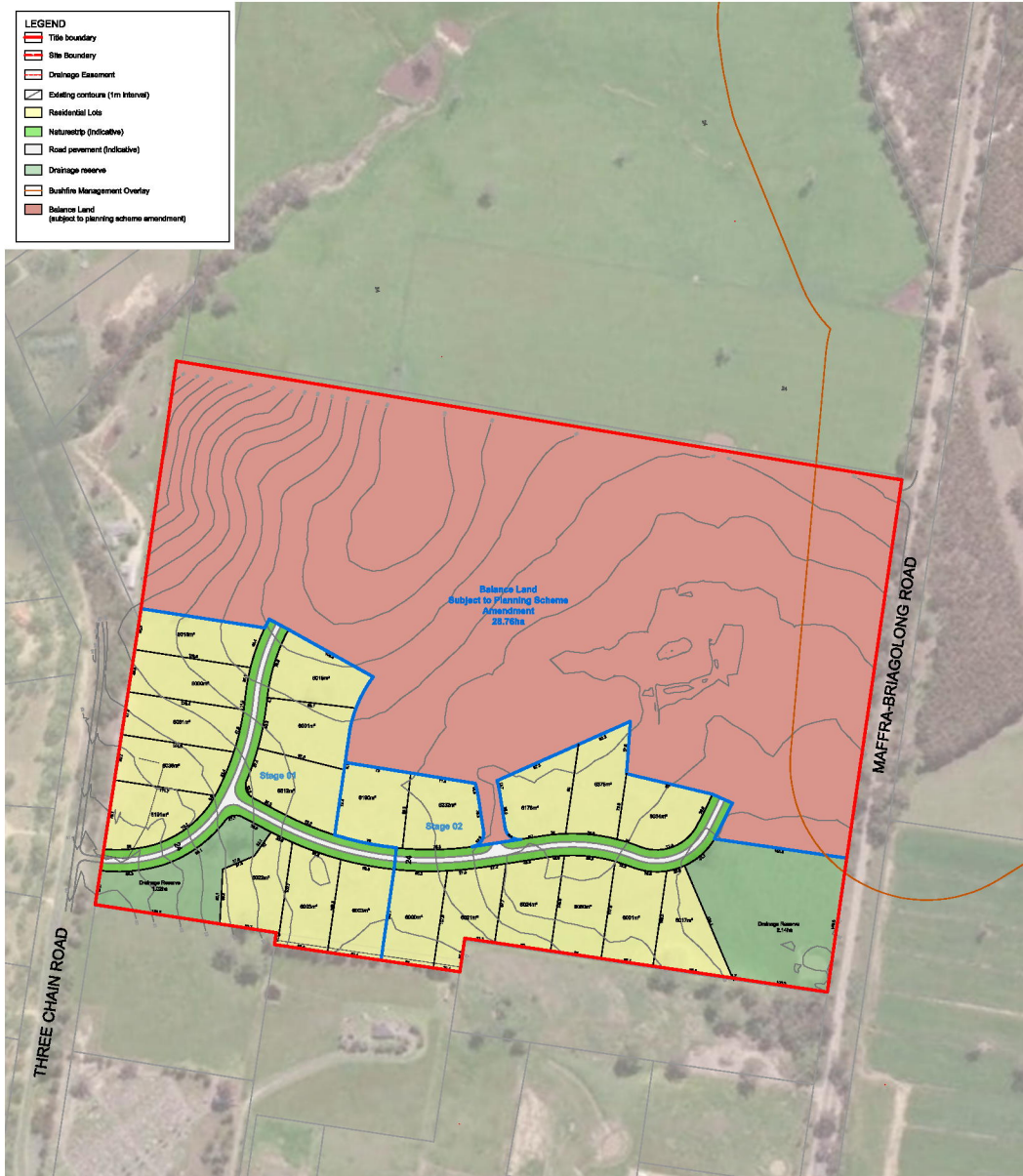
Master Plan - Phase 1 (Development Plan)
Maffra-Briagolong Road, Maffra

15	04.11.2024	Approved stage boundary
16	07.11.2024	Approved stage boundary
17	10.04.2025	Approved to Internal Council for works
18	11.04.2025	Approved to Council for Council
19	14.04.2025	Approved drainage reserve
Version	Date	Description
DRAWING NUMBER: DA17012504 - MAFFRABRIAGOLONG ROAD, MAFFRA, LOCAL GOVERNMENT OF MAFFRA		

Date: 26.04.2025
Version No: 19
Job No: 210254
Scale (A1): 1:2000
Scale (A3): 1:4000

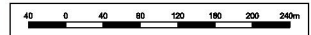
Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

LEGEND	
	Title boundary
	Site Boundary
	Drainage Easement
	Existing contours (1m intervals)
	Residential Lots
	Naturestrip (indicative)
	Road pavement (indicative)
	Drainage reserve
	Bushfire Management Overlay
	Balance Land (subject to planning scheme amendment)



- Notes:**
- This plan was prepared as a PROPOSAL only and should not be used for any other purpose.
 - This plan is subject to Council approval.
 - All dimensions and areas are subject to survey and final computations.
 - The layout and area required will be subject to engineering detail design and Council approval.
 - Existing drainage directions shown are approximates only and subject to a detailed storm water management investigation.
 - Existing dams located within construction areas will be filled during construction.
 - Further investigation may be required for the buffers, vegetation retention and removal, site access and signs, and Aboriginal and cultural heritage.
 - Road pavement is indicative only and subject to detailed engineering design.
 - NO ALLIANCE has been made for Public Open Space within this development.
 - Area showmarks shown are length of any (not shown)
 - Site building enclosures to be applied to those to be retained.

Land Budget Table	
Site (Approx.)	46.735 ha
* Residential Lots	13.388 ha
* Balance Land (Subject to Planning Scheme Amendment)	28.758 ha
* Local Roads	1.426 ha
Drainage Reserve	3.155 ha
Net Developable Area	43.500 ha
Lot Yield (Overall)	22 lots @ 1.5 lots per ha 6080m ² average lot size
Total Number of Lots	22



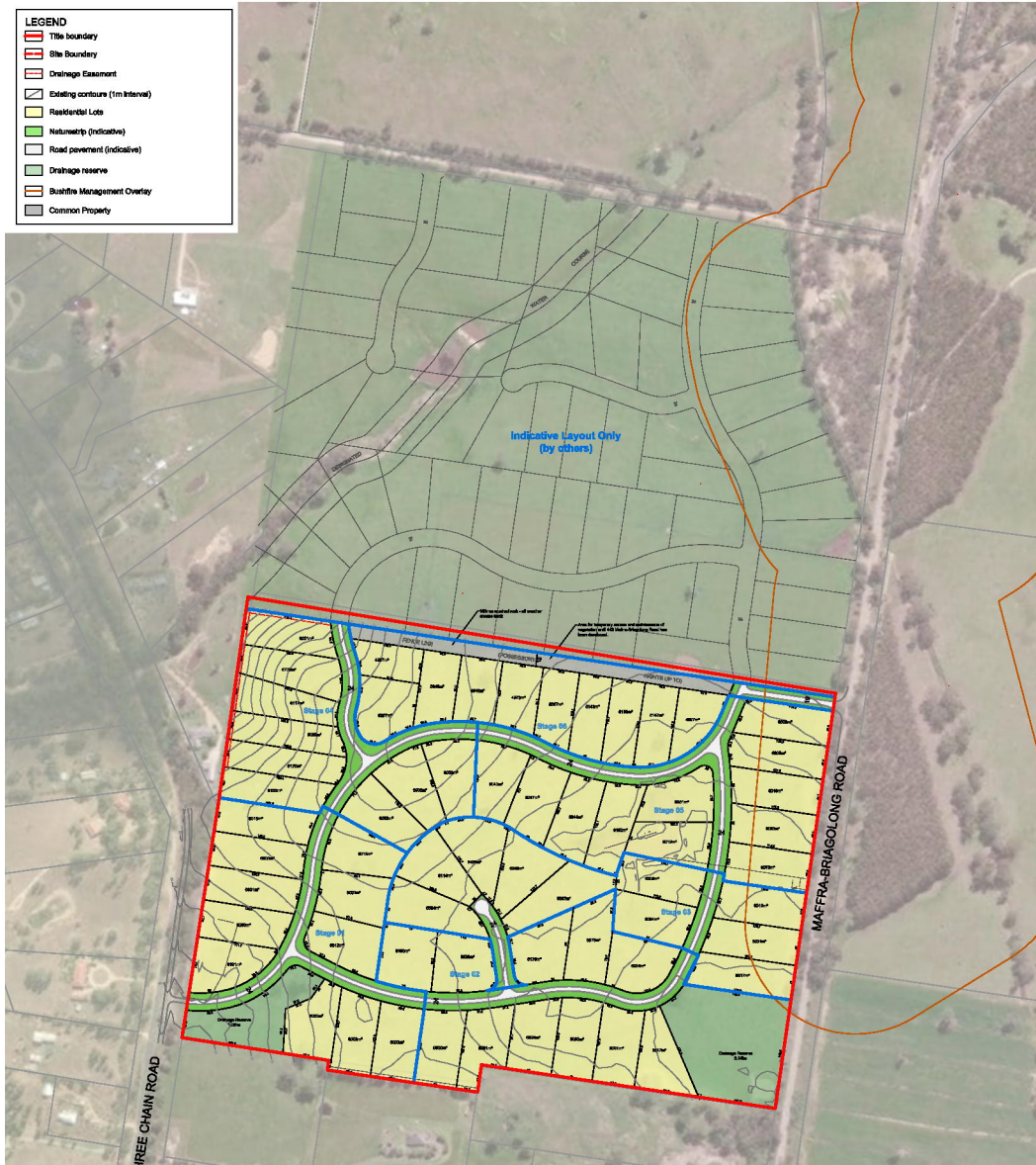
Master Plan - Phase 2 (Planning Permit Application for Stage 1 & 2)
Maffra-Briagolong Road Maffra

Version	Date	Description	Drafted	Approved
15	26.04.2026	Approved design boundary		
16	27.04.2026	Approved design boundary		
17	04.05.2026	Approved to Internal Council external		
18	11.05.2026	Approved to Council Council		
19	26.04.2026	Approved design review		

Date: 26.04.2026
 Version No: 19
 Job No: 2102640
 Scale (A1): 1:2000
 (A3): 1:4000

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

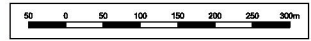
LEGEND	
	Title boundary
	Site Boundary
	Drainage Easement
	Existing contours (1m Interval)
	Residential Lots
	Naturalstrip (indicative)
	Road pavement (indicative)
	Drainage reserve
	Bushfire Management Overlay
	Common Property



- Notes:**
- This plan was prepared as a PROPOSAL only and should not be used for any other purpose.
 - This plan is subject to Council approval.
 - All dimensions and areas are subject to survey and final computations.
 - The layout and area required will be subject to engineering detail design and Council approval.
 - Existing drainage directions shown are approximates only and subject to a detailed storm water management investigation.
 - Existing dams located within construction areas will be filled during construction.
 - Further investigation may be required for the buffers, vegetation retention and removal, site access and signs, and aboriginal and cultural heritage.
 - Road pavement is indicative only and subject to detailed engineering design.
 - NO ALLOWANCE has been made for Public Open Space within this development.
 - Area shown above shown are length of any (not shown)
 - Site building exclusions to be applied to these to be installed.

Site	48.735 ha
* Residential Lots	38,969 ha
* Common Property	0.965 ha
* Non-Arterial Roads	5.628 ha
Drainage Reserve	3.156 ha
Net Developable Area	43.580 ha
Lot Yield (Overall excludes common property)	62 lots @ 1.4 lots per ha 5961m ² average lot size
Lot Yield (Overall includes common property)	62 lots @ 1.4 lots per ha 6122m ² average lot size
Total Number of Lots	62

* Indicates Inclusion in NDA



Master Plan - Phase 3 (Indicative only / Not to be approved)
Maffra-Briagolong Road, Maffra

Version	Date	Description	Drafted	Approved
19	26.04.2026	Amended design boundary		
16	27.11.2025	Amended design boundary		
17	04.08.2025	Amended to Internal Council comments		
18	11.08.2025	Amended to Council Council comments		
15	26.04.2025	Amended drainage reserves		

Date: 26.04.2026
Version No: 19
Job No: 2102640
Scale (A1): (A3)

