Maven Waikato Ltd

Hooker Road

Technical Memorandum

To:	Hooker Road
From:	Malik ur Rahman (Maven Waikato Limited)
Subject:	Hooker Road – Water Demand and Disposal Technical Memorandum
Date:	October 2026

1 Introduction

Maven has been tasked to review and assess the grey-water disposal demands and requirements for an event site. This ultimately includes potable water and blackwater requirements, which has been briefly detailed also.

The project is a temporary event occurring within the Waikato district boundary, located South of Hamilton near Cambridge. The main event is to run for 4 days and 4 nights, with on-site amenities and campsites for overnight stayers. The expected daily turn-out is up to 35,000 people, therefore usage and disposal require thorough assessment. There will be a portion of attendees arriving a day early and leaving a day later. Therefore, the total volumes will need to account for the additional loading over this total 6-day span.

Assessments were undertaken to evaluate the demands of the temporary site development assuming the site will be running at full capacity between the 4-day main event, and partial loading on days 1 & 6. The purpose of this review is to identify potential constraints associated with the temporary site and to determine whether any mitigation measures may be required to support the anticipated growth within the Waikato area.

2 Parameters

The key parameters for the site are predominantly due to being a rural site, being unfeasible to pursue permanent fixtures due to the duration of the event and the shear mass of attendees. There are no public water, wastewater, or stormwater mains available to service the site, therefore options have been presented to suit the varying outcomes for the event and participants.

This memorandum has been written in accordance and conjunction with the following standards and guidelines:

1. Auckland City Council TC58
2. Waikato LASS Regional Infrastructure Technical Standards (2025)
3. AS/NZS 1547:2012 On-site domestic wastewater management
4. Building Regulation G12 – Water Supplies
5. Building Regulation G13 – Foul Water
6. Public Health Guidance for Festival and Event Organisers, Health NZ, Dec. 2024

Deviations from the standards and guidelines will be noted and will likely require approval from the local authority prior to establishment.

3 Options

The optioneering for the site will be comprised of:

1. Potable water demand
2. Greywater disposal
3. Wastewater demand

3.1 Water Demand

The expected water demand has been detailed below in Table 1: Water Demands. The assumptions made to produce these results are as follows:

- 35,000 total people attending
- 18,000 people staying overnight
- 4-day main event duration
- 1 day (24hr) worth of set up and pack down for the expected before and after the 4-day event
- Demands in accordance with, or interpolated from, Auckland City Council TP58

From these assumptions, we can evaluate the demand as shown:

Water Demands & Outputs			
Activity	**Portable Demand (L/d)**	**Greywater Output (L/d)**	**Blackwater Output (L/d)**
Total Visitor: (35,000 People per Day)	700,000	-	525,000
Night-Stay Showers: (18,000 People)	576,000	576,000	-
Food Vendors & Wash up	175,000	-	175,000
Night-Stay Toilets	180,000	-	180,000
Total Daily	1,631,000	576,000	880,000
6-Day Cumulative	6,704,000	2,419,200	3,700,000

Table 1: Water Demands

Therefore, the estimated total water demand, including for the setup and pack down is estimated to be 6,704m³. This figure may be able to be reduced reasonably, if there is adequate reasoning and a factor of safety to mitigate any adverse effects. Examples are:

1. Refinement regarding flow rates of equipment
2. Tested or reduced demand/ allowance figures; including a percentage figure of the daily demand for non-overnight attendees
3. Refined numbers for attendees.

3.2 Onsite Soakage Testing

On-site soakage testing carried out by CMW Geoscience on 11th September 2026, with the report included in Appendix A and summary of results presented in the Table 2 below

Units	Soakage rate (m/day)		Soakage rate (mm/hr)	
	CIRIA 113	Hvorslev	CIRIA 113	Hvorslev
1	10.28	2.22	428.33	92.50
2	3.06	1.08	127.50	45.00
3	6.97	1.76	290.42	73.33
4	5.01	2.37	208.75	98.75

Table 2: Soakage test results

The raw data from the field has been evaluated using both the CIRIA 113 and Hvorslev calculation methods to provide soakage rate. While CIRIA C750 (2016) is the most recent revision to the standard, CIRIA 113 (1989) has been selected for this report as it yields more conservative dewatering results, aligning with TC58 practice and ensuring appropriate safety margins.

3.3 Greywater Disposal

For onsite greywater disposal, the following assumptions have been made as per below:

- **Overnight Campers:** 18,000 people will shower once per day.
- **Flow Rate** of 8L/min & **Shower Duration** of 5 minutes per shower per person has been assumed as per SNZ HB 44:2001
- **Shower Blocks:** The below calculations are based on a total setup of 100 showers are available across the site, increase in shower will increase the daily output volume.
- **Commercial Vendors:** Any water produced by food and beverage vendors will be treated as blackwater/high-strength waste and trucked off-site, as covered in **Section 4** of this report.
- **Collection & Pumping:** Greywater will drain into collection tanks to absorb peak hourly flows. From there, it will be pumped out to the designated treatment or disposal areas as per the recommendations below.

Calculation					
Primary Calculation:					
Water Volume per Single Shower	40	L/shower			
No of Showers per Hr	12				
Total output per shower per Day	5,760	L/day	Assuming 12Hrs of constant shower usage per day		
Maximum daily capacity	576,000	L/day	≈	**576**	**m³**
Daily Capacity per Hr	24,000	L/hr	≈	**24**	**m³**
Total 3-day Maximum usage	**1,728,000**	L	≈	**1,728**	**m³**
Secondary Check:					
Total Daily Showers	14,400	showers/day			
Daily water usage	576,000	L/day	≈	**576**	**m³**
Daily Capacity per Hr	24,000	L/hr	≈	**24**	**m³**
Total 3-days usage	1,728,000	L	≈	**1,728**	**m³**

Table 3: Approximate Greywater Calculation

Several potential disposal zones have been located at site as per Figure 1 below. To cater a high daily flow volume of 576m³/day (or an average peak rate of 24m³/hr), Zones 1, 2, and 7 are identified as the primary and most suitable disposal locations. These zones are selected based on high soakage rate, proximity to the shower block and topography at site.

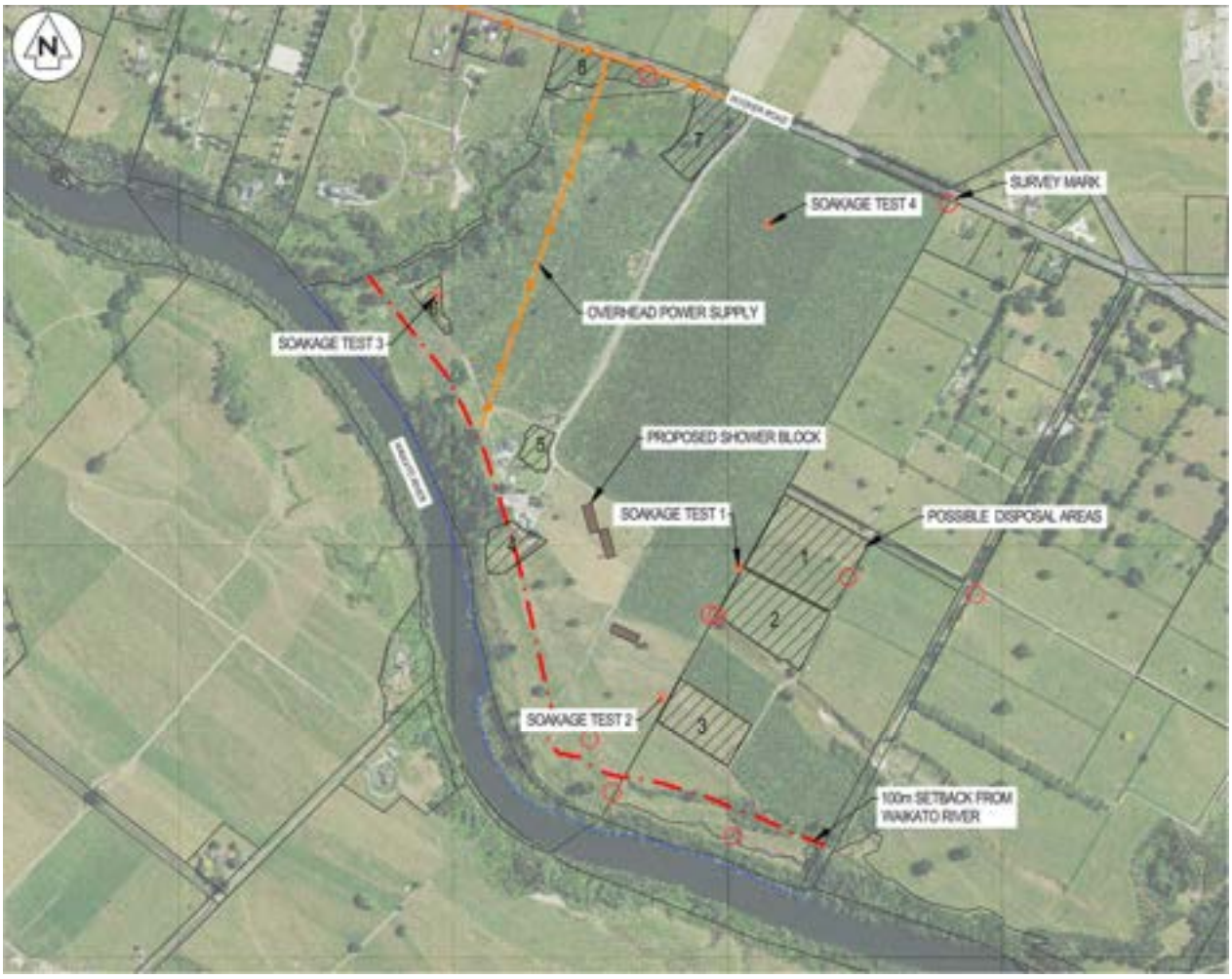


Figure 1: Possible disposal areas at the site

Areas 4 and 6 have been completely ruled out for greywater disposal. Both areas fall within or directly adjacent to the mandatory 100m buffer zone of the Waikato River as shown in the Figure 1 above.