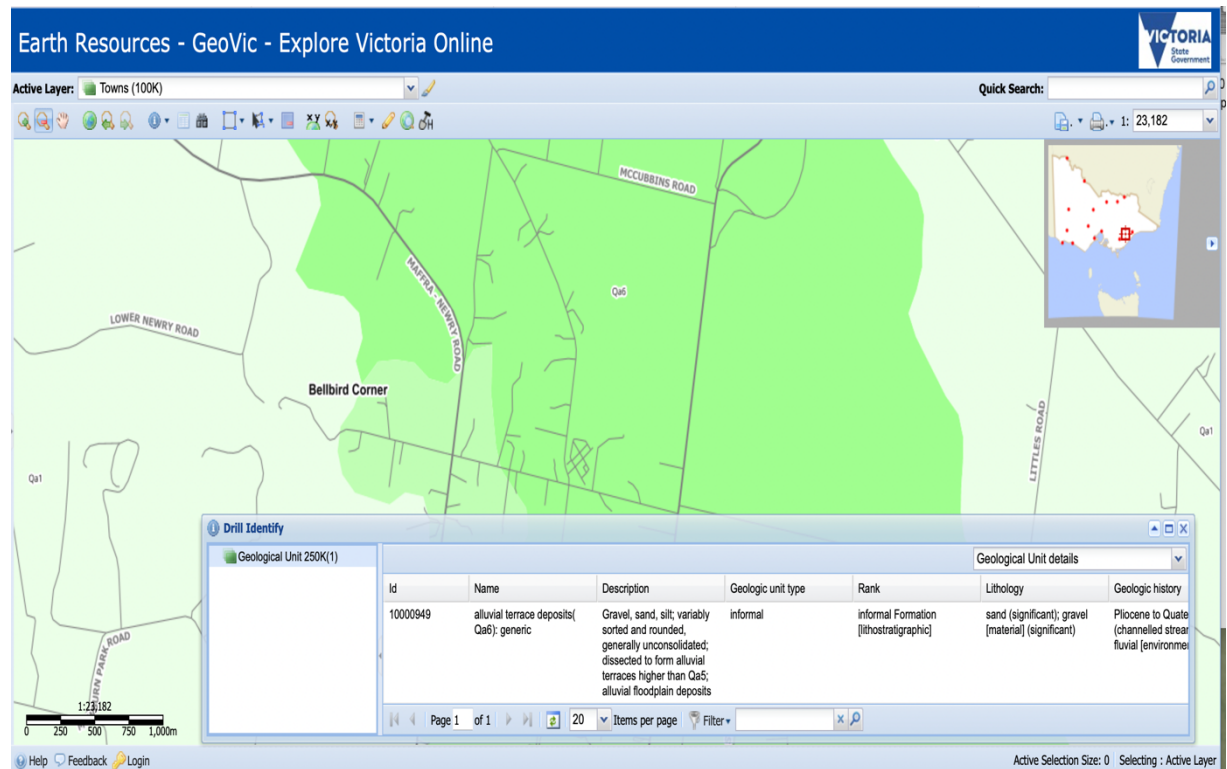
Table 5 Site Features	
Climate	The nearest weather station with long term data is the Maffra Station with a mean annual rainfall of 528.2 mm (BOM 2026). Climate Data from BOM presented in Appendix 2. The region has a near Mediterranean climate with maximum temperatures and minimum rainfall in the summer.
Exposure	The site is relatively shielded with exposure to winds which predominate from the NW/SW directions
Vegetation	Sparse with some mature trees
Landform	Undulating slopes
Slope, Slope Stability and Aspect	Minor slope, no identified stability issues, variable aspects
Fill	No fill evident in proposed land application areas
Rocks and Rock Outcrops	None observed.
Erosion Potential	No evidence of erosion, soils possibly subject to dispersion and surface rill or sheet erosion. Recommend irrigation systems into constructed ornamental garden beds.
Nearest Surface Water	Dams onsite. Off-site surface waters as noted on page 8. 30m separation form any surface water achievable on each proposed lot.
Flood Potential	Unknown
Stormwater Run-on and Upslope Seepage	Stormwater to be directed away from proposed effluent envelopes. No seepage observed.
Groundwater	<p>No registered bores onsite. One registered bore off site to the south approximately 100m away. (See VVG Portal results page 10). Risk to groundwater from subsurface irrigation into topsoils of secondary effluent considered low if recommended buffer distances maintained. Based on the Department of Natural Resources and Environment Groundwater Resources Victoria Map groundwater is likely to be >10m below ground surface and have a salinity range of 501-1000 mg/L TDS.</p> <p>The following beneficial uses are indicated SEPP (Waters):</p> <ul style="list-style-type: none"> • Maintenance of ecosystems • Stock watering • Industrial water use • Primary contact recreation • Buildings and structures
Site Surface Drainage and Subsurface Drainage	The site receives minimal run on and does not show signs of springs or other areas of ephemeral subsurface water retention.
Recommended Buffer Distances	Given the significant land area, all buffer distances as stipulated in EPA (2024) are achievable. Please refer to Note 4 Table 5 of EPA 2024.
Available Land Application Area	There is surplus space to land application area requirements (including reserves).

4. Soil Assessment and Constraints

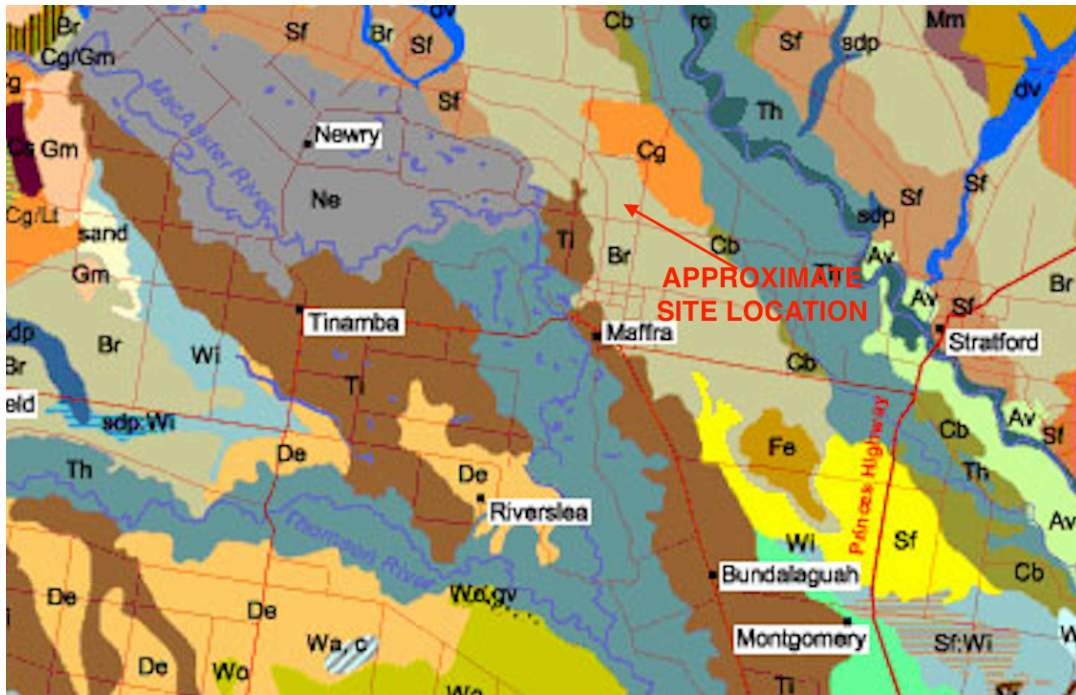
Soils have been assessed for their suitability for onsite wastewater management through both desktop review and intrusive field investigation.

4.1 Site Geology

Referring to Geoscience Australia 1:250000 geological mapping series, the site is underlain by Quaternary alluvial terrace deposits.



Referring to the Major Agricultural Soils of the Maffra Region mapping of Sargeant and Imhof (2000) the site is underlain by Briagolong soil class.



Br Briagolong Pleistocene sediments Level to Gently Undulating Plain Yellow and Brown Sodosols

4.2 Field Investigation

Field investigation consisted of drilling soil bores using a vehicle mounted 100mm solid flight auger to 2.0m or refusal with retrieval of disturbed soil samples for logging, sampling and laboratory testing.

Bore logs and field permeability data/soil test results (where relevant) are presented in Appendix 1. Laboratory results are presented in Appendix 3. As a general comment soils appeared relative uniform over the site with one soil mapping unit consistent with the soil and geological mapping noted above.

With reference to the classification system of Isbell (2002) soils are classified as Brown **Sodosols** being clays soils with high sodium contents. Soils will exhibit duplex profiles with lighter SAND (SC/SM/SP) SILTS (ML) or Gravels (GM) grading to CLAYS (CL/CH) at variable depths from the existing ground surface. Subsoils clays will exhibit a moderate structure and will show the existence of vertical macropores throughout drier periods, significantly increasing their unsaturated hydraulic conductivities. Subsoils will likely show

slow to moderate cation exchange complex for the absorption of nutrients, may contain dispersive phases and a slightly acidic pH trend.

Table 4 Typical Soil Characteristics	
Soil Depth (m)	1.0-2m+
Depth to Water Table (m)	2.0m+
Coarse Fragments (%)	0-5%
Colloid Stability	Emmerson class and exchangeable sodium percentage results indicate sodic soil phases present.
Soil Nutrient Attenuation	Good – clay phases will have moderate Cation Exchange Capacity.
Soil Field Permeability and Concept Design Loading Rates	Field permeability variable, recommend DIR of 3mm/d given clays encountered in bores.
Basement Permeability	Basement rock likely >5m – permeability therefore not relevant

	Topsoils	Subsoils
Description	Silty SAND (SM)/Clayey SAND(SC)	CLAY (CH)
Soil Category (AS1547-2011)	2	5
DIR (mm/d)/DLR (L/D)	4.5	3
pH	5.8	5.5
EMMERSON	7-8	1-3

Table 5 Summary of Key Soil Chemical Parameters							
	Units	BH1	BH2	BH3	BH 4	BH5	Indicative Desirable Levels*1
Conductivity	uS/cm	38	580	46	30	11	<300
Exchangeable Ca	meq/100g	2	0.4	3	3.8	11	>1
Exchangeable Na	meq/100g	2.1	0.1	0.8	3.1	0.2	<1
Exchangeable Mg	meq/100g	6.2	0.4	2.7	11	0.9	>1.6
Exchangeable K	meq/100g	0.2	0.2	0.2	0.2	0.2	>0.5
Field pH	units	5.4	5.4	5.1	5.6	4.6	5.5-7.5
CEC	meq/100g	11	1	6.7	18	2.1	Sum>15
Exchangeable Sodium Percentage (ESP%) *2	%	20	3.5	12	17	6.8	<5
Emmerson Class	units	1	3b	2	2	3b	7-8

Table 5 (cont) Summary of Key Soil Chemical Parameters							
	Units	BH6	BH7	BH8	BH 9	BH10	Indicative Desirable Levels*1
Conductivity	uS/cm	74	24	21	21	22	<300
Exchangeable Ca	meq/100g	1	3	1.5	1.6	2.5	>1
Exchangeable Na	meq/100g	0.2	0.9	1.1	0.9	1.3	<1
Exchangeable Mg	meq/100g	0.9	6.5	1.1	0.5	5.3	>1.6
Exchangeable K	meq/100g	1.3	0.1	0.1	0.1	1.4	>0.5
Field pH	units	5.3	5.4	5.4	5.9	4.9	5.5-7.5
CEC	meq/100g	12	3	1.7	2.4	10	Sum>15
Exchangeable Sodium Percentage (ESP%) *2	%	10	8.7	13	6.7	8.8	<5
Emmerson Class	units	2	8	2	3b	2	7-8

Table 5 (cont) Summary of Key Soil Chemical Parameters						
	Units	BH11	BH12			Indicative Desirable Levels*1
Conductivity	uS/cm	56	15			<300
Exchangeable Ca	meq/100g	1.5	2.2			>1
Exchangeable Na	meq/100g	0.3	0.3			<1
Exchangeable Mg	meq/100g	0.5	0.5			>1.6
Exchangeable K	meq/100g	0.1	0.1			>0.5
Field pH	units	5.4	5.4			5.5-7.5
CEC	meq/100g	2.5	3.1			Sum>15
Exchangable Sodium Percentage (ESP%) *2	%	12	8.4			<5
Emmerson Class	units	1	5			7-8

* 1 Note Green shading indicates desirable levels for plant growth without soil amendment, Yellow indicates suboptimal.}

*2 Northcote (1972)

5. Land Capability Assessment Matrix

5.1 Assessment Matrix

Referring to MAV & DSE (2006), EPA Victoria Publication 746.1 Land Capability Assessment for Onsite Domestic Wastewater Management and MAV DEPI & EPA 2014 Land Capability Assessment Framework, a qualitative LCA assessment table has been produced for the site.

Table 6: Risk Assessment of Site Characteristics (MAV, DEPI, EPA 2014)

Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
Aspect (affects solar radiation received)	North / North-East / North-West	East / West / South-East / South-West	South	Minor-Moderate
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	Moderate
Erosion ¹ (or potential for erosion)	Nil or minor	Moderate	Severe	Moderate
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 ² (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	Minor
Flood frequency (ARI) ³	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	Minor
Groundwater bores ⁴	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)	Minor

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
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	Minor
Landslip (or landslip potential) ⁵	Nil	Minor to moderate	High or Severe	Minor
Rock outcrops (% of surface)	<10%	10-20%	>20%	Minor
Slope Form (affects water shedding ability)	Convex or divergent side-slopes	Straight side-slopes	Concave or convergent side-slopes	Minor
Slope gradient ⁶ (%)				
(a) for absorption trenches and beds	<6%	6-15%	>15%	Minor
(b) for surface irrigation	<6%	6-10%	>10%	Minor
(c) for subsurface irrigation	<10%	10-30%	>30%	Minor
Soil Drainage ⁷ (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	Moderate

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Characteristic	Level of Constraint					Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor		Moderate	Major		
Stormwater run-on	Low likelihood of stormwater run-on			High likelihood of inundation by stormwater run-on		Minor
Surface waters - setback distance (m) ⁹	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)		Minor – 30m setback for primary irrigation field
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		Moderate
Characteristic	Level of Constraint					Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor		Moderate	Major		
Soil Drainage ⁸ (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 gleying. All horizons wet for several months	Major

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra

Table 7: Risk Assessment of Soil Characteristics				
Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
Electrical Conductivity (ECe) (dS/m) as a measure of soil salinity ¹	<0.8	0.8 – 2	>2	Minor
Emerson Aggregate Class (consider in context of sodicity)	4, 5, 6, 8	7	1, 2, 3	Major
Gleying ² (see Munsell Soil Colour Chart)	Nil	Some evidence of greenish grey / black or bluish grey / black soil colours	Predominant greenish grey / black, bluish grey / black colours	Minor
Mottling (see Munsell Soil Colour Chart)	Very well to well-drained soils generally have uniform brownish or reddish colour	Moderately well to imperfectly drained soils have grey and/or yellow brown mottles and in the mottled areas occur higher in the profile the less well-drained the soil	Poorly drained soils have predominant grey colours with yellow brown or reddish brown mottles located along root channels, large pores and cracks	Minor
pH ³ (favoured range for plants)	5.5 - 8 is the optimum range for a wide range of plants; 4.5 - 5.5 suitable for many acid-loving plants		<4.5, >8	Minor

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
Rock Fragments (size & volume %)	0 – 10%	10 – 20 %	>20%	Minor
Sodicity ⁴ (ESP %)	<6%	6 – 8%	>8%	Major
Soil Depth to Rock or other impermeable layer (m) ⁵	>1.5 m	1.5 – 1 m	<1 m	Minor
Soil Structure (pedality)	Highly or Moderately structured	Weakly-structured	Structureless, Massive or hardpan	Minor
Soil Texture, ⁶ Indicative Permeability	Cat. 2b, 3a, 3b, 4a	Cat. 4A, 4c, 5a	Cat. 1, 2a, 5b, 5c, 6	Moderate
Watertable Depth (m) below the base of the LAA	>2 m	2 – 1.5 m	<1.5 m	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.