Additionally, in accordance with environmental health standards and AS/NZS 1547 guidelines, land allocated for disposal area shall not be utilized for the cultivation of edible crops for a minimum period of 60 days following greywater application. Therefore, owners of any potential greywater disposal areas must be notified, and compliance achieved.

Collection Tank Options

To maintain a peak hour flow and continuous, steady flow to the disposal area, localised collection tanks would be required. These tanks provide the necessary surge capacity and ensure a minimum 4-hour retention buffer before greywater is pumped to the treatment.
The primary options for the requirement would as per following:

1. Tank option A (100m³ capacity): Four 25,000L (25m³) plastic water tanks.
2. Tank option B (120m³ capacity): Four 30,000L (30m³) plastic water tanks.

These options account for the storage required while greywater discharge is ongoing, and then for the buffer tanks to sustain the 4-hour minimum buffering time. These tanks would need to be cleaned at the end of the event with a suction-truck and carted to be processed at blackwater.

Alternatively, a smaller intermediate tank can be placed close to the shower blocks and reduce the capacity of the collection tanks. This would not change the size of the final disposal field; it takes the pressure off the main system during peak rushes. It holds the water locally first, giving an extra safety margin if usage spikes, and makes the whole network much more reliable.

Option A – Below Ground System

This method follows the standards and guidelines set out by AS/NZS 1547:2023 On-site domestic wastewater treatment, Appendix L. These Disposal areas are subjected to the adopted DLR and sizing of the trenches, any changes in them may vary the final gross area. There are multiple preliminary locations that have been allocated for greywater disposal. A map has been provided below to illustrate the locations.

Option A.1 - Trenches

Based on the soakage test, the adopted infiltration rate at the disposal zone 1 is 400mm/day. To calculate the required footprint at site, the assumed dimensions of the trenches are 1m wide, 20m long, 0.6m deep and 1m spacing between adjacent trenches. The calculation is subjected to the above adopted infiltration rate and dimension of the trenches.

Option 1:	**Disposal Trench**							
Q (Design Daily Flow in)			576,000	L/day				
DLR (Design loading rate)			400	mm/day	(Assumed based on Category 2 soil)			
Minimum Bed Width			1	m				
Required Total Length			1,440	L				
No of beds			75	No's				
Length Per Bed			19.2	m	≈	20	m	
Secondary Check:								
Total Bed Surface Area			20	m^2	(Bed Width X Bed Length)			
Total Absorption Area			1,500	m^2	(Net Surface Area X No of Beds)			
Design Loading Rate (DLR)			384	mm/day	(Daily Design Flow/Net Absorption Rate)			
Area:								
Bed Width	1	m		Minimum Spacing		1	m	
Bed Length	20	m		Minimum Spacing		1	m	
Total Area per bed (including spacing)			42	m^2				
Total Gross area			3,150	m^2	≈	0.32	ha	
Based on As NZS 1547-2012 Section L4.2 Sizing: Assuming the width of bed as 1.0m wide, 20m long and 0.6m deep bed with 1.0m separation between the bed would require a maximum of 75 beds over a gross land area of 0.32ha								

Table 4: Greywater option A.1

As an area reference, these are illustrated in below:

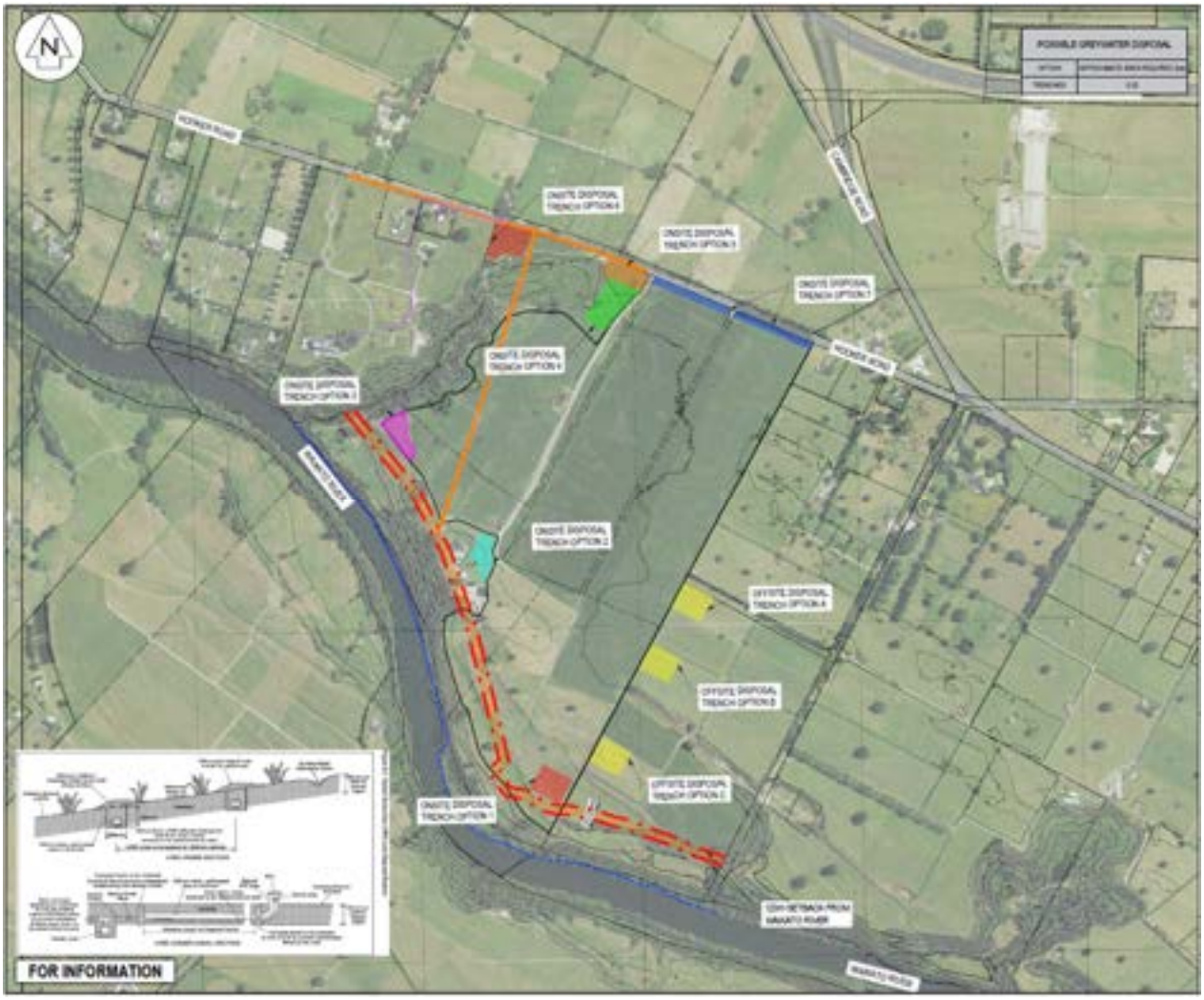


Figure 2: Option A.1 footprint

Please note that the final gross land area required for each disposal zone is directly linked to the adopted Design Loading Rate (DLR) and specific trench dimensions.

Option A.2 – Absorptions Beds

Based on the soakage test, the adopted infiltration rate at the disposal zone 1 is 400mm/day. To calculate the required footprint at site, the assumed dimensions of the beds are 1.8m wide, 20 long, 0.6m deep and 1m spacing between adjacent trenches. The calculation is subjected to the above adopted infiltration rate and dimension of the trenches.