5.2 LCA Conclusions

Qualitative LCA modelling has identified the following site constraints/risks:

- Aspect
- Erosion
- Climate
- Vegetation Cover
- Soil Texture
- Emmerson
- Sodidity
- Soil Drainage

5.3 Risk Mitigation and Design Implications

The identified constraints may be risk mitigated by:

- Treat to minimum secondary levels
- Install subsurface irrigation into constructed ornamental garden beds scaled to the water balance model
- Confirm minimum setback distances to all sensitive environmental receivers

Please refer to See Section 6 and Appendices for further specific system recommendations.

6. Proposed Onsite Wastewater System Design

6.1 General System Recommendations

Given the results of the LCA, the following recommendations are made for a suitable wastewater treatment system:

- Secondary treatment of effluent with subsurface disposal via water/nutrient balanced irrigation is a suitable method for onsite wastewater system disposal.

6.2 Onsite Wastewater Flow and Land Application Area Modelling

For modelling purposes, it is proposed that a **five bedroom** equivalent dwelling with standard water saving fixtures will be constructed with a loading rate of **180L/EP/day** and a total daily loading of **1080 L/day** being applicable.

Therefore, the calculated effluent flows and required disposal area for is as follows:

6.2.1 Water Balance and Land Application Area Modelling

Please refer to Appendix 2 for the water balance modelling based upon VLCAF (2013). The nominated area method is used to calculate the area required to balance all inputs and outputs, without the need for wet weather storage. As a result of these calculations, at least **450 m²** of area is required to achieve zero wet weather storage.

6.2.2 Nutrient Balance and Land Application Area Modelling

Please refer to Appendix 2 for the nutrient balance modelling (Nitrogen and Phosphorus) based upon VLCAF (2013). The methodology aims to ensure that the LAA is of sufficient size to ensure all nutrients from the applied effluent are assimilated by soils and vegetation. As a result of these calculations, at least **358 m²** of area is required to achieve sustainable assimilation of N and P over the nominated system design life.

BASED UPON THE ABOVE MODELLING THE MINIMUM MODELLED LAA REQUIREMENT IS 456 m² FOR SECONDARY TREATED EFFLUENT BASED UPON THE WATER BALANCE MODEL.

6.2.3 Alternative Land Application Area Modelling

Given that the water balance model produces the most conservative LAA, it has been used to calculate the subsurface irrigation area for a range of loadings based upon the “Number of bedrooms plus 1” model at 180L/person/day. Results are detailed in Table 8 below:

Table 8 LAA Requirement for Various Dwelling Sizes		
Number of Bedrooms	Theoretical Loading (L/day)	Required LAA (m² of Irrigation)
4	900	375
5	1080	450
6	1260	525
7	1440	600

6.3 System Concept Design

6.3.1 Treatment System

Given the above modelling the following treatment system would be appropriate:

- Minimum 4 star WELS rated dual flush toilets (3/4.5L) or approved dry composting toilets
- Min DN100 gravity fed sewer pipe
- Min 1500L/day (Treatment Capacity) Approved Packaged Treatment Plant capable of secondary treatment

6.3.2 Land Application Areas

The land application areas could consist of:

- Min 450 m² of subsurface irrigation dosed into constructed ornamental gardens as detailed in Appendix 3.
- Irrigation should be zoned into maximum 250m² zones and dose loaded via a pressure dosed sequencing valve.

6.3.3 Provision of Adequate Setback Distances and Relevance of Reserve Provision

Given the minimum land application areas modelled above combined with the current development plan, setback distances complying with the minimum requirements of EPA Vic (2024) are achievable (see Figure 2 and Appendix 3).

It is noteworthy that Section 3.10.2 of EPA (2024) stipulates that a reserve area is not required for a surface or sub-surface pressure-compensating irrigation system where the size of the system has been calculated and designed using the latest version of the Model LCA Report and the recommended Design Irrigation Rates in Tables 3 and 9.

6.4 System Risk Management

Risk identification and reduction measures compliant with AS1547 – 2012 Clause A3.2 is presented below:

Table 9 System Risk Management		
Risk	Factors that Increase Risk Likelihood	Design Risk Reduction Measures
Hydraulic Overloading of System	<ul style="list-style-type: none"> • Under scaled system • Prolonged overuse • Leaking taps • Shock Loading • Excessive solid disposal 	<ul style="list-style-type: none"> • Scale to peak potential loading using water balance modelling • Use Conservative DLR/DIR • Use water conservation practices eg water reduction fixtures • Not rated for spa installation
Biological Failure	<ul style="list-style-type: none"> • Overuse of household chemicals • Shock loading 	<ul style="list-style-type: none"> • Limit detergents and bleach use where practical • System not fit for spa or sinkerator installation
Marginal Soil Conditions	<ul style="list-style-type: none"> • Low soil hydraulic conductivity • Dispersive soils • Poor drainage 	<ul style="list-style-type: none"> • Use appropriate DLR/DIR after permeability testing • Treat with gypsum, manage sodium inputs • Dose effluent into constructed garden beds.
Site Constraints	<ul style="list-style-type: none"> • See section 5 	<ul style="list-style-type: none"> • See recommendations Section 5

Risk	Factors that Increase Risk Likelihood	Design Risk Reduction Measures
High Rainfall/Torrential Rainfall	<ul style="list-style-type: none"> • Inappropriate LAA Scaling • Stormwater impacts 	<ul style="list-style-type: none"> • Use suitable hydraulic scaling following water balance model • Stormwater Diversion around LAA if required
Clogged Filter	<ul style="list-style-type: none"> • Overloading • Infrequent cleaning 	<ul style="list-style-type: none"> • Clean monthly • Regular servicing inline with manufacturers recommendations
Pipe Blockages	<ul style="list-style-type: none"> • Overloading • Infrequent de-sludging 	<ul style="list-style-type: none"> • Reduce solids inflows • Service AWTS regularly • Check IO's/flush lines regularly
Sludge transport to LAA	<ul style="list-style-type: none"> • Infrequent de-sludging • Clogged outlet filter • High organic loading 	<ul style="list-style-type: none"> • Regular servicing inline with manufacturers recommendations • Clean outlet filter/flush lines regularly • No sinkerator installation
Broken pipes in LAA	<ul style="list-style-type: none"> • Stock/vehicles 	<ul style="list-style-type: none"> • Exclude stock/vehicles

6.5 System Management and Maintenance

The proposed system is designed to allow for system automation and as such there are negligible management requirements from owners/site managers. A detailed operations manual and maintenance log should be provided to the owners/site managers upon installation of the system. This should remain onsite and will provide details on troubleshooting, emergency service technical support, service scheduling, flow rate and effluent quality monitoring.

Emergency contacts for on call service agents should be listed next to alarm modules and in operations manual to provide support in the event of technical difficulties/breakdown

6.5.1 Servicing

The following servicing program is recommended:

- Servicing of AWTS and associated infrastructure (via a servicing contract) is proposed in line with minimum manufacturer's recommendations.
- Desludging of anaerobic/sedimentation chambers and septic tanks at a maximum frequency of three years.

6.5.2 Monitoring

Annual effluent sampling and analysis at a NATA accredited laboratory is recommended over the first two years of operation. Sampling should be conducted by suitable qualified personnel and involve chain of custody documentation.

The following parameters should be included in any analysis

- BOD
- TSS
- Thermotolerant Coliforms
- Oil and Grease
- Total Nitrogen
- Ammonia
- Total Phosphorous
- pH

6.5.3 Effluent Quality Objectives

The proposed upgraded treatment system process will perform to a minimum secondary treatment standard as prescribed by EPA (2024). Namely:

- BOD <20mg/L
- TSS<30mg/L
- CFU<30cfu/100ml

If treatment quality objectives are not met then advice MUST be sort from the servicing agent, manufacturer and designer.

6.5.4 Contingency Planning

Specific contingencies for installed systems will be included in the operations manual and include:

Table 10 Contingency Planning	
Problem	Contingency
Overflow of effluent from treatment plant	<ul style="list-style-type: none"> • Call service agent immediately • Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off) • Minimise building use until problem fixed • Attempt to contain pooling effluent (only if safe to do so)
Critical components of treatments Plants not working	<ul style="list-style-type: none"> • Structure duty standby of all critical components with auto changeover.
Treatment plant pump not working (Alarm ringing/flashing)	<ul style="list-style-type: none"> • Check power supply to pump • Call service agent immediately • Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off) • Minimise building use until problem fixed

Structural failure of treatment plant tank	<ul style="list-style-type: none"> • Call service agent immediately • Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off) • Minimize building use until problem fixed
Effluent overflowing in land application area	<ul style="list-style-type: none"> • Call service agent immediately • Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off) • Minimise building use until problem fixed • If problem persists seek advice from designer
Water run on to land application area	<ul style="list-style-type: none"> • Ensure upslope diversion of any run on • Check existing diversion system and clear if required
Land application area emitting odours	<ul style="list-style-type: none"> • Call service agent immediately – check treatment quality of effluent at outlet to land application area • Check for physical damage to land application area • If problem persists seek advice from designer
Excessive growth of vegetation in land application area	<ul style="list-style-type: none"> • Check for physical damage to land application area. • Mow/slash/thin/prune/weed land application area at regular intervals. • Remove aggressive invasive weed species. • If problem persists seek advice form designer

7. Conclusions and Further Recommendations

In conclusion, the following comments and recommendations are made:

- Given the identified site and soil limitations, secondary treatment with subsurface disposal into constructed ornamental gardens is recommended.
- The maximum wastewater flow rate modelling shows that the generated flows from the proposed development is likely to be no more than 1080 L/day (for a 5 bedroom dwelling).
- Modelled flows will likely require a land application area comprising:
 - Min 450 m² of subsurface irrigation based upon the water balance method.
- It is likely that peak flows associated with the modelled development should be within the buffering capacity of proposed system both in terms of the system sizing as well as for effluent acceptance into the disposal area.
- Given the lot sizes and current development plan adequate setback distances can be met.
- Any earthworks and drainage installation associated with lot development may alter conditions of the site and as a result the recommendations of this report MUST be reconfirmed after these works have occurred. Failure to ensure this will void report recommendations. Stormwater diversion or interceptor drain installation may be appropriate at this time.

- **If the prescriptions of this report are followed the likely human and environmental health risks associated with effluent disposal over the site is low.**



*Environmental Engineering Scientist
Strata Geoscience and Environmental Pty Ltd
E:
W: www.strataconsulting.com.au*

8. References

- AS1726-1993- Geotechnical Site Investigations
- AS 1547-2012 Onsite Wastewater Disposal
- Bureau of Meteorology Website- Monthly Climate Statistics
- EPA (2024) Vic Code of Practice for Onsite Wastewater Management
- MAV & DSE 2006 (as amended) Model LCA Report
- VLCAF (2024) Victorian Land Capability Assessment Framework – Calculation of Water and Nutrient Balances
- Isbell (2002) Australian Soil Classification (Revised Edn) CSIRO Publishing
- Northcote, K.H. and Skene J.K.M., (1972) Australian soils with saline and sodic properties. *CSIRO Soil Publication 27*.