Option 2:	**Absorption Beds**				
Q (Design Daily Flow in)	576,000	L/day			
DLR (Design loading rate)	400	mm/day	(Assumed based on Category 2 soil)		
Minimum Bed Width	1.8	m			
Required Total Length	800	L			
No of beds	40	No's			
Length Per Bed	20.00	m	≈	20	m

Secondary Check:							
Total Bed Surface Area			36	m²	(Bed Width X Bed Length)		
Total Absorption Area			1,440	m²	(Net Surface Area X No of Beds)		
Design Loading Rate (DLR)			400	mm/day	(Daily Design Flow/Net Absorption Rate)		
Area:							
Bed Width	1.8	m		Minimum Spacing	1	m	
Bed Length	20	m		Minimum Spacing	1	m	
Total Area per bed (including spacing)				58.8	m²		
Total Gross area				2,352	m²	≈ 0.24	ha
Based on As NZS 1547-2012 Section L4.2 Sizing: Assuming the width of bed as 1.8m wide, 20m long and 0.6m deep bed with 1.0m separation between the bed would require a maximum of 40beds over a gross land area of 0.24ha.							

Table 5: Greywater Option A.2

As an area reference, these are illustrated in Figure 3 below:

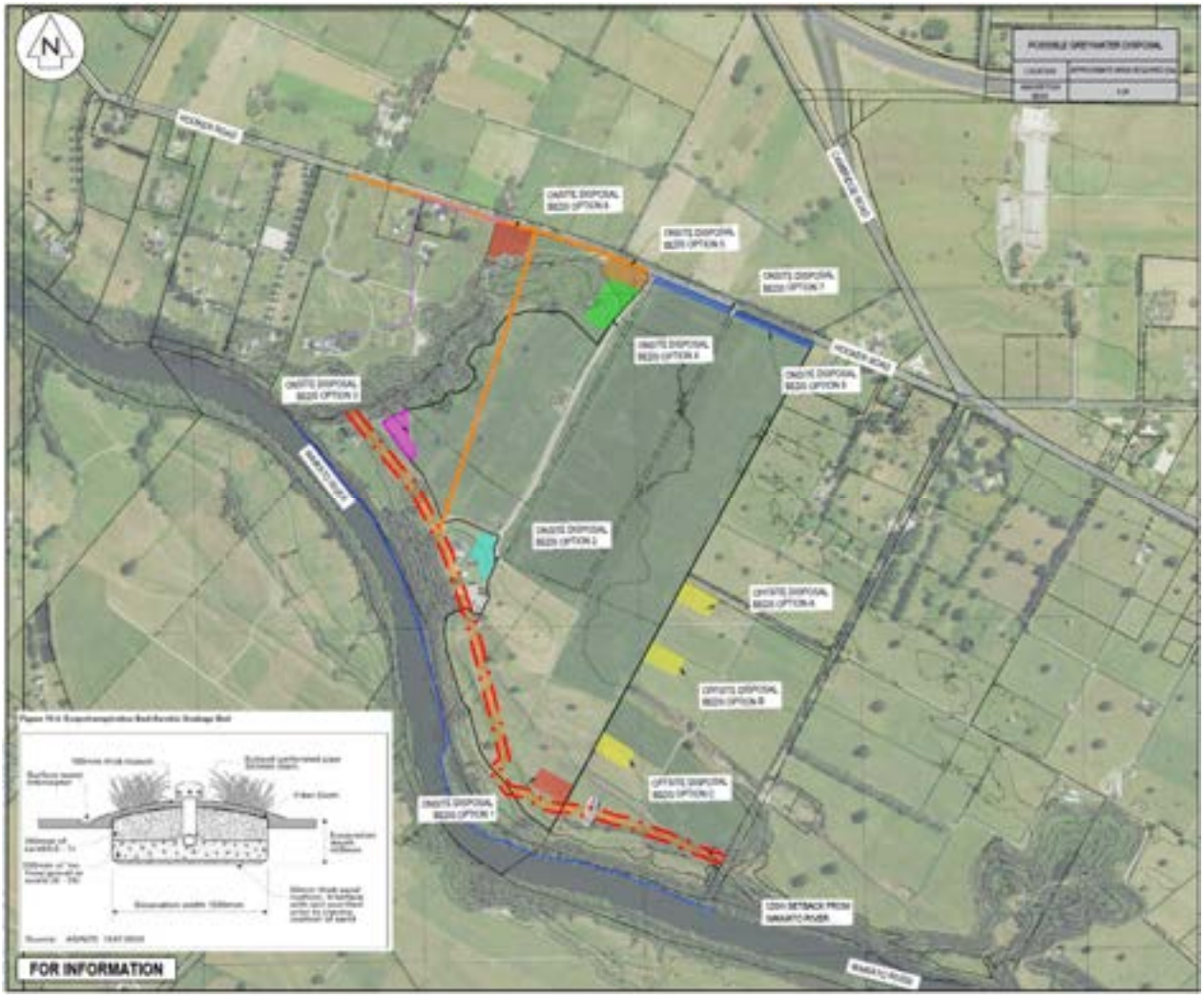


Figure 3: Option A.2 footprint

Please note that the final gross land area required for each disposal zone is directly linked to the adopted Design Loading Rate (DLR) and specific trench or bed dimensions.

Option B – Subsurface Drip Lines

Option B uses subsurface drip lines to spread greywater evenly over the soil (AS/NZS 1547:2023, Appendix M).

Under standard permanent operational guidelines, a typical Design Irrigation Rate (DIR) of 25mm/day (25 L/m²/day) would be adopted for secondary wastewater application. However, the proposed event operates for a short duration of 4 days per year and is designed specifically to treat greywater from the shower facilities only, the soil profile is not subjected to long-term soil structure degradation.

Based on the above assumptions, the DIR for the calculations is adopted as 50mm/m²/day, and the calculations are as per the table 5 below:

Option 3:	**Dripper Lines Treatment**				
DIR =	50	mm/m²/day	≈	0.050	m/m²/day
Infiltration Rate =	40	mm/hr	≈	0.96	m/m²/day
Volume per day =	576	m³/day			
Required Irrigation Area	11,520	m²	≈	1.15	ha
Minimum spacing between lines	1	m			
To convert the area to KMs	11.5	kms			
Maximum Length of each line	40	m	≈	0.04	km
Total Number of lateral runs	288	Parallel lines			
No of Zones Required	3				
Dipper Lines per Zone	96	Parallel lines			
Based on As NZS 1547-2012: Assuming a 40m long dripper line with 1.0m separation between the lines would require a maximum of 360 parallel line over a gross land area of 1.44ha					

Table 6: Option B - Drip lines

Possible locations of dripper lines are illustrated below:

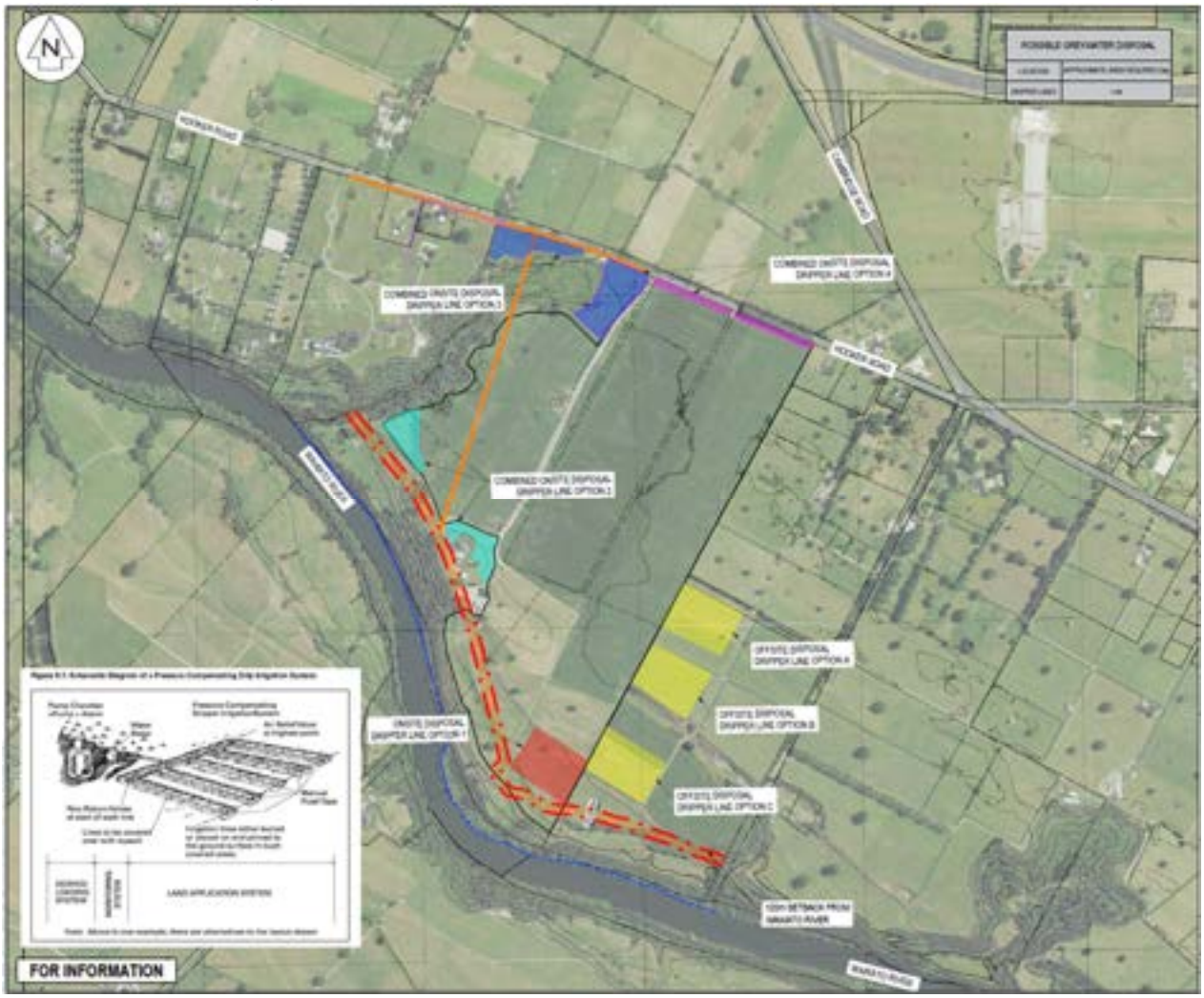


Figure 4: Option B footprint

Option C – Above Surface Greywater Sprinklers Disposal

Sprinkler disposal is a feasible method, provided greywater receives primary treatment before reaching the disposal area and a setback is implemented to reduce spray drift. To ensure the public is protected from fine spray drift, a strict 100 m setback must be maintained between the spray field, event boundaries, and nearby homes. To further reduce the possibility of fine-spray drift, this setback could be extended to include an additional factor of safety. The calculations for the required area using this method are shown below:

Option 4:	Sprinkler Treatment				
Flow Rate per Sprinklers	0.5	m^3/hr	≈	8.33	L/min
Approximate spraying Diameter	25	m		Radius = 12.5	m
No of sprinklers required	48	No's			
Total Area Calculations:					
Total Area Coverage per Sprinkler	156.25	m^2	≈	160	m^2
Total Gross Area	7680	m^2	≈	0.77	ha
Based on As NZS 1547-2012: Assuming an individual sprinkler flow rate of 0.5m^3/hr and an effective spray radius of 12.5m, the network requires a total of 24 sprinklers, covering a gross surface application area of approximately 0.77 ha.					

Table 7: Greywater option C

As an area reference, these are illustrated below:

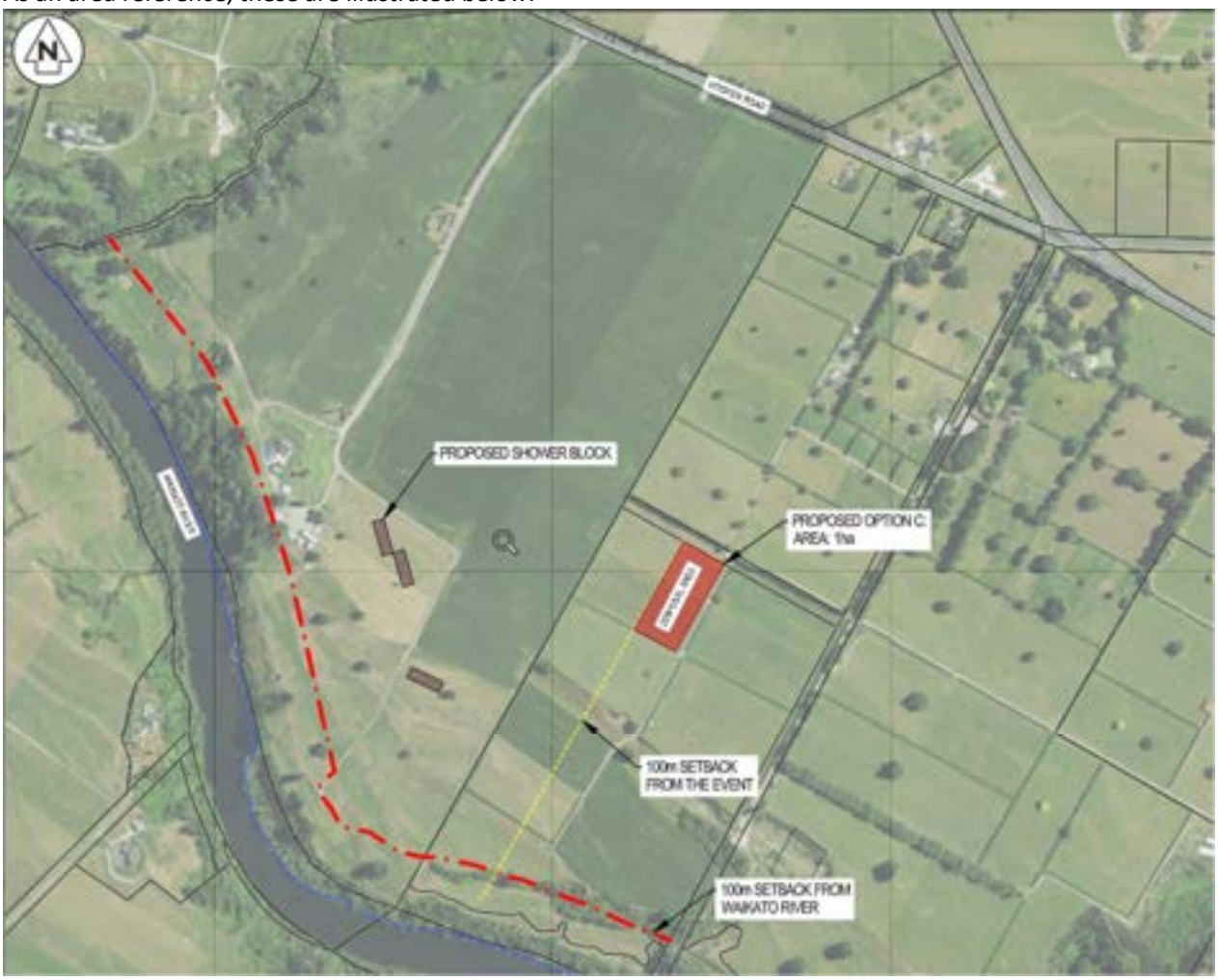


Figure 5: Option C footprint

3.4 Greywater Disposal Locations

For onsite greywater disposal areas, there are several options either onsite or on the adjacent neighbouring property (off site) that could both accommodate the required disposal area and/or work with the proposed site master plan layout, while complying with the Waikato Regional Council River set back requirements.

Onsite Disposal

For onsite disposal options, either Trench, Absorption Beds or Dripper lines are considered feasible, however due to setback requirements sprinkler options are not deemed appropriate. For cost and practically Dripper lines are the recommended option for onsite disposal with 4 options available listed in order of preference below:

- **Option 1** - Single combined disposal field at the south easter corner of the site
- **Option 2** - Two separate fields
    - One in the area to the west of the existing dwelling
    - One in the western corner of the site
- **Option 3**- Two separate fields
    - One on the northwestern edge of the site between northern side of the existing gully and the Hooker Road boundary
    - One on the north of the site between the eastern side of the existing gully and the Hooker Road boundary
- **Option 4**- Three separate fields
    - One on the north of the site between the eastern side of the existing gully and the Hooker Road boundary
    - Two single strip areas along the northern edge of the site running parallel to Hooker Road, either side of the proposed site entrance for the festival

Offsite Disposal

For offsite disposal options, Trench, Absorption Beds, Dripper lines or Sprinkler options are considered feasible, however neighbours' approval would be required to progress these options further.

Options A, B & C show proposed areas for disposal on the adjacent land – if that option is to be considered in the future.

4 Blackwater Disposal

Blackwater categorises the water with higher contaminant and pathogen loading. The site blackwater loading will be created from the on-site toilets, vendor outputs, and overnight stayers.
Our assumptions for the blackwater loading, based on wastewater loading from ACC TP58, are:

- That food vendors will average 5L per person worth of blackwater (food preparation, cleaning, etc.)
- That attendees will output 15L per day of blackwater (toilets, handwash, etc)

Since the contaminant loading is high in the expected blackwater volume, it is recommended to cart off-site to the Cambridge Wastewater Treatment Plant or the Pukete Wastewater plant in Hamilton for processing is recommended. Since both have been upgraded/ established, and are designed for future demand projections, they are both theoretically viable options. Based on the assumptions recorded above, there is an expected loading of 980m³ of blackwater per day. This volume per day is not manageable via solely truck carting and therefore will need to be to be assessed in higher detail with more accurate rates.

A key operation factor to consider is that the portable toilets will be hired from a third-party company. These units are sanitized using a specialized chemical biocide, producing a biohazardous blackwater. Under the hire agreement, the vendor is responsible for both supplying the sanitizing solution and servicing the units via their own vacuum extraction trucks. Because the vendor directly manages and hauls this portion of the waste, it removes the portable toilet volume from our primary site disposal calculations—directly reducing the overall daily truck trips as per the above calculations.