Appendix 1 Site Photos and Indicative Borelogs



*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 1
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	END OF BOREHOLE						

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 2
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
2000	END OF BOREHOLE	GNO					

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 3
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	<u>FILL</u> <i>Sand, silt, clay, gravel</i>						
300	<u>SILTY CLAY (CI)</u> <i>Light brown, slightly moist, firm, intermediate plasticity</i>						
600				1.9			
1000				1.8			
1200	<i>Grading to <u>CLAYEY SAND (SC)</u> Medium dense, slightly moist to moist Trace of gravel</i>				6		
1500					6		
		GNO					
2000	<u>END OF BOREHOLE</u>						

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 4
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	FILL <i>Sand, silt, clay, gravel</i>						
300	SILTY CLAY (CI) <i>Light brown, slightly moist, firm, intermediate plasticity</i>						
600				1.9			
1000				1.8			
1200	Grading to CLAYEY SAND (SC) <i>Medium dense, slightly moist to moist Trace of gravel</i>				6		
1500					6		
2000	END OF BOREHOLE	GNO					

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 5
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	END OF BOREHOLE						

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 6
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	<u>FILL</u> <i>Sand, silt, clay, gravel, compact, slightly moist</i>						
300	<u>SILTY CLAY (CI)</u> <i>Light brown, slightly moist, firm, intermediate plasticity</i>						
600				2.3			
900				2.3			
1000	Grading to <u>CLAYEY SAND (SC)</u> <i>Light brown, slightly moist, medium dense</i>						
1200					5		
2000	<u>END OF BOREHOLE</u>	GNO					

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 7
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	END OF BOREHOLE						

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 8
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	END OF BOREHOLE						

ABBREVIATIONS PER APPENDIX

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 9
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	END OF BOREHOLE						

ABBREVIATIONS PER APPENDIX

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 10
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	<u>TOPSOIL</u> <i>Sand, silt, clay, loose, slightly moist</i>						
200	<u>SILTY SAND (SM)</u> <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to <u>SILTY CLAY (CI)</u> <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to <u>CLAYEY SAND (SC)</u> <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	<u>END OF BOREHOLE</u>						

ABBREVIATIONS PER APPENDIX

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 11
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	END OF BOREHOLE						

ABBREVIATIONS PER APPENDIX

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*



PROJECT NO.: 010669
DATE: 12/4/22
HOLE LOCATION: *Per Sketch*

HOLE NO.: 12
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	POCKET PENETROMETER (1kg per 1cm ²)	DYNAMIC CONE PENETROMETER (Blows per 100mm)	EXISTING FOOTING (mm)	DEPTH (mm)
	TOPSOIL <i>Sand, silt, clay, loose, slightly moist</i>						
200	SILTY SAND (SM) <i>Grey/brown, slightly moist, medium dense</i>						
500	Grading to SILTY CLAY (CI) <i>Light brown, slightly moist to moist, firm, intermediate plasticity</i>						
600				2.2			
900				2.3			
1000	Grading to CLAYEY SAND (SC) <i>Light brown, slightly moist, medium dense</i>						
1200					6		
		GNO					
2000	END OF BOREHOLE						

ABBREVIATIONS PER APPENDIX

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

Permeability Results

To see the instructions on the right hand side of this page, make sure that 75% is entered in the Zoom box in the right hand corner of the Standard toolbar. (This note will not be printed)

Constant head permeameter

Project MAFFRA

Site description

Tested by SN

Location BH01/BH03

Date

Test hole geometry

	Test 1	Test 2
Hole depth (m)	0.4	0.3
Depth (m) of water in hole	0.3	0.2
Hole diameter (mm)	38	38
Depth (m) to imperv. layer	0.6	0.6

TEST 1

Depth interval (m) tested 0.1 to 0.4

Test duration (mins)

Reading No.	Water infiltrated (L)	Time to infiltrate (min)	Infiltrat. rate (L/min)	Permeability (m/day)
1	0.4	5	8.0E-02	8.4E-01
2	0.3	5	6.0E-02	6.3E-01
3	0.4	5	8.0E-02	8.4E-01
4	0.3	5	6.0E-02	6.3E-01

Soil type tested

TEST 2

Depth interval (m) tested 0.1 to 0.3

Test duration (mins)

Reading No.	Water infiltrated (L)	Time to infiltrate (min)	Infiltrat. rate (L/min)	Permeability (m/day)
1	0.5	5	1.0E-01	1.9E+00
2	0.2	5	4.0E-02	7.7E-01
3	0.3	5	6.0E-02	1.2E+00
4	0.2	5	4.0E-02	7.7E-01

Soil type tested

Note: Permeability $K = 4.4Q[\sin^2(H/2) - (r/H)^2 + 0.25]^{0.5} + (r/H) / 2\pi H^2$ where Q = infiltration rate, H = depth of water in test hole, r = hole radius and $\pi = 3.1416$. H should be in the range 5r to 10r. See Australian/New Zealand Standard 1547: 2000

On-site domestic wastewater management. Appendix 4.1F. The Standard's equation has a typographical error, which has been corrected here.

If an impermeable layer is at depth S no more than 2H below the base of the test hole, use $K = 3Q\ln(H/r) / \pi H(2H+3S)$.

See Talsma, T. and Hallam, P. (1980): Hydraulic Conductivity Measurement of Forest Catchments. Australian Journal of Soil Research 30, pp 139-148.

Scientific Notation

Infiltration rates and permeabilities often range over several orders of magnitude. Using standard number notation, there is not enough room in the cells to cope with the possible range of values, and significant figures. Scientific notation is used to get around the problem.

Any number can be expressed as a power of 10, in the form NEX where N (positive or negative) is a number with one or more digits, E means 10, and X (2 digit; positive or negative) is the power to which 10 is raised. If you are unfamiliar with this method, try entering a few numbers in the yellow box below to see how it works. A few examples:

1E+02 = 100
1.5E+02 = 150
2.3E+01 = 23
1E0+1 = 10
1E+00 = 1 (ie 1 x 10 raised to the power 0 = 1)
1E-01 = 0.1
1E-02 = 0.01
1E-03 = 0.001

Enter any number 0.63

This is the same number in scientific notation 6.3E-01

(The number has been rounded to one decimal place)

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

Permeability Results

To see the instructions on the right hand side of this page, make sure that 75% is entered in the Zoom box in the right hand corner of the Standard toolbar. (This note will not be printed)

Project MAFFRA

Site description

Tested by SN

Test hole geometry

	Test 1	Test 2
Hole depth (m)	0.5	0.5
Depth (m) of water in hole	0.3	0.2
Hole diameter (mm)	38	38
Depth (m) to imperv. layer	0.6	0.6

Location BH05/BH08

Date

TEST 1

Depth interval (m) tested 0.2 to 0.5

Test duration (mins)

Reading No.	Water infiltrated (L)	Time to infiltrate (min)	Infiltrat. rate (L/min)	Permeability (m/day)
1	0.7	5	1.4E-01	1.5E+00
2	0.5	5	1.0E-01	1.1E+00
3	0.7	5	1.4E-01	1.5E+00
4	0.6	5	1.2E-01	1.3E+00

Soil type tested

Reading No.	Permeability (m/day)
1	1.5E+00
2	1.1E+00
3	1.5E+00
4	1.3E+00

TEST 2

Depth interval (m) tested 0.3 to 0.5

Test duration (mins)

Reading No.	Water infiltrated (L)	Time to infiltrate (min)	Infiltrat. rate (L/min)	Permeability (m/day)
1	1	5	2.0E-01	3.9E+00
2	0.4	5	8.0E-02	1.5E+00
3	0.4	5	8.0E-02	1.5E+00
4	0.4	5	8.0E-02	1.5E+00

Soil type tested

Reading No.	Permeability (m/day)
1	3.9E+00
2	1.5E+00
3	1.5E+00
4	1.5E+00

Note: Permeability $K = 4.4Q[\sin^2(H/2) - (r/H)^2 + 0.25]^{0.5} / (r/H) / 2\pi H^2$ where Q = infiltration rate, H = depth of water in test hole, r = hole radius and $\pi = 3.1416$. H should be in the range 5r to 10r. See Australian/New Zealand Standard 1547: 2000

On-site domestic wastewater management. Appendix 4.1F. The Standard's equation has a typographical error, which has been corrected here.

If an impermeable layer is at depth S no more than 2H below the base of the test hole, use $K = 3Q\ln(H/r) / \pi H(2H+3S)$.

See Talsma, T. and Hallam, P. (1980): Hydraulic Conductivity Measurement of Forest Catchments. Australian Journal of Soil Research 30, pp 139-148.

Scientific Notation

Infiltration rates and permeabilities often range over several orders of magnitude. Using standard number notation, there is not enough room in the cells to cope with the possible range of values, and significant figures. Scientific notation is used to get around the problem.

Any number can be expressed as a power of 10, in the form NEX where N (positive or negative) is a number with one or more digits, E means 10, and X (2 digit; positive or negative) is the power to which 10 is raised. If you are unfamiliar with this method, try entering a few numbers in the yellow box below to see how it works. A few examples:

1E+02 = 100
1.5E+02 = 150
2.3E+01 = 23
1E0+1 = 10
1E+00 = 1 (ie 1 x 10 raised to the power 0 = 1)
1E-01 = 0.1
1E-02 = 0.01
1E-03 = 0.001

Enter any number 1.1

This is the same number in scientific notation 1.1E+00

(The number has been rounded to one decimal place)

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

Permeability Results

Constant head permeameter

Project MAFFRA Location BH10/BH12

Site description Date

Tested by SN

Test hole geometry

	Test 1	Test 2
Hole depth (m)	0.5	0.5
Depth (m) of water in hole	0.3	0.3
Hole diameter (mm)	38	38
Depth (m) to imperv. layer	0.5	0.5

TEST 1

Depth interval (m) tested: 0.2 to 0.5
 Test duration (mins):

Reading No.	Water infiltrated (L)	Time to infiltrate (min)	Infiltrat. rate (L/min)	Permeability (m/day)
1	0.9	5	1.8E-01	1.2E+00
2	0.8	5	1.6E-01	1.1E+00
3	0.4	5	8.0E-02	5.3E-01
4	0.3	5	6.0E-02	4.0E-01

Soil type tested

TEST 2

Depth interval (m) tested: 0.2 to 0.5
 Test duration (mins):

Reading No.	Water infiltrated (L)	Time to infiltrate (min)	Infiltrat. rate (L/min)	Permeability (m/day)
1	0.4	5	8.0E-02	5.3E-01
2	0.3	5	6.0E-02	4.0E-01
3	0.2	5	4.0E-02	2.7E-01
4	0.2	5	4.0E-02	2.7E-01

Soil type tested

Note: Permeability $K = 4.4Q[\sinh^2(H/2r) - \{r/H\}^2 + 0.25\{r/H\}^2] / 2\pi H^2$ where Q = infiltration rate, H = depth of water in test hole, r = hole radius and $\pi = 3.1416$. H should be in the range 5r to 10r. See Australian/New Zealand Standard 1547:2000. On-site domestic-wastewater management. Appendix 4.1F. The Standard's equation has a typographical error, which has been corrected here. If an impermeable layer is at depth S no more than 2H below the base of the test hole, use $K = 3Q\{r/H\}[\pi H(2H+3S)]$. See Talsma, T. and Hallam, P. (1980): Hydraulic Conductivity Measurement of Forest Catchments. Australian Journal of Soil Research 30, pp 139-148.

Scientific Notation
 Infiltration rates and permeabilities often range over several orders of magnitude. Using standard number notation, there is not enough room in the cells to cope with the possible range of values, and significant figures. Scientific notation is used to get around the problem.

Any number can be expressed as a power of 10, in the form NEX where N (positive or negative) is a number with one or more digits, E means 10, and X (2 digit, positive or negative) is the power to which 10 is raised. If you are unfamiliar with this method, try entering a few numbers in the yellow box below to see how it works. A few examples:

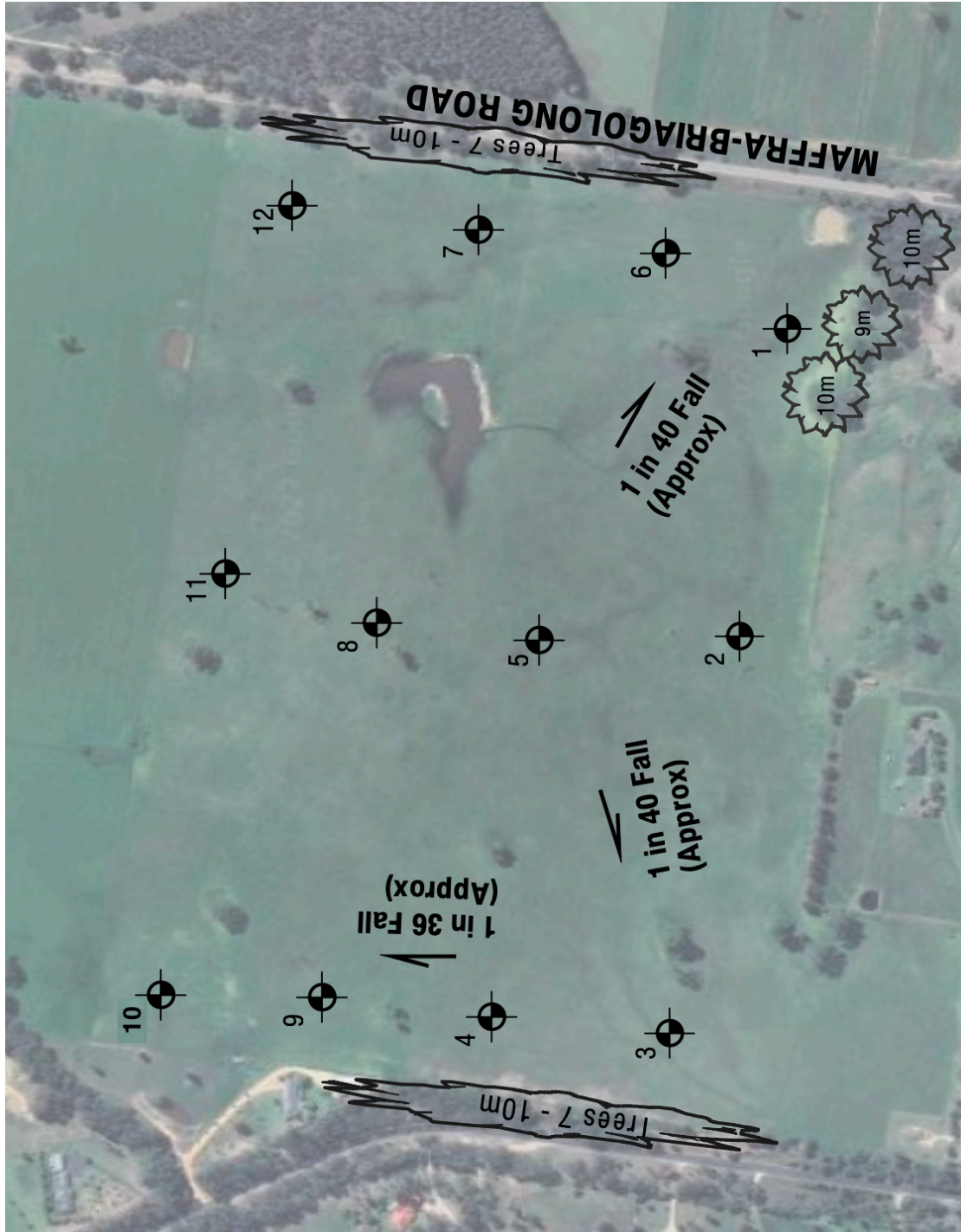
1E+02 = 100
 1.5E+02 = 150
 2.3E+01 = 23
 1E0+1 = 10
 1E+00 = 1 (ie 1 x 10 raised to the power 0 = 1)
 1E-01 = 0.1
 1E-02 = 0.01
 1E-03 = 0.001

Enter any number

This is the same number in scientific notation

(The number has been rounded to one decimal place)

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra

Appendix 2 Climate Data, Water and Nutrient Balance Calculations (after
VLCAF 2024)

Irrigation area sizing using Nominated Area Water Balance & Storage Calculations																
Site Address:		Maffra-Briagolong Road Maffra														
Date:		####	Assessor:		Nielsen											
INPUT DATA																
Design Wastewater Flow	Q	1,080	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013)												
Design Irrigation Rate	DIR	3.0	mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013)												
Nominated Land Application Area	L	450	m ²													
Crop Factor	C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type ²												
Rainfall Runoff Factor	RF	1	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff												
Mean Monthly Rainfall Data	Maffra			BoM Station and number												
Mean Monthly Pan Evaporation Data	East Sale Airport			BoM Station and number												
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	46.1	48.4	43	43.1	32.2	43.1	36.1	32.9	39.5	53.6	70.4	50.5	538.9
Evaporation	E		mm/month	201.5	162.4	136.4	84	52.7	42	46.5	68.2	93	124	153	196	1349.7
Crop Factor	C		unitless	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.70	0.80	0.80	0.80	0.80	0.80
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	161	130	95	59	32	25	28	41	65	99	122	149	1006.54
Percolation	B	DIRxD	mm/month	93.0	84	93.0	90.0	93.0	90.0	93.0	93.0	90.0	93.0	90.0	93.0	1095.0
Outputs		ET+B	mm/month	254.2	213.92	188.5	148.8	124.6	115.2	120.9	133.9	155.1	192.2	212.4	241.8	2101.5
INPUTS																
Retained Rainfall	RR	RxCF	mm/month	46.1	48.4	43	43.1	32.2	43.1	36.1	32.9	39.5	53.6	70.4	50.5	538.9
Applied Effluent	W	(QxD)/L	mm/month	74.4	67.2	74.4	72.0	74.4	72.0	74.4	74.4	72.0	74.4	72.0	74.4	876.0
Inputs		RR+W	mm/month	120.5	115.6	117.4	115.1	106.6	115.1	110.5	107.3	111.5	128.0	142.4	124.9	1414.9
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-133.7	-98.3	-71.1	-33.7	-18.0	-0.1	-10.4	-26.6	-43.6	-64.2	-70.0	-118.9	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE																
			m ²	161	183	230	307	362	449	395	331	280	242	228	175	
MINIMUM AREA REQUIRED FOR ZERO STORAGE:																
			m ²	450.0												

Nutrient Balance										
Site Address:										
SUMMARY - LAND APPLICATION AREA REQUIRED BASED ON MOST LIMITING NUTRIENT BALANCE									358	m ²
INPUT DATA¹										
Wastewater Loading					Nutrient Crop Uptake					
Hydraulic Load		1080	L/day	Crop N Uptake	220	kg/ha/yr	which equals	60.27	mg/m ² /day	
Effluent N Concentration		25	mg/L	Crop P Uptake	50	kg/ha/yr	which equals	13.70	mg/m ² /day	
% N Lost to Soil Processes (Geary & Gardner 1996)		0.2	Decimal	Phosphorus Sorption						
Total N Loss to Soil		5400	mg/day	P-sorption result	240	mg/kg	which equals	3360	kg/ha	
Remaining N Load after soil loss		21600	mg/day	Soil Bulk Density	1400	kg/m ³				
Effluent P Concentration		8	mg/L	Depth of Soil	1	m				
Design Life of System		25	yrs	% of Predicted P-sorp. ²	0.5	Decimal				
NUTRIENT BALANCE BASED ON ANNUAL CROP UPTAKE RATES										
Minimum Area required with zero buffer			Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)							
Nitrogen	358	m ²	Nominated LAA Size	561	m ²					
Phosphorus	269	m ²	Predicted N Export from LAA	-4.46	kg/year					
			Predicted P Export from LAA	-3.42	kg/year					
			Phosphorus Longevity for LAA	270	years					
			Minimum Buffer Required for excess nutrient	0	m ²					
PHOSPHORUS BALANCE										
Using the nominated LAA Size										
Nominated LAA Size	561	m ²								
Daily P Load	0.009	kg/day		Phosphorus generated over life of system	78.840	kg				
Daily P Uptake	0.008	kg/day		Phosphorus vegetative uptake for life of system	0.125	kg/m ²				
Measured P-sorption capacity	0.336	kg/m ²								
Assumed P-sorption capacity	0.168	kg/m ²		Phosphorus adsorbed over 50 years	0.168	kg/m ²				
Site P-sorption capacity	94.248	kg		Desired Annual P Application Rate	6.575	kg/year				
P-load to be sorbed	0.349	kg/year					which equals	0.018	kg/day	

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Relevant Climate Data

Monthly Rainfall (millimetres)

MAFFRA

Station Number: 085297 · State: VIC · Opened: 1993 · Status: Open · Latitude: 37.97°S · Longitude: 146.99°E · Elevation: 35 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1993										54.8	41.2	63.0	
1994	33.6	198.8	39.8	27.8	22.8	35.2	13.4	11.4	43.0	58.2	84.8	35.6	604.4
1995	74.3	26.0	15.6	42.6	57.8	45.4	39.8	20.4	52.4	175.6	139.6	51.8	741.3
1996	55.4	61.4	31.4	60.2	28.2	33.6	64.4	40.1	44.0	19.2	76.0	22.0	535.9
1997	42.8	8.4	33.4	5.0	37.0	60.8	18.2	19.0	56.4	19.0	45.4	36.8	382.2
1998	27.2	37.6	12.8	11.4	9.2	104.2	11.6	28.8	42.2	70.6	108.6	66.4	530.6
1999	72.2	36.4	101.6	18.0	32.6	9.4	19.0	38.2	24.1	52.1	12.0		
2000	40.4	30.4		36.2	93.8	13.8		33.2	89.2		76.0	2.6	
2001		17.8	36.8	75.4	29.8	33.2	66.2		31.0	88.6		80.4	
2002	39.0	73.4	35.2	124.6		34.6	9.0	6.2	18.4	24.2	53.8		
2003			25.4	32.4	12.8	41.0	34.6				37.2	71.4	
2004	49.2	36.4	2.8	119.8	31.6	32.6	33.4	34.6	45.2	25.8	65.6	43.0	520.0
2005	40.8	60.8		21.4	7.4	17.4	73.0	23.4	32.6	21.8	84.4	49.8	
2006	44.6	18.2	15.4	42.6	55.8	9.2	40.0	51.0	30.4		20.2		
2007	9.2			37.2	43.4	170.4	58.8	24.5		31.4	136.6	53.4	
2008	67.8	81.6	5.0	13.6	24.0	10.8	27.2	34.0	17.4	8.4	110.8	49.0	449.6
2009	0.0	26.0	29.6	37.8	7.4	13.6	21.8	36.8	58.2	29.0	68.6	34.8	363.6
2010	25.2	100.4	36.3	18.6	40.8	30.4	5.6	56.0	19.4	68.0	88.2	77.2	566.1
2011	39.8	84.4	92.8	43.6	37.9	20.1	59.8	58.2	63.5	82.2	130.8	46.0	759.1
2012	21.4	89.2	114.6	17.2	69.2	98.6	18.0	42.5	38.0	30.6	57.0		
2015				124.8	20.7	46.1	27.2	77.0	19.1	28.6	39.6	31.2	
2016	115.8	2.4	63.0	20.4	34.7	87.2	89.6	18.1	73.1	54.6	43.4	23.0	625.3
2017	13.9	28.8	59.3	35.2	14.9	11.6	16.7	47.6	29.4	59.0	22.6	112.8	451.8
2018	51.0	19.6	15.0	4.8	26.2	16.6	33.1	18.5	25.8	43.8	75.2	39.6	369.2
2019	20.4	29.2	24.4	5.7	45.0	29.2	28.8	28.9	40.4	18.7	47.5	7.6	325.8
2020	117.3	97.3	23.0	89.6	23.7	19.4	72.6	0.0	0.0	0.0	0.0	0.0	442.9
2021	0.0	0.0	0.0	0.0	59.8	131.1	12.6	58.2	95.8	108.2	136.1	54.0	655.8
2022	114.6	26.5	86.0	100.0	30.6	33.3	26.2	62.8	24.8	81.2	99.0	41.3	726.3
2023	23.4	10.4	93.6		27.6	41.0	8.4	19.8	18.2	145.8	87.8	165.1	
2024	75.3	5.2	17.0	76.8	8.0	31.8	47.2	17.4	61.6	64.9	26.6	25.4	457.2
2025	45.4	79.8	59.0		25.2	31.2	69.8	13.4	13.6	37.7	98.7	81.2	
2026	29.4	69.4	92.9	8.4	6.6								

Quality control: 12.3 Done & acceptable, 12.3 Not completed or unknown



© Copyright Commonwealth of Australia 2026, Bureau of Meteorology.
Prepared using Climate Data Online, Bureau of Meteorology <http://www.bom.gov.au/climate/data>.
Contact us using details on <http://www.bom.gov.au/climate/how/contacts.shtml>.
We have taken all due care but cannot provide any warranty nor accept any liability for this information.
<http://www.bom.gov.au/other/copyright.shtml>

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Monthly Rainfall (millimetres)

MAFFRA

Station Number: 085297 · State: VIC · Opened: 1993 · Status: Open · Latitude: 37.97°S · Longitude: 146.99°E · Elevation: 35 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	46.1	48.4	43.0	43.1	32.2	43.1	36.1	32.9	39.5	53.6	70.4	50.5	528.2
Lowest	0.0	0.0	0.0	0.0	6.6	9.2	5.6	0.0	0.0	0.0	0.0	0.0	325.8
5th percentile	3.2	3.4	3.5	4.9	7.4	10.0	8.6	8.0	14.9	12.0	15.7	4.1	357.9
10th percentile	12.5	7.4	9.7	5.6	7.9	11.5	11.1	12.8	18.0	18.9	22.4	16.2	367.5
Median	40.6	33.4	33.4	35.2	29.0	32.9	28.8	31.0	35.3	48.0	71.9	46.0	525.3
90th percentile	87.1	91.6	93.2	104.0	58.0	99.2	70.4	58.2	66.4	94.5	131.3	80.7	730.8
95th percentile	115.4	99.3	99.2	122.7	65.0	119.0	72.8	61.2	83.6	132.6	136.4	103.3	744.0
Highest	117.3	198.8	114.6	124.8	93.8	170.4	89.6	77.0	95.8	175.6	139.6	165.1	759.1

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

<http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml>.



Product code: IDCJAC0001 reference: 0131314163 Created on Tue 02 Jun 2026 10:08:29 AM AEST

© Copyright Commonwealth of Australia 2026, Bureau of Meteorology.

Prepared using Climate Data Online, Bureau of Meteorology <http://www.bom.gov.au/climate/data>.

Contact us using details on <http://www.bom.gov.au/climate/how/contacts.shtml>.

We have taken all due care but cannot provide any warranty nor accept any liability for this information.