5 Recommendations

The preferred outcome would be to use **Option B – Subsurface Drip Lines**, utilising **Disposal Area Option** 1 for greywater disposal, where a logical and approved rate can be used for the greywater dispersion fields. This reduces the amount of work & cost affiliated with trench digging, allows farmers to continue grazing within the dispersion field area, and removes other potential risks associated with trench and spray dispersal.

Appendix A– CMW Soakage Test Results

Appendix B– Possible Location for Wastewater Bed

Appendix C– Greywater Disposal Spreadsheets



POSSIBLE GREYWATER DISPOSAL	
OPTION	APPROXIMATE AREA REQUIRED (ha)
TRENCHES	0.32

NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
3. LEVELS IN TERMS OF THE NZ VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M.BOUNDARIES ARE SUBJECT TO FINAL SURVEY
4. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.
5. THE CONTRACTORS SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.

LEGEND

- EX OVERHEAD POWER
- EX TELECOM
- EX PARCEL BOUNDARIES
- EX MINOR CONTOUR (1m)
- EX MAJOR CONTOUR (5m)
- PR AVAILABLE DISPOSAL AREAS
- PR FESTIVAL BOUNDARY

Rev	Description	By	Date
A	FOR INFORMATION	GH	10/2026

	By	Date
Survey	-	MM/YYYY
Design	MR	09/2026
Drawn	MR	09/2026
Checked	SM	09/2026

Maven Waikato
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www.maven.co.nz
19 Kaimiro Street, Pukete
Hamilton 3200
New Zealand

Project

254 - 276C HOOKER ROAD
TAMAHERE
WAIKATO
FOR
KIERAN SPILLANE

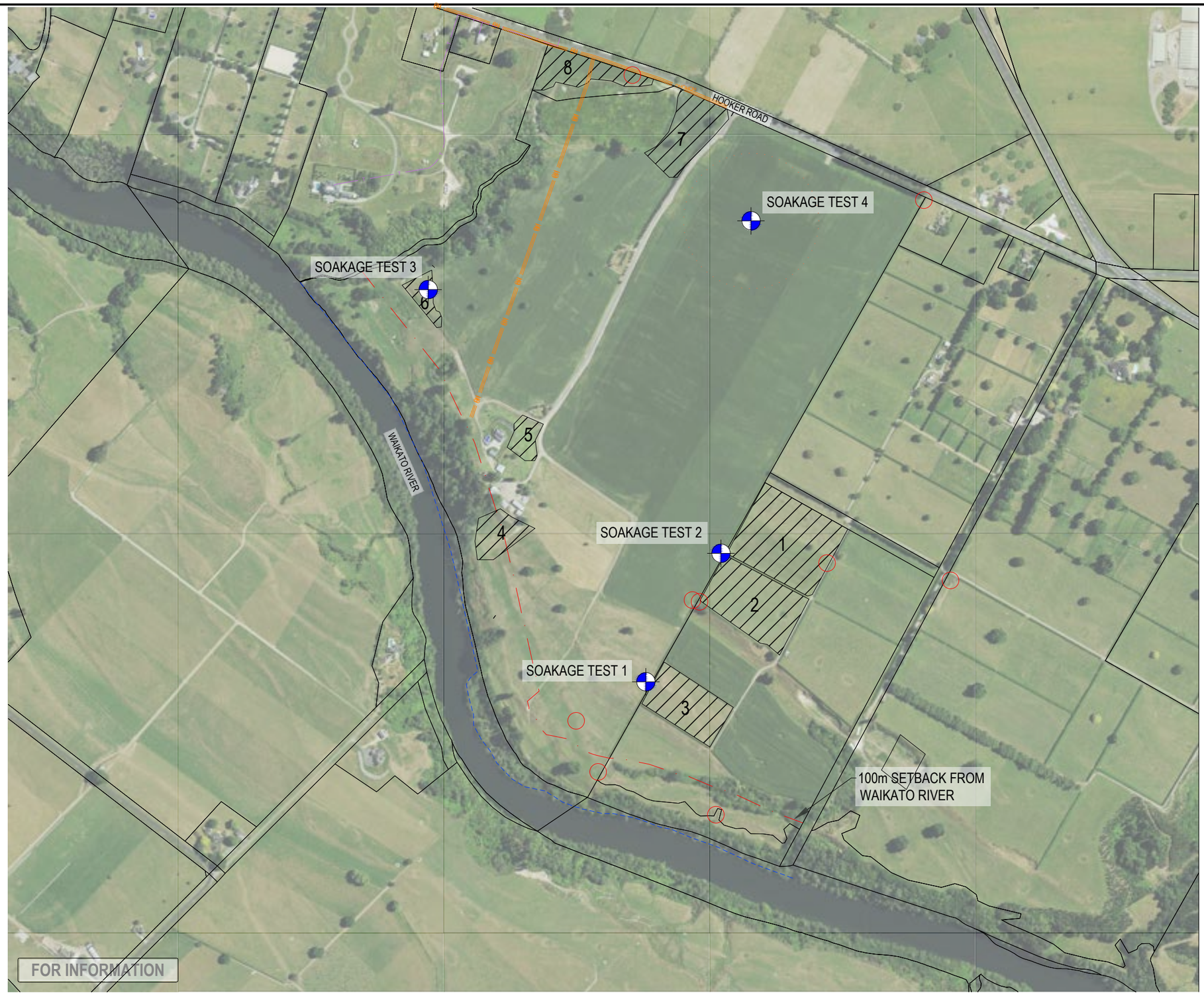
Title

GREYWATER DISPOSAL MASTER PLAN

Project no.	11111
Scale	1:7500 @ A3
Cad file	SK01-MASTER PLAN.DWG
Drawing no.	MASTER PLAN Rev A

FOR INFORMATION

DATE: 10/29/26 FILE PATH: F:\MAVEN HAMILTON\6 PROJECTS\1 PROMO\HOOKER ROAD PROJECT\7 DRAWING\SK01-MASTER PLAN.DWG



REV	DATE	DESCRIPTION	BY
A	21/09/2026	FOR INTERNAL REVIEW	NK
0	22/09/2026	FOR FINAL ISSUE	NK

CMW Geosciences
Great People | Practical Solutions

CLIENT: MAVEN WAIKATO LIMITED		DRAWN: NK	PROJECT: HAM2026-0109
PROJECT: SOAKAGE TESTING 256 HOOKER ROAD, CAMBRIDGE		CHECKED: RR	DRAWING: 01
		REVISION: 0	SCALE: NTS
TITLE: SOAKAGE TESTING LOCATION PLAN		DATE: 22/09/2026	SHEET: A3

CMW Geosciences	CLIENT: **Maven Waikato Ltd**	DESIGNER:	LA
	PROJECT: **256 Hooker Road Soakage**	CHECKED:	NK
		REVISION:	0
	TITLE: **SO1 Falling Head Permeability Test**	DATE:	21/09/2026
		PROJECT:	HAM2026-0109

Specifications - Open-Ended Tube

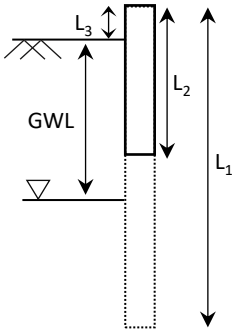
Length L_1:	1.6	m
Diameter:	90	mm
Non-Perm L_2:	0	m
Above Gnd L_3:	0	m

Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy m: 1.41421356 $m = \sqrt{k_h / k_v}$

Bottom of Test Hole: 2.00 m BGL



Hydraulic Conductivity (k)

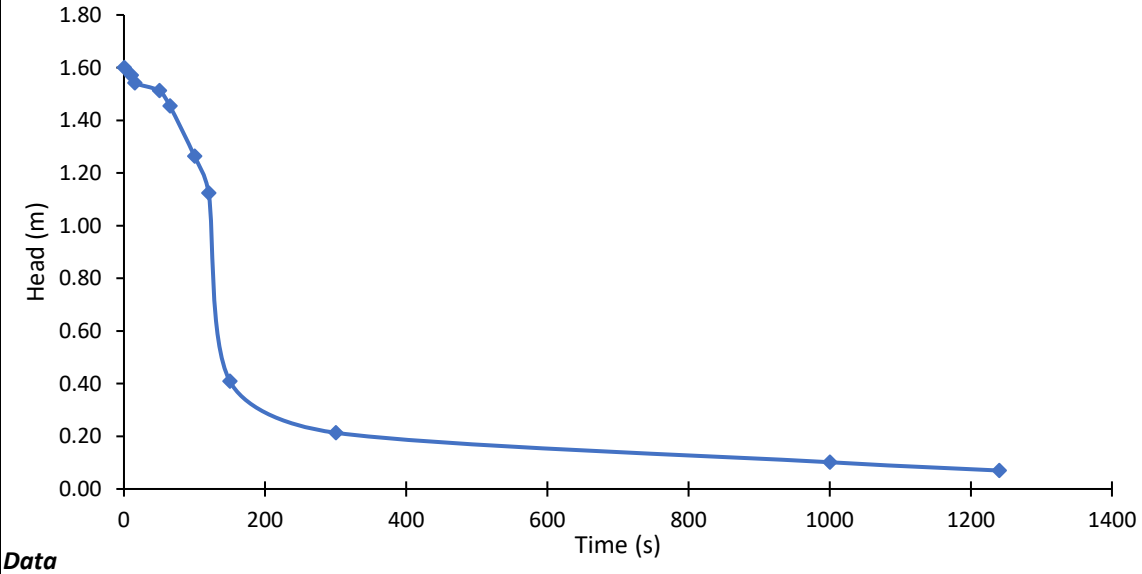
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d} \right) . \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 1.19E-04 ms^{-1} = 10.28 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1} \right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 2.57E-05 ms^{-1} = 2.22 m/day



STRATIGRAPHIC LOG

- Silt
- Sand
- Silt

EOH @ 2m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})
0	0.000	1.600				
10	0.029	1.571	1.585		4.65E-06	3.54E-05
15	0.058	1.542	1.556		9.44E-06	7.08E-05
50	0.088	1.512	1.527		1.42E-06	1.05E-05
65	0.146	1.454	1.483		6.79E-06	4.91E-05
100	0.337	1.263	1.359		1.13E-05	7.66E-05
120	0.477	1.123	1.193		1.80E-05	1.11E-04
150	1.191	0.409	0.766		1.41E-04	7.21E-04
300	1.387	0.214	0.311		3.23E-05	7.84E-05
1000	1.498	0.102	0.158		1.12E-05	1.71E-05
1240	1.530	0.070	0.086		2.02E-05	2.01E-05

CMW Geosciences	CLIENT: **Maven Waikato Ltd**	DESIGNER:	LA
	PROJECT: **256 Hooker Road Soakage**	CHECKED:	NK
		REVISION:	0
	TITLE: **SO2 Falling Head Permeability Test**	DATE:	21/09/2026
		PROJECT:	HAM2026-0109

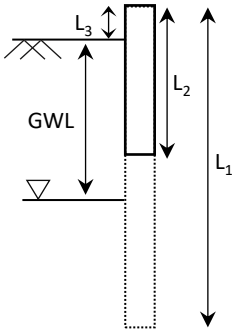
Specifications - Open-Ended Tube

Length L_1:	1	m
Diameter:	90	mm
Non-Perm L_2:	0	m
Above Gnd L_3:	0	m

Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy m: 1.41421356 $m = \sqrt{k_h / k_v}$



Bottom of Test Hole: 1.50 m BGL

Hydraulic Conductivity (k)

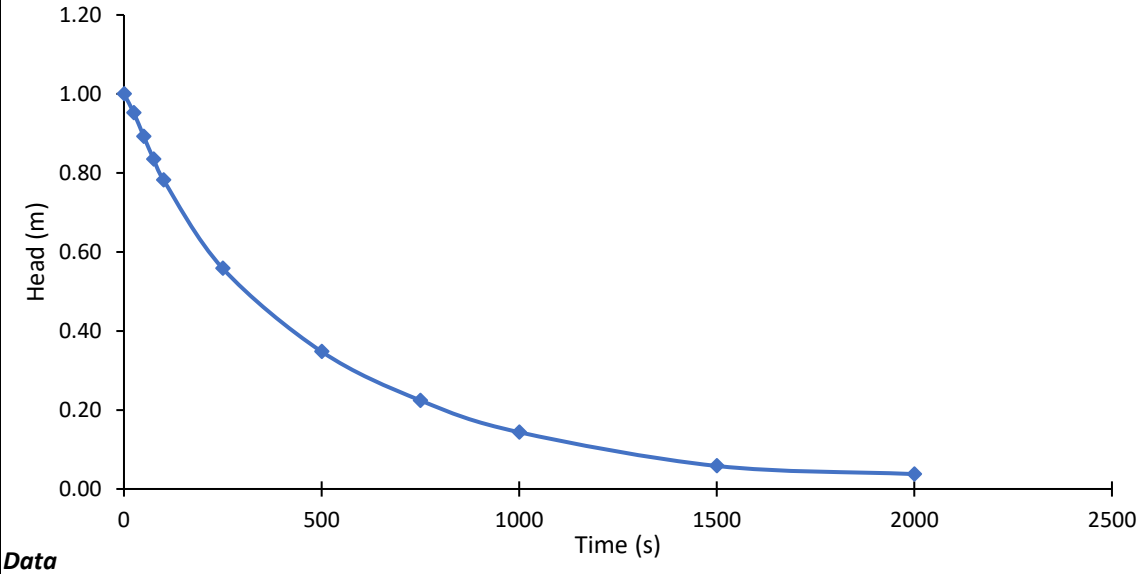
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

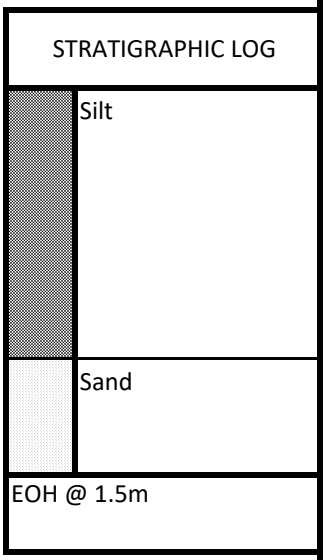
CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d} \right) . \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 3.54E-05 ms^{-1} = 3.06 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1} \right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 1.26E-05 ms^{-1} = 1.08 m/day





Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})
0	0.000	1.000				
25	0.048	0.952	0.976		6.99E-06	3.68E-05
50	0.108	0.893	0.922		9.55E-06	4.81E-05
75	0.165	0.835	0.864		1.04E-05	4.97E-05
100	0.218	0.782	0.808		1.06E-05	4.83E-05
250	0.442	0.558	0.670		1.04E-05	4.19E-05
500	0.652	0.348	0.453		1.12E-05	3.47E-05
750	0.776	0.224	0.286		1.37E-05	3.04E-05
1000	0.856	0.144	0.184		1.75E-05	2.86E-05
1500	0.942	0.058	0.101		2.25E-05	2.63E-05
2000	0.962	0.038	0.048		1.28E-05	8.90E-06

CMW Geosciences	CLIENT: **Maven Waikato Ltd**	DESIGNER:	LA
	PROJECT: **256 Hooker Road Soakage**	CHECKED:	NK
		REVISION:	0
	TITLE: **SO3 Falling Head Permeability Test**	DATE:	21/09/2026
		PROJECT:	HAM2026-0109

Specifications - Open-Ended Tube

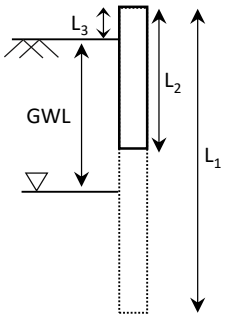
Length L_1:	1.6	m
Diameter:	90	mm
Non-Perm L_2:	0	m
Above Gnd L_3:	1.1	m

Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy m: 1.41421356 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 2.00 m BGL



Hydraulic Conductivity (k)

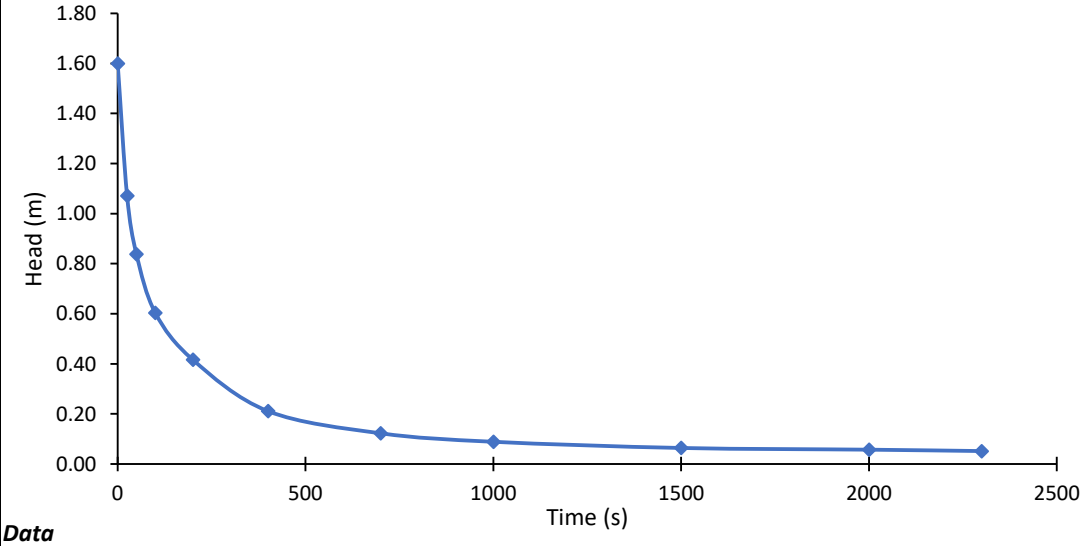
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d}\right).\frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 8.06E-05 ms^{-1} = 6.97 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2\, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1}\right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 2.04E-05 ms^{-1} = 1.76 m/day