<http://www.bom.gov.au/other/copyright.shtml>

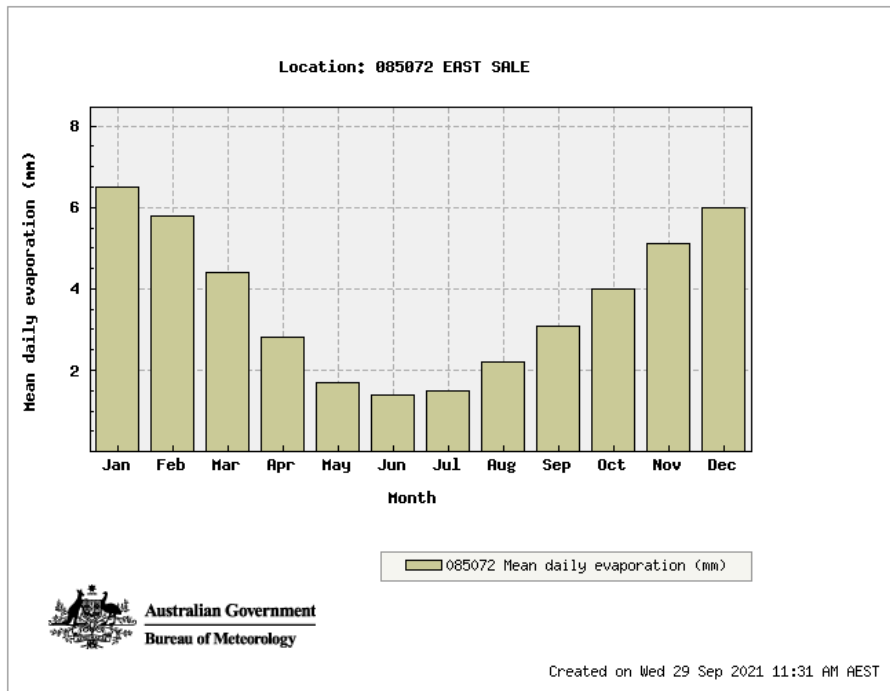
Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra

Mean total evaporation (mm)

Site details			
Site name: EAST SALE	Longitude: 147.13 °E	Site number: 085072	Commenced: 1943
Latitude: 38.12 °S	Elevation: 4 m	Operational status: Still Open	

Yearly data **30 year statistics** Comparison site First statistic Second statistic **Note:** Only one option can be redrawn at a time

Include data for the year: 2015



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean daily evaporation (mm) for years 1971 to 2015	6.5	5.8	4.4	2.8	1.7	1.4	1.5	2.2	3.1	4.0	5.1	6.0	3.7	44

12.3 = Not quality controlled

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Braigolong Road Maffra

Appendix 3 Laboratory Results



Environment Testing

Certificate of Analysis

Strata Geoscience and Environmental P/L
17 Little Arthur Street
North Hobart
TAS 7000



NATA Accredited
Accreditation Number 1261
Site Number 1264

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the IAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention:

Report 922769-S
Project name MAFFRA-BRAIGOLONG ROAD MAFFRA
Received Date Sep 13, 2022

Client Sample ID			BH01	BH02	BH03	BH04
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M22- Se0025965	M22- Se0025966	M22- Se0025967	M22- Se0025968
Date Sampled			Jun 19, 2022	Jun 19, 2022	Jun 19, 2022	Jun 19, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	38	580	46	30
Exchangeable Sodium Percentage (ESP)	0.1	%	20	3.5	12	17
Magnesium (exchangeable)	0.1	meq/100g	6.2	0.4	2.7	11
Potassium (exchangeable)	0.1	meq/100g	0.2	0.2	0.2	0.2
Sodium (exchangeable)	0.1	meq/100g	2.1	<0.1	0.8	3.1
% Moisture	1	%	21	8.3	11	23
Emerson Class Number	1	units	see attached	see attached	see attached	see attached
Cation Exchange Capacity						
Calcium (exchangeable)	0.1	meq/100g	2.0	0.4	3.0	3.8
Cation Exchange Capacity	0.05	meq/100g	11	1.0	6.7	18

Client Sample ID			BH05	BH06	BH07	BH08
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M22- Se0025969	M22- Se0025970	M22- Se0025971	M22- Se0025972
Date Sampled			Jun 19, 2022	Jun 19, 2022	Jun 19, 2022	Jun 19, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	11	74	24	21
Exchangeable Sodium Percentage (ESP)	0.1	%	6.8	10	8.7	13
Magnesium (exchangeable)	0.1	meq/100g	0.9	6.5	1.1	0.5
Potassium (exchangeable)	0.1	meq/100g	0.1	1.3	0.1	0.1
Sodium (exchangeable)	0.1	meq/100g	0.2	1.2	0.3	0.2
% Moisture	1	%	8.5	15	3.9	7.5
Emerson Class Number	1	units	see attached	see attached	see attached	see attached
Cation Exchange Capacity						
Calcium (exchangeable)	0.1	meq/100g	1.0	3.0	1.5	0.9
Cation Exchange Capacity	0.05	meq/100g	2.1	12	3.0	1.7

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



Environment Testing

Client Sample ID			BH09	BH10	BH11	BH12
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M22- Se0025973	M22- Se0025974	M22- Se0025975	M22- Se0025976
Date Sampled			Jun 19, 2022	Jun 19, 2022	Jun 19, 2022	Jun 19, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	21	22	56	15
Exchangeable Sodium Percentage (ESP)	0.1	%	6.7	8.8	12	8.4
Magnesium (exchangeable)	0.1	meq/100g	0.5	5.3	0.5	0.5
Potassium (exchangeable)	0.1	meq/100g	< 0.1	1.4	0.1	0.1
Sodium (exchangeable)	0.1	meq/100g	0.2	0.9	0.3	0.3
% Moisture	1	%	3.8	16	4.0	17
Emerson Class Number	1	units	see attached	see attached	see attached	see attached
Cation Exchange Capacity						
Calcium (exchangeable)	0.1	meq/100g	1.6	2.5	1.5	2.2
Cation Exchange Capacity	0.05	meq/100g	2.4	10	2.5	3.1

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



Environment Testing

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Conductivity (1:5 aqueous extract at 25 °C as rec.) - Method: LTM-INO-4030 Conductivity	Melbourne	Sep 15, 2022	7 Days
Magnesium (exchangeable) - Method: LTM-MET-3060 Cation Exchange Capacity and ESP	Melbourne	Sep 15, 2022	180 Days
Potassium (exchangeable) - Method: LTM-MET-3060 Cation Exchange Capacity and ESP	Melbourne	Sep 15, 2022	180 Days
Sodium (exchangeable) - Method: LTM-MET-3060 Cation Exchange Capacity and ESP	Melbourne	Sep 15, 2022	180 Days
Cation Exchange Capacity - Method: LTM-MET-3060 Cation Exchange Capacity by bases & Exchangeable Sodium Percentage	Melbourne	Sep 15, 2022	28 Days
Exchangeable Sodium Percentage (ESP) - Method: LTM-MET-3060 - Cation Exchange Capacity (CEC) & Exchangeable Sodium Percentage (ESP)	Melbourne	Sep 15, 2022	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Melbourne	Sep 13, 2022	14 Days

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

Eurofins ARL Pty Ltd
 Eurofins Environment Testing NZ Ltd
 NZBN: 942924924854
 Auckland
 25 O'Rourke Road
 Penrose, Auckland 1061
 Tel: +64 9 526 45 51
 IANZF 1387

Eurofins ARL Pty Ltd
 ABN: 91 05 0159 898
 Perth
 46-48 Banksea Road
 Westpool, WA 6106
 PO Box 60 Wickham 2263
 Tel: +61 8 9253 4444
 NATAF 2377 Site# 2370

Eurofins ARL Pty Ltd
 Brisbane
 121 Smallwood Place
 Muramba, QLD 4172
 Tel: +61 7 3902 4600
 NATAF 1261 Site# 20794-NATAF 1261 Site# 25079

Eurofins ARL Pty Ltd
 Canberra
 Unit 11 21 Dunes Street
 Mitchell, ACT 2911
 Tel: +61 2 8113 6091

Eurofins ARL Pty Ltd
 Sydney
 179 Mcowen Road
 Greeness, NSW 2145
 Tel: +61 2 9900 8400
 NATAF 1261 Site# 18217

Eurofins ARL Pty Ltd
 Melbourne
 198 Lillian Street
 Grovedale, VIC 3216
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Eurofins ARL Pty Ltd
 Melbourne
 6 Melburn Road
 Dandenong South, VIC 3175
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Eurofins ARL Pty Ltd
 Melbourne
 179 Mcowen Road
 Greeness, NSW 2145
 Tel: +61 2 9900 8400
 NATAF 1261 Site# 18217

Eurofins ARL Pty Ltd
 Melbourne
 198 Lillian Street
 Grovedale, VIC 3216
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Eurofins ARL Pty Ltd
 Melbourne
 6 Melburn Road
 Dandenong South, VIC 3175
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Eurofins ARL Pty Ltd
 Melbourne
 198 Lillian Street
 Grovedale, VIC 3216
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Eurofins ARL Pty Ltd
 Melbourne
 6 Melburn Road
 Dandenong South, VIC 3175
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Eurofins ARL Pty Ltd
 Melbourne
 179 Mcowen Road
 Greeness, NSW 2145
 Tel: +61 2 9900 8400
 NATAF 1261 Site# 18217

Eurofins ARL Pty Ltd
 Melbourne
 198 Lillian Street
 Grovedale, VIC 3216
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Eurofins ARL Pty Ltd
 Melbourne
 6 Melburn Road
 Dandenong South, VIC 3175
 Tel: +61 3 8564 5000
 NATAF 1261 Site# 1254

Company Name: Strata Geoscience and Environmental P/L
Address: 17 Little Arthur Street
 North Hobart
 TAS 7000

Project Name: MAFFRA-BRAIGOLONG ROAD MAFFRA

Order No.: 922789
Report #: 922789
Phone: 922789
Fax:

Received: Sep 13, 2022 8:00 AM
Due: Sep 20, 2022
Priority: 5 Day
Contact Name: Michael Morrison
Eurofins Analytical Services Manager : Michael Morrison

Sample Detail		Moisture Set		Eurofins Suite B20		Emerson Class Number	
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID		
1	BH01	Jun 19, 2022		Soil	M22-S60025965	X	X
2	BH02	Jun 19, 2022		Soil	M22-S60025966	X	X
3	BH03	Jun 19, 2022		Soil	M22-S60025967	X	X
4	BH04	Jun 19, 2022		Soil	M22-S60025968	X	X
5	BH05	Jun 19, 2022		Soil	M22-S60025969	X	X
6	BH06	Jun 19, 2022		Soil	M22-S60025970	X	X
7	BH07	Jun 19, 2022		Soil	M22-S60025971	X	X
8	BH08	Jun 19, 2022		Soil	M22-S60025972	X	X
9	BH09	Jun 19, 2022		Soil	M22-S60025973	X	X
10	BH10	Jun 19, 2022		Soil	M22-S60025974	X	X
11	BH11	Jun 19, 2022		Soil	M22-S60025975	X	X
12	BH12	Jun 19, 2022		Soil	M22-S60025976	X	X
Test Counts						12	12

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra



Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

µg/L: micrograms per litre

ppm: parts per million

ppb: parts per billion

%: Percentage

org/100 mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
DRY	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report. QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (bis-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



Environment Testing

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code		
Method Blank									
Conductivity (1:5 aqueous extract at 25 °C as rec.)	uS/cm	< 10			10	Pass			
Exchangeable Sodium Percentage (ESP)	%	< 0.1			0.1	Pass			
Magnesium (exchangeable)	meq/100g	< 0.1			0.1	Pass			
Potassium (exchangeable)	meq/100g	< 0.1			0.1	Pass			
Sodium (exchangeable)	meq/100g	< 0.1			0.1	Pass			
Method Blank									
Cation Exchange Capacity									
Calcium (exchangeable)	meq/100g	< 0.1			0.1	Pass			
Cation Exchange Capacity	meq/100g	< 0.05			0.05	Pass			
LCS - % Recovery									
Conductivity (1:5 aqueous extract at 25 °C as rec.)	%	107			70-130	Pass			
Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Conductivity (1:5 aqueous extract at 25 °C as rec.)	K22-Se0015150	NCP	uS/cm	590	430	32	30%	Fail	
Duplicate									
% Moisture	M22-Se0025968	CP	%	23	23	<1	30%	Pass	

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



Comments

Analysis of Emerson Class has been completed by East West, NATA Accreditation Number 12360, report reference EWReport 221661-1

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	Yes

Authorised by:

Analytical Services Manager
Senior Analyst-Sample Properties
Senior Analyst-Inorganic
Senior Analyst-Metal
Senior Analyst-Inorganic

General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra



eastwest
geo ag enviro

82 Plain Street Tamworth NSW 2340
e admin@eastwestonline.com.au
t 02 6762 1733
f 02 6765 9109
abn 82 125 442 382

eastwestonline.com.au 

ANALYSIS REPORT SOIL

PROJECT NO: EW221661	Date of Issue: 23/09/2022
Customer: EUROFINS Melbourne	Report No: 1
Address: 6 Monterey Road, DANGENONG SOUTH VIC 3175 DANDENONG SOUTH VIC 3175	Date Received: 16/09/2022
Attention: Michael Morrison	Matrix: Soil
Phone: 03-8564 5000	Location: 922769
Fax:	Sampler ID: Client
Email: MichaelMorrison@eurofins.com	Date of Sampling: 19/06/2022
	Sample Condition: Acceptable

Comments:

3b = moderate to slight dispersion of the remould.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

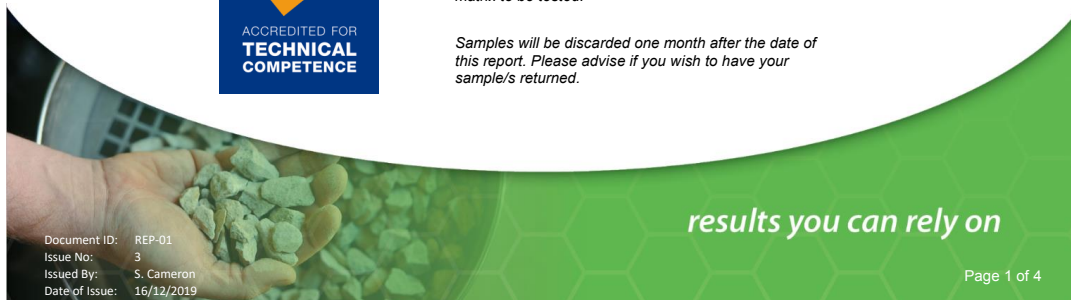
Signed: Stephanie Cameron
Laboratory Operations Manager