STRATIGRAPHIC LOG

Silt

Sand

EOH @ 2m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})
0	0.000	1.600				
25	0.528	1.072	1.336		4.54E-05	3.11E-04
50	0.762	0.838	0.955		3.55E-05	1.85E-04
100	0.996	0.604	0.721		2.87E-05	1.22E-04
200	1.183	0.417	0.510		2.05E-05	6.81E-05
400	1.389	0.211	0.314		2.52E-05	6.17E-05
700	1.477	0.123	0.167		1.86E-05	2.89E-05
1000	1.511	0.089	0.106		1.32E-05	1.49E-05
1500	1.536	0.064	0.076		8.78E-06	8.09E-06
2000	1.543	0.057	0.061		3.17E-06	2.52E-06
2300	1.548	0.052	0.055		4.94E-06	3.67E-06

CMW Geosciences	CLIENT: **Maven Waikato Ltd**	DESIGNER:	LA
	PROJECT: **256 Hooker Road Soakage**	CHECKED:	NK
		REVISION:	0
	TITLE: **SO4 Falling Head Permeability Test**	DATE:	21/09/2026
		PROJECT:	HAM2026-0109

Specifications - Open-Ended Tube

Length L_1:	1.6	m
Diameter:	90	mm
Non-Perm L_2:	0	m
Above Gnd L_3:	0	m

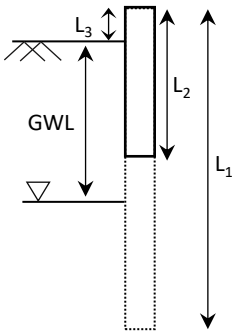
Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1.41421356 $m = \sqrt{k_h / k_v}$

Bottom of Test Hole: 2.00 m BGL



Hydraulic Conductivity (k)

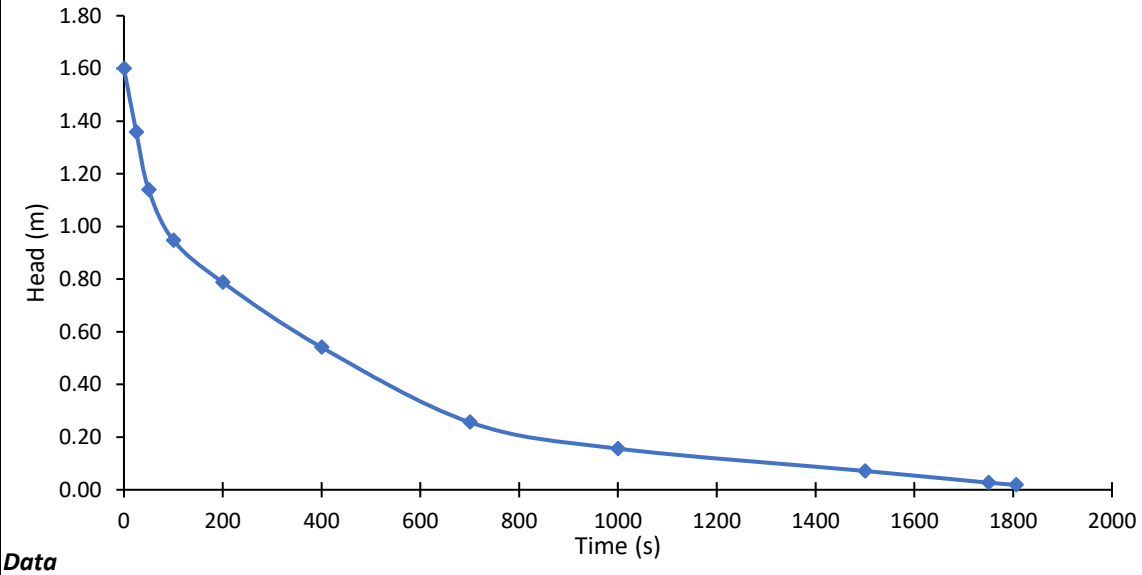
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

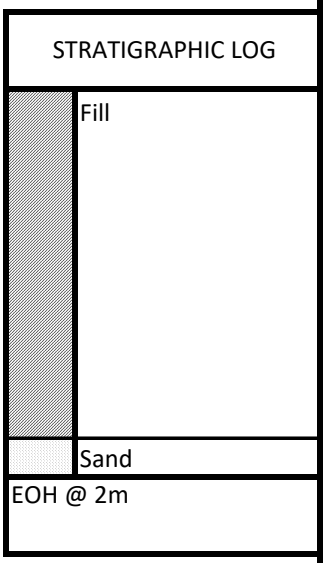
CIRIA 113: Somerville (1986), *Control of groundwater for temporary works,* CIRIA Report 113, Appendix 4

$$k = \left(log\frac{h_1}{h_2} - log\frac{2h_1 + d}{2h_2 + d} \right) . \frac{(h_1 + h_2)}{2(t_2 - t_1)} =$$ 5.80E-05 ms^{-1} = 5.01 m/day

Hvorslev: Hvorslev (1951) *Time Lag and Soil Permeability in Ground-Water Observations* , Fig 18, p49

$$k = \frac{d^2 \, ln\left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d}\right)^2 + 1} \right)}{8L(t_2 - t_1)} ln\frac{H_1}{H_2} =$$ 2.74E-05 ms^{-1} = 2.37 m/day





Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms^{-1})	CIRIA 113 'k' (ms^{-1})
0	0.000	1.600				
25	0.242	1.358	1.479		1.73E-05	1.25E-04
50	0.460	1.140	1.249		2.09E-05	1.33E-04
100	0.653	0.948	1.044		1.25E-05	6.95E-05
200	0.812	0.788	0.868		7.12E-06	3.45E-05
400	1.059	0.541	0.664		8.71E-06	3.52E-05
700	1.343	0.257	0.399		1.60E-05	4.71E-05
1000	1.444	0.156	0.206		1.54E-05	2.74E-05
1500	1.529	0.071	0.114		1.87E-05	2.33E-05
1750	1.573	0.027	0.049		5.70E-05	4.21E-05
1806	1.581	0.019	0.023		1.01E-04	4.28E-05

HAND AUGER BOREHOLE LOG - Soakage 01

Client: Maven Waikato Limited
Project: 256 Hooker Road
Site Location: 256 Hooker Road
Project No.: HAM2026-0109
Date: 18/09/2026
Borehole Location: Refer to site plan Logged by: SA Checked by: NK Scale: 1:25 Sheet 1 of 1

CMW Geosciences
Great People | Practical Solutions

Position: Site Plan Projection: NZVD 2016
Datum: Mount Eden 2000 Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/ geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
				0		OL: Organic SILT: dark brown. No plasticity. (Topsoil)			
	0.3	Peak = 133kPa Residual = 47kPa				ML: SILT: with some sand. Low plasticity. (Hinuera Formation)		St to VSt	
	0.6	Peak = 89kPa Residual = 30kPa				... at 0.60m, containing trace gravel.			
				1		SW: SAND: with some gravel and trace silt. Well graded, subrounded to subangular. (Hinuera Formation)	M	TP	
	1.2	Peak = 98kPa Residual = 35kPa				ML: SILT: with some sand. Low plasticity. (Hinuera Formation)		St to VSt	
	1.5	Peak = 89kPa Residual = 38kPa							
	1.8	Peak = 115kPa Residual = 41kPa				... at 1.80m, containing trace gravel.			
				2		Borehole terminated at 2.0 m			
				3					
				4					
				5					

Dynamic Cone Penetrometer (Blows/100mm): 5, 10, 15

Termination Reason: Target Depth Reached
Shear Vane No: 2993 DCP No:
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

HAND AUGER BOREHOLE LOG - Soakage 02

Client: Maven Waikato Limited
Project: 256 Hooker Road
Site Location: 256 Hooker Road
Project No.: HAM2026-0109
Date: 18/09/2020
Borehole Location: Refer to site plan Logged by: SA Checked by: NK Scale: 1:25 Sheet 1 of 1

CMW Geosciences
Great People | Practical Solutions

Position: Site Plan Projection: NZVD 2016
Datum: Mount Eden 2000 Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
						OL: Organic SILT: dark brown. No plasticity. (Topsoil)			
	0.3	Peak = 74kPa Residual = 30kPa				ML: SILT: orange brown. Low plasticity. (Hinuera Formation)			
	0.6	Peak = 74kPa Residual = 27kPa				*... at 0.70m, containing some fine to coarse sand.*	M	St	
	0.9	Peak = 103kPa Residual = 47kPa		1		SW: Fine to coarse SAND: with minor silt. Orange brown. Well graded, subrounded. (Hinuera Formation)		TP	
						... at 1.40m, containing some fine to coarse gravel.			
						Borehole terminated at 1.5 m			
				2					
				3					
				4					
				5					