NATA Accredited Laboratory 12360
Accredited for compliance with ISO/IEC 17025 - Testing

*This analysis relates to the sample submitted
and it is the client's responsibility to make
certain the sample is representative of the
matrix to be tested.*

*Samples will be discarded one month after the date of
this report. Please advise if you wish to have your
sample/s returned.*



Document ID: REP-01
Issue No: 3
Issued By: S. Cameron
Date of Issue: 16/12/2019

results you can rely on

Page 1 of 4



ANALYSIS REPORT

PROJECT NO: EW221661

Location: 922769

					CLIENT SAMPLE ID	22-SE0025965	22-SE0025966	22-SE0025967	22-SE0025968
					DEPTH	BH01	BH02	BH03	BH0
Test Parameter	Method Description	Method Reference	Units	LOR	221661-1	221661-2	221661-3	221661-4	
Emerson Aggregate Test	Class	PMS-21	Number	na	1	3b	2	2	



Document ID: REP-01
Issue No: 3
Issued By: S. Cameron
Date of Issue: 16/12/2019

results you can rely on

Page 2 of 4



ANALYSIS REPORT

PROJECT NO: EW221661

Location: 922769

					CLIENT SAMPLE ID			
					22-SE0025969	22-SE0025970	22-SE0025971	22-SE0025972
					DEPTH			
					BH05	BH06	BH07	BH08
Test Parameter	Method Description	Method Reference	Units	LOR	221661-5	221661-6	221661-7	221661-8
Emerson Aggregate Test	Class	PMS-21	Number	na	3b	2	8	2





ANALYSIS REPORT

PROJECT NO: EW221661

Location: 922769

					CLIENT SAMPLE ID			
					22-SE0025973	22-SE0025974	22-SE0025975	22-SE0025976
					DEPTH			
					BH09	BH10	BH11	BH12
Test Parameter	Method Description	Method Reference	Units	LOR	221661-9	221661-10	221661-11	221661-12
Emerson Aggregate Test	Class	PMS-21	Number	na	3b	2	1	5

This Analysis Report shall not be reproduced except in full without the written approval of the laboratory.

Soils are air dried at 40°C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END



Document ID: REP-01
Issue No: 3
Issued By: S. Cameron
Date of Issue: 16/12/2019

results you can rely on

Page 4 of 4

Site De-vegetation and Soil Renovation Processes

1. Soils may be disturbed by site de-vegetation and removal of large trees. Soil may also be compacted by vehicular traffic or livestock. The following steps should be taken to renovate the soil profile before irrigation is installed:
 - a. Mechanically till, harrow or plough and level the residual soil surface. Ensure that all areas where vehicles or livestock have compacted the soil are deeply ripped or tilled to ensure adequate soil permeability. Ensure that the ground surface is levelled along natural slope contours and that all major rocks, gravels, road surfacing and large roots are removed.
 - b. Gypsum should be incorporated at the rate of 1kg/5m²
 - c. Imported topsoil (not clay) should be applied as shown in Fig 1 above. Do not compact this layer, and avoid travelling over with large machinery.
 - d. Irrigation should be laid as per the specifications below (point 2-18) and covered with further topsoil as per Fig 1 above.
 - e. Selected vegetation should be planted at a density of approx. 1 plant per 4m².
 - f. Mulch should be placed over the site as shown in Figure 1 above.

Land Application Area Design and Construction Notes

2. Delivery/flush line diameter = 25 -30 mm
3. Irrigation line diameter = 12-16mm
4. Irrigation line spacing (A) =300 mm for Sands, Sandy Loams and Loams to 600mm for Clay Loams, Light Clays and Heavy Clays (see the wastewater flow modelling section of this report for soil classification).
5. Dripper/Sprinkler spacing (B) as per manufacturers specifications.
6. A vacuum breaker should be installed at the highest point of the irrigation area (or in the case of multiple irrigation lots at each lot). This breaker should be protected and marked).
7. A flush line should be installed at the lowest point of the irrigation area incorporating a return valve for back flushing of the system back into the treatment chamber.
8. Irrigation areas greater than 400 m² should be split into a maximum 250 m² cells with effluent flows switched between irrigation lots with an automatic valve system.
9. All lateral lines MUST be installed parallel to the contours of the land. All minimum setbacks MUST be adhered to.
10. An inline filter must be inserted into the delivery line.
11. The first 100mm of the natural soil below the ground surface should be mechanically tilled to aid soil permeability.
12. Gypsum should be incorporated at the rate of 1kg/5m² into soils.
13. Imported topsoil (not clay) should be applied as shown above.
14. Selected vegetation should be planted at a density of approx. 1 plant per 4m².
15. A minimum 50mm of heavy mulch should be imported to cover the ground surface.
16. Where practical a 50% reserve area should be identified on the site to allow movement or expansion of the irrigation area if required.
17. In areas of moderate to steep slopes (>10%) then upslope cut off drainage should be installed to minimise shallow ground water recharge of the irrigation area from upslope.
18. All livestock and Vehicles MUST be excluded from irrigation area.

Appendix 4 Extract from EPAV 2024

Table 4-4: Minimum daily wastewater flow rates and organic loading rates – community/commercial premises¹⁰

Source	Design hydraulic flow rates for all water supplies (L/person/day)	Organic material loading design rates (g BOD/person/day)
Motels/hotels/guesthouse		
Bar trade per customer	7	8
Bar meals per diner	10	10
Per resident guest and staff with in-house laundry	150	80
Per resident guest and staff with outsourced laundry	100	80
Restaurants (per potential diner)¹¹		
Premises <50 seats	40	50
Premises >50 seats	30	40
Tearooms, cafés (light refreshments and prepared food (e.g. cakes, etc.) per seat	10	10
Conference facilities per seat	25	30
Function centre per seat	30	35
Take-away food shop per customer	10	40
Public areas (with toilet, but no showers and no café)¹²		
Public toilets	6	3
Theatres, art galleries, museums	3	2
Meeting halls with kitchenette	10	5
Premises with showers and toilets		
Golf clubs, gyms, pools etc. (per person)	50	10
Hospitals – per bed	350	150
Shops/shopping centres		
Per employee	15	10
Public access	5	3
School – childcare		
Per day pupil and staff	20	20
Resident staff and boarders	150	80
Factories, offices, day training centres,		

¹⁰ Based on EPA Publication 500: Code of Practice for Small Wastewater Treatment Plants.

¹¹ Number of seats multiplied by the number of seatings, i.e., may include multiple seatings for breakfast, morning and afternoon teas, lunch and dinner.

¹² For premises such as public areas, factories or offices with showers and toilets, use the flow rates for 'Premises with showers and toilets' in the calculations.

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

<u>Source</u>	<u>Design hydraulic flow rates for all water supplies (L/person/day)</u>	<u>Organic material loading design rates (g BOD/person/day)</u>
medical centres		
No showers	20	15
With showers	50	30
Camping grounds		
Fully serviced – onsite cabins/ caravans with showers, toilets and cooking facilities	150	60
Recreation areas/Amenity blocks with showers, communal kitchen and toilets	100	40

Table 4-1: Design flow rates for households³.

<u>Sewage source</u>	<u>Design flow rate (L/person/day)</u>	
	<u>Reticulated water supply⁴</u>	<u>Onsite roof water tank supply</u>
Households with standard water fixtures	180	150
Households with extra sewage-producing facilities ⁵	220	190
Households with WELS ⁶ scheme fixtures and fittings	150	120

³ Adapted from Government of South Australia, SA Health (2013), On-site wastewater systems Code.

⁴ Includes reticulated town water supply, groundwater bores or stock and domestic waterway diversion licences (where connected to household use).

⁵ Extra wastewater producing facilities could include, but are not limited to, spa baths.

⁶ WELS – Water efficiency labelling scheme. Requires 4 Stars or higher for dual-flush toilets, shower-flow restrictors, aerator taps, flow/pressure control valves, and 3 Stars or higher for all appliances (for example. clothes washing machines).

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

Table 4-8. Soil categories and design loading/irrigation rates (reproduced from AS1547:2012 with permission by Standards Australia)

Soil texture	Soil structure	Soil category	Indicative soil permeability Ksat (m/d)	Design irrigation rates (DIR)/design loading rates (DLR) (mm/day)						
				Absorption trenches/ beds			ETA trenches/ beds	Subsurface and surface irrigation	LPED irrigation	Mounds (basal area)
				Table L1, AS/NZS 1547:2012 Primary treated effluent		Secondary treated effluent	Table L1, AS/NZS 1547:2012	Table M1, AS/NZS 1547:2012	Table M1, AS/NZS 1547:2012	Table N1, AS/NZS 1547:2012
Conservative rate	Maximum rate									
Gravels and sands	Structureless (massive)	1	>3.0	See Note 1 of Table L1, AS/NZS 1547:2012 for DLR values			See Note 4 of Table L1, AS/NZS1547:2012	5	See Note 3 of Table M1, AS/NZS154:2012)	32
Sandy loams	Weakly structured	2a	>3.0					5		24
	Massive	2b	1.4-3.0	15	25	50		(See Note 1 Table M1, AS/NZS 1547:2012)	4	24
Loams	Highly/moderately structured	3a	1.5-3.0	15	25	50		4	3.5	24
	Weakly structured or massive	3b	0.5-1.5	10	15	30		4	3.5	16
Clay loams	Highly/moderately structured	4a	0.5-1.5	10	15	30	12	3.5	3	16
	Weakly structured	4b	0.12-0.5	6	10	20	8	3.5	3	8
	Massive	4c	0.06-0.12	4	5	10	5	3.5	3	5 (See Note

Guideline for onsite wastewater management
Page 47

Soil texture	Soil structure	Soil category	Indicative soil permeability Ksat (m/d)	Design irrigation rates (DIR)/design loading rates (DLR) (mm/day)						
				Absorption trenches/ beds			ETA trenches/ beds	Subsurface and surface irrigation	LPED irrigation	Mounds (basal area)
				Table L1, AS/NZS 1547:2012 Primary treated effluent		Secondary treated effluent	Table L1, AS/NZS 1547:2012	Table M1, AS/NZS 1547:2012	Table M1, AS/NZS 1547:2012	Table N1, AS/NZS 1547:2012
Conservative rate	Maximum rate									
Light clays	Strongly structured	5a	0.12-0.5	5	8	12	8	3	2.5	8
	Moderately structured	5b	0.06-0.12		5	10	5	3	(See Note 4 of Table M1, AS/NZS1547:2012)	5 (See Note of Table N1 AS/NZS 1547:2012)
	Weakly structured or massive	5c	<0.06			8	(See Note 2, 3 5 of Table L1 AS/NZS 1547:2012)	(See Note 1 of Table M1, AS/NZS1547:2012)	12	1547:2012)
Medium to heavy clays	Strongly structured	6a	0.06-0.5	(See Notes 2 and 3 of Table L1 AS/NZS1547:2012)			Table L1 AS/NZS 1547:2012	2	(See Note 3 of Table M1, AS/NZS1547:2012)	12
	Moderately structured	6b	<0.06				(See Note 2 of Table M1, AS/NZS1547:2012)			
	Weakly structured or massive	6c	<0.06							

Guideline for onsite wastewater management
Page 48

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

The design loading rates and design irrigation rates in Table 4-9 are amended to meet Victorian specific recommendations.

Table 4-9: Soil categories and design loading/irrigation rates recommended for Victoria

Soil texture	Soil structure	Soil category	Design irrigation rates (DIR)/design loading rates (DLR) (mm/day)				
			Absorption trenches/ beds Table L1, AS/NZS 1547:2012	ETA trenches/ beds Table L1, AS/NZS 1547:2012	Subsurface and surface irrigation Table M1, AS/NZS 1547:2012	LPED irrigation Table M1, AS/NZS 1547:2012	Mounds (basal area) Table N1, AS/NZS 1547:2012
Gravels and sands	Structureless (massive)	1	Recommended to use values from "conservative rate" column of Table 4-8 See also Note 1, 2 and 3 of Table 4-9	ETA/ETS systems are not normally used on soil categories 1 and 2a. 15	Refer to values and notes in Table 4-8 See also Note 4 of Table 4-9	LPED irrigation is not suitable on soil categories 1 and 2a	Refer to values and notes in Table 4-8
Sandy loams	Weakly structured	2a					
	Massive	2b					Refer to values and notes in Table 4-8
Loams	Highly/moderately structured	3a		Refer to values and notes in Table 4-8			Refer to values and notes in Table 4-8
	Weakly structured or massive	3b					
Clay loams	Highly/moderately structured	4a					
	Weakly structured	4b					
	Massive	4c					

Guideline for onsite wastewater management
Page 49

Soil texture	Soil structure	Soil category	Design irrigation rates (DIR)/design loading rates (DLR) (mm/day)				
			Absorption trenches/ beds Table L1, AS/NZS 1547:2012	ETA trenches/ beds Table L1, AS/NZS 1547:2012	Subsurface and surface irrigation Table M1, AS/NZS 1547:2012	LPED irrigation Table M1, AS/NZS 1547:2012	Mounds (basal area) Table N1, AS/NZS 1547:2012
Light clays	Strongly structured	5a					
	Moderately structured	5b					
	Weakly structured or massive	5c					
Medium to heavy clays	Strongly structured	6a				LPED irrigation is not suitable on soil category 6	
	Moderately structured	6b					
	Weakly structured or massive	6c					

Notes to Table 4-9:

- There is elevated risk associated with primary treated effluent being dispersed to trenches and beds in soil categories 1 and 2a. This is due to the high infiltration rate of these soils, which leads to uneven distribution along the base of the trench. These soils have low nutrient retention capacities, often allowing accession of nutrients to groundwater.
- Use of absorption trenches/beds in category 1 and 2a soils require design by a suitably qualified and experienced person. Where groundwater quality is at risk, secondary treatment is required and consideration should also be given to disinfection, nutrient removal, soil modification or distribution over a large application area.
- Use of absorption trenches/beds in category 5b, 5c and 6 soils requires special design and distribution techniques or soil modification procedures. In most situations the design will need to rely on more processes than just absorption by the soil.
- The design irrigation rate for subsurface or surface irrigation may be increased in sandy soils (categories 1 and 2) where secondary treatment is installed with disinfection and nutrient reduction.

Guideline for onsite wastewater management
Page 50

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Table 4-10: Setback distances (m) ^{20,21}

Landscape feature or structure	OWMS with primary treated effluent	OWMS with secondary treated effluent or Level 3 greywater effluent	OWMS with Level 1 and 2 greywater effluent
Building/allotment boundary			
Up-slope of building (See Note 1)	6	3	3
Down-slope of building	3	1.5	1.5
Up-slope of adjacent lot	6	3	1
Down-slope of adjacent lot	3	1.5	0.5
Services			
Water supply pipe	3	1.5	1.5
Up-slope of potable supply channel (stock and domestic)	300	150	150
Down-slope of potable water supply	20	10	10

²⁰ Setback distances are measured horizontally from the external wall of the treatment plant and the boundary of the land application area, except for soil depth as per Note 10.

²¹ The setback distances for flat land are equivalent to down-slope setback distances.

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Landscape feature or structure	OWMS with primary treated effluent	OWMS with secondary treated effluent or Level 3 greywater effluent	OWMS with Level 1 and 2 greywater effluent
channel (stock and domestic)			
In-ground water tank (See Note 2)	15	7.5	3
Closed stormwater drain	6	3	2
Open stormwater drain	50	30	10
Gas supply pipe	3	1.5	1.5
Recreational areas			
Children's grassed playground (See Note 3)	6	3	2
In-ground swimming pool	6	3	2
Surface waters			
Dam, lake or reservoir (used as source water for drinking or within a special water supply catchment) (See Notes 5, 6)	300	300	150
Waterways (used as a source of water for drinking or within a special water supply catchment) (See Notes 4, 5)	100	100	50
Waterways not used as source of water for drinking or within a special water supply catchment (for example, wetlands (continuous or ephemeral); estuaries (See Note 4)	60	30	30
Ocean beach at high-tide mark; dams, reservoirs or lakes not used as source of water for drinking or within a special water supply catchment (See Note 6)	60	30	30
Dam, lake or reservoir (used as source water for drinking or within a special water supply catchment) (See Notes 5, 6)	300	300	150
Drainage lines (See Note 7)	40	20	20

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briogolong Road Maffra*

Landscape feature or structure	OWMS with primary treated effluent	OWMS with secondary treated effluent or Level 3 greywater effluent	OWMS with Level 1 and 2 greywater effluent
Up-slope of cutting/escarpment (See Note 8)	15	15	15
Groundwater bores			
Groundwater bores – category 1 and 2a soils	NA	50	20
Groundwater bores – category 2b to 6 soils	20	20	20
Soil depth (See Note 9)			
Depth to highest seasonal water table (See Note 10)	1.5	1.5	1.5
Depth to hydraulically limiting layer (for example, bedrock)	1.5	0.6	0.6

Notes to Table 4-10:

1. Establishing an OWMS up-slope of a building may have implications for the structural integrity of the building. This should be examined by a building surveyor on a site-by-site basis.
2. It is recommended that OWMS are installed down-slope of an in-ground water tank.
3. 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.
4. Means a waterway as defined in the *Water Act 1989*.
5. Applies to land adjacent to a dam, lake, reservoir or waterway that provides source water used for the supply of public drinking water or, which is subject to an environmental significance overlay (ESO) that designates maintenance of water quality as the environmental objective to be achieved, or within a special water supply catchment area listed in Schedule 5 of the *Catchment and Land Protection Act 1994*.
6. Does not apply to dams, lakes or reservoirs located above ground level that cannot receive runoff.
7. An intermittent stream that is found to be a drainage line (drainage depression) with no defined banks and the bed is not incised. The topography of the drainage line should be demonstrated in writing and photographs in the LCA report.
8. A cutting/escarpment from which water is likely to emanate.
9. Depth is measured vertically through the soil profile from the base of absorption/ETA trenches/beds or from the irrigation pipes.
10. The highest seasonal water table occurs when groundwater is closest to the ground surface. This usually occurs in the wettest months of the year.

*Reconnaissance LCA and Onsite System Concept Design for
Maffra-Briagolong Road Maffra*

Table 4-11 shows risk factors that may influence setback distance.

Table 4-11: Site constraint risk factors

<u>Risk factor</u>	<u>Parameter</u>
Soil type and geology	Permeability of soil
Topography	Slope Landform Drainage Position of land application area (including system/soil interfaces)
Groundwater	Depth and quality
Weather conditions (rainfall)	Rainfall Evaporation Flood potential
Wastewater quality	Primary treated effluent Secondary treated effluent
Microbial quality of effluent	Consistency of high microbial quality of effluent
Application method	Drip irrigation or subsurface application versus surface/above ground application of effluent
Sensitivity of the receiving environment	Proximity to sensitive receptors (drinking water reservoir/offtake/catchment)

Appendix 5 Professional Indemnity Insurance Certificate of Currency



CERTIFICATE OF CURRENCY

Class of Business: Professional Indemnity
Policy Number: PIPOL11002060
Policyholder: Strata Geoscience & Environmental PL (Sven Nielsen t/as); Nielsen Family Trust
Industry Group: Engineers
Policy Wording: Architects and Engineers PI Policy Version 1124
Professional Services: As defined in the Policy Schedule
Policy Period: From 26/05/2026 To 26/05/2027
both 4pm local time at the **Policyholder's** registered address.

Policy Section 1 – Professional Indemnity

Limit of Liability (any one Claim) \$2,000,000
Aggregate Limit \$2,000,000
Insurer: Probitas Syndicate 1492 at Lloyd's of London

Signature:

Mitchell Spurr
Underwriting Manager – Professional Indemnity
Probitas 1492 (Pacific) Pty Ltd on behalf Probitas Syndicate 1492

Sydney | Melbourne

australia@probitas1492.com

1300 001 492

probitaspacific.com

Probitas Syndicate 1492 is managed at Lloyd's by Probitas Managing Agency Limited. Probitas Managing Agency Limited is registered in England and Wales (No. 12242600) at 88 Leadenhall Street, London, EC3A 3BP and is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority (firm reference number 931446). Probitas 1492 (Pacific) Pty Ltd (ABN 92 663 993 244) is registered in Australia and is a Lloyd's approved service company and coverholder of Probitas Managing Agency Limited. Probitas 1492 (Pacific) Pty Ltd is regulated in Australia by the Australian Securities and Investments Commission (Licence No. 545082).

Entia Aviva_Certificate of Currency V004

Page 1 of 1



Appendix 6 Terms and Conditions

Scope of Work

These Terms and Conditions apply to any services provided to you ("the Client") by Strata Geoscience and Environmental Pty Ltd ("Strata"). By continuing to instruct Strata to act after receiving the Terms and Conditions or by using this report and its findings for design and/or permit application processes and not objecting to any of the Terms and Conditions the Client agrees to be bound by these Terms and Conditions, and any other terms and conditions supplied by Strata from time to time at Strata's sole and absolute discretion. The scope of the services provided to the Client by Strata is limited to the services and specified purpose agreed between Strata and the Client and set out in the correspondence to which this document is enclosed or annexed ("the Services"). Strata does not purport to advise beyond the Services.

Third Parties

The Services are supplied to the Client for the sole benefit of the Client and must not be relied upon by any person or entity other than the Client. Strata is not responsible or liable to any third party. All parties other than the Client are advised to seek their own advice before proceeding with any course of action.

Provision of Information

The Client is responsible for the provision of all legal, survey and other particulars concerning the site on which Strata is providing the Services, including particulars of existing structures and services and features for the site and for adjoining sites and structures. The Client is also responsible for the provision of specialised services not provided by Strata. If Strata obtains these particulars or specialised services on the instruction of the Client, Strata does so as agent of the Client and at the Client's expense. Strata is not obliged to confirm the accuracy and completeness of information supplied by the Client or any third party service provider. The Client is responsible for the accuracy and completeness of all particulars or services provided by the Client or obtained on the Client's behalf. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever suffered by the Client or any other person or entity resulting from the failure of the Client or third party to provide accurate and complete information. In the event additional information becomes available to the Client, the Client must inform Strata in writing of that information as soon as possible. Further advice will be provided at the Client's cost. Any report is prepared on the assumption that the instructions and information supplied to Strata has been provided in good faith and is all of the information relevant to the provision of the Services by Strata. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever if Strata has been supplied with insufficient, incorrect, incomplete, false or misleading information.

Integrity

While all reasonable care is taken reporting to the Client, Strata does not warrant that the information contained in any report is free from errors or omissions. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever resulting from errors in a report. Any report should be read in its entirety, inclusive of any summary and annexures.. Strata does not accept any responsibility where part of any report is relied upon without reference to the full report. Latter versions of any report invalidate any recommendations, assumptions, or designs contained in former reports. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever based upon the use of older versions of any report.

Project Specific Criteria

Any report provided by Strata will be prepared on the basis of unique project development plans which apply only to the site that is being investigated. Reports provided by Strata do not apply to any project other than that originally specified by the Client to Strata. The Report must not be used or relied upon if any changes to the project are made. The Client should engage Strata to further advise on the effect of any change to the project. Further advice will be provided at the Client's cost. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever where any change to the project is made without obtaining a further written report from Strata. Changes to the project may include, but are not limited to, changes to the investigated site or neighbouring sites, for instance, variation of the location of proposed building envelopes/footprints, changes to building design which may impact upon sewage treatment plant system design, specification and performance.

Interpretation

Strata is not responsible for the interpretation of site data or report findings by other parties, including parties involved in the design and construction process. The Client must seek advice from Strata about the interpretation of the site data or report.

Design/Report Recommendations

Where sewage treatment plant and/or application system designs are provided by Strata, reasonable effort will be made to minimise environmental, public health and commercial risks associated with the disposal of effluent within site boundaries with respect to relevant Australian guidelines and industry best practise at the time of investigation. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever resulting from:

- (i) changes to either the project or site conditions that affect the onsite wastewater land application system's ability to safely dispose of modelled wastewater flows; or
- (ii) changes to original use of site infrastructure or changes from original modelled loadings as a result of change of use or incorrect loading information supplied by the client: or
- (iii) seepage, pollution or contamination or the cost of removing, nullifying or clearing up seepage, polluting or contaminating substances; or
- (iv) poor system performance where septic tanks have not been de-sludged at maximum intervals of 3 years or sewage treatment plants have not been serviced in compliance with the manufacturers recommendations; or
- (v) system /component failure of any recommended system/component; or

Reconnaissance LCA and Onsite System Concept Design for Maffra-Briagolong Road Maffra

- (vi) poor contractor construction/installation practice; or
- (vii) Inferior product/component selection by installing contractor ; or
- (viii) any treatment plant , treatment plant component or land application area breakdown of any kind; or
- (ix) failure of the client to commission both interim and final inspections by the designer throughout the system construction; or
- (x) the selection of inappropriate plants for irrigation areas or any increased cost associated with upkeep of recommended plants or their replacement; or
- (xi) damage to any infrastructure by seepage/effluent including but not limited to foundations, walls, driveways and pavements; or
- (xii) land instability, soil erosion or dispersion caused by seepage/effluent or the installation of sewage plant infrastructure; or
- (xiii) Excavation difficulties given hard rock, watertables, collapsing soils or other difficult conditions; or
- (xiv) Dammmages to underground services via excavation or system installation; or
- (xv) design changes requested by the Permit Authority;or
- (xvi) time delays associated with any of the above, or to strata or any of its representatives being able to mobilise to site for any reason.

Furthermore Strata does not guarantee land application area esign life beyond 2 years from installation. Strata does not warrant EPA sand filter designs.

Strata does not consider site contamination, unless the Client specifically instructs Strata to consider the site contamination in writing. If a request is made by the Client to consider site contamination, Strata will provide additional terms and conditions that will apply to the engagement.

Copyright and Use of Documents

Copyright in all drawings, reports, specifications, calculations and other documents provided by Strata or its employees in connection with the Services remain vested in Strata. The Client has a licence to use the documents for the purpose of completing the project. However, the Client must not otherwise use the documents, make copies of the documents or amend the documents unless express approval in writing is given in advance by Strata. The Client must not publish or allow to be published, in whole or in part, any document provided by Strata or the name or professional affiliations of Strata, without first obtaining the written consent of Strata as to the form and context in which it is to appear.

If, during the course of providing the Services, Strata develops, discovers or first reduces to practice a concept, product or process which is capable of being patented then such concept, product or process is and remains the property of Strata and:

- (i) the Client must not use, infringe or otherwise appropriate the same other than for the purpose of the project without first obtaining the written consent of Strata; and
- (ii) the Client is entitled to a royalty free licence to use the same during the life of the works comprising the project.

Digital Copies of Report

If any report is provided to the Client in an electronic copy except directly from Strata, the Client should verify the report contents with Strata to ensure they have not been altered in any way from the original provide by Strata.