Dynamic Cone Penetrometer (Blows/100mm): 5, 10, 15

Termination Reason: Refusal on gravel.
Shear Vane No: 2993 DCP No:
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

HAND AUGER BOREHOLE LOG - Soakage 03

Client: Maven Waikato Limited
Project: 256 Hooker Road
Site Location: 256 Hooker Road
Project No.: HAM2026-0109
Date: 18/09/2026
Borehole Location: Refer to site plan Logged by: SA Checked by: NK Scale: 1:25 Sheet 1 of 1

CMW Geosciences
Great People | Practical Solutions

Position: Site Plan Projection: NZVD 2016
Datum: Mount Eden 2000 Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
				0		OL: Organic SILT: dark brown. No plasticity. (Topsoil)			
						SW: Fine to coarse SAND: with some silt and gravel. Well graded, subrounded to subangular. (Hinuera Formation)	M	TP	
						... at 0.50m, containing trace silt.			
				1					
						SW: Silty SAND: with some gravel. (Hinuera Formation)			
						... at 1.70m, containing no gravel.			
	1.9	Peak = 101kPa Residual = 33kPa				ML: Sandy SILT: low plasticity, (Hinuera Formation)	W	VSt	
				2		Borehole terminated at 2.0 m			
				3					
				4					
				5					

Termination Reason: Target Depth Reached
Shear Vane No: 2993 DCP No:
Remarks: Groundwater not encountered.

HAND AUGER BOREHOLE LOG - Soakage 04

Client: Maven Waikato Limited
Project: 256 Hooker Road
Site Location: 256 Hooker Road
Project No.: HAM2026-0109
Date: 18/09/2026
Borehole Location: Refer to site plan Logged by: SA Checked by: NK Scale: 1:25 Sheet 1 of 1

CMW Geosciences
Great People | Practical Solutions

Position: Site Plan Projection: NZVD 2016
Datum: Mount Eden 2000 Survey Source: Hand Held GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/ geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
				0		OL: Organic SILT: dark brown. No plasticity. (Topsoil)			
	0.3	Peak = 118kPa				ML: SILT: with some fine to coarse sand and organic silt. Low plasticity. (Uncontrolled Fill)		VSt	
	0.9	Peak = 118kPa Residual = 44kPa				SW: Fine to coarse SAND: with trace fine gravel. Orange brown. Well graded, subrounded. (Uncontrolled Fill)		TP	
				1		ML: SILT: with some organics and trace fine to coarse sand and fine gravel. Orange grey. Low plasticity. (Uncontrolled Fill)	M		
	1.2	Peak = 109kPa Residual = 33kPa						VSt	
	1.5	Peak = 106kPa Residual = 33kPa							
						SW: Fine to coarse SAND: with trace fine gravel. Light brownish grey. Well graded, subrounded. (Hinuera Formation)		TP	
				2		Borehole terminated at 2.0 m			
				3					
				4					
				5					

Termination Reason: Target Depth Reached
Shear Vane No: 2993 DCP No:
Remarks: Groundwater not encountered.

POSSIBLE GREYWATER DISPOSAL	
OPTION	APPROXIMATE AREA REQUIRED (ha)
TRENCHES	0.32

HOOKER ROAD

CAMBRIDGE ROAD

HOOKER ROAD

ONSITE DISPOSAL TRENCH OPTION 6

ONSITE DISPOSAL TRENCH OPTION 5

ONSITE DISPOSAL TRENCH OPTION 7

ONSITE DISPOSAL TRENCH OPTION 4

ONSITE DISPOSAL TRENCH OPTION 3

WAIKATO RIVER

ONSITE DISPOSAL TRENCH OPTION 2

OFFSITE DISPOSAL TRENCH OPTION A

OFFSITE DISPOSAL TRENCH OPTION B

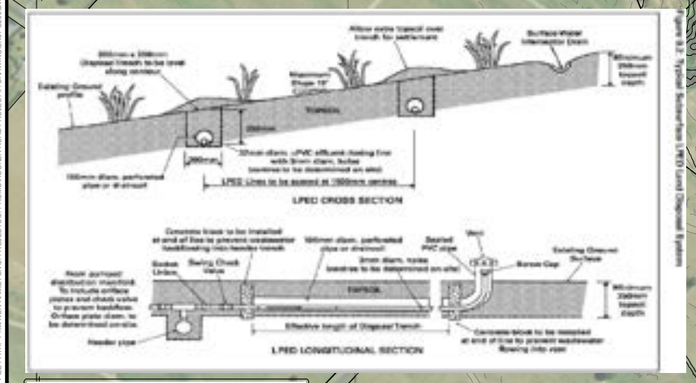
OFFSITE DISPOSAL TRENCH OPTION C

ONSITE DISPOSAL TRENCH OPTION 1

20.06m

120m SETBACK FROM WAIKATO RIVER

WAIKATO RIVER



FOR INFORMATION

NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
3. LEVELS IN TERMS OF THE NZ VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M.BOUNDARIES ARE SUBJECT TO FINAL SURVEY
4. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.
5. THE CONTRACTORS SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.

LEGEND

- EX OVERHEAD POWER
- EX TELECOM
- EX PARCEL BOUNDARIES
- EX MINOR CONTOUR (1m)
- EX MAJOR CONTOUR (5m)

Rev	Description	By	Date
A	FOR INFORMATION	GH	10/2026

	By	Date
Survey	-	MM/YYYY
Design	MR	09/2026
Drawn	MR	09/2026
Checked	SM	09/2026

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19 Kaimiro Street, Pukete
Hamilton 3200
New Zealand

Project

254 - 276C HOOKER ROAD TAMAHERE WAIKATO FOR KIERAN SPILLANE

Title

GREYWATER DISPOSAL OPTION 1 - TRENCH

Project no.	11111		
Scale	1:7500 @ A3		
Cad file	SK01-C200.DWG		
Drawing no.	SK01-200-1	Rev	A

DATE: 10/29/26 FILE PATH: F:\MAVEN HAMILTON\6. PROJECTS\0. PROMO\HOOKER ROAD PROJECT\7. DRAWINGS\SK01-C200.DWG

N

HOOKER ROAD

CAMBRIDGE ROAD

HOOKER ROAD

WAIKATO RIVER

WAIKATO RIVER

ONSITE DISPOSAL BEDS OPTION 6

ONSITE DISPOSAL BEDS OPTION 5

ONSITE DISPOSAL BEDS OPTION 7

ONSITE DISPOSAL BEDS OPTION 4

ONSITE DISPOSAL BEDS OPTION 8

ONSITE DISPOSAL BEDS OPTION 3

ONSITE DISPOSAL BEDS OPTION 2

ONSITE DISPOSAL BEDS OPTION 1

OFFSITE DISPOSAL BEDS OPTION A

OFFSITE DISPOSAL BEDS OPTION B

OFFSITE DISPOSAL BEDS OPTION C

20.09m

120m SETBACK FROM WAIKATO RIVER

POSSIBLE GREYWATER DISPOSAL	
LOCATION	APPROXIMATE AREA REQUIRED (ha)
ABSORPTION BEDS	0.24

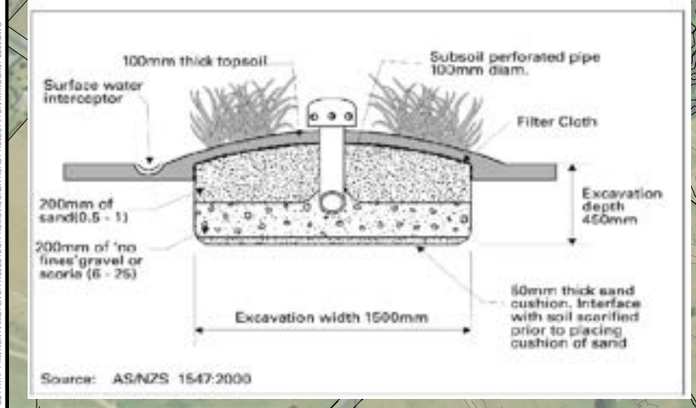
NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
3. LEVELS IN TERMS OF THE NZ VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M.BOUNDARIES ARE SUBJECT TO FINAL SURVEY
4. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.
5. THE CONTRACTORS SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.

LEGEND

- OH OH — EX OVERHEAD POWER
- T T — EX TELECOM
- EX PARCEL BOUNDARIES
- EX MINOR CONTOUR (1m)
- EX MAJOR CONTOUR (5m)

Figure 10.4: Evapotranspiration Bed/Aerobic Soakage Bed



Source: AS/NZS 1547:2000

FOR INFORMATION

Rev	Description	By	Date
A	FOR INFORMATION	GH	10/2026

	By	Date
Survey	-	MM/YYYY
Design	MR	09/2026
Drawn	MR	09/2026
Checked	SM	09/2026

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Hamilton 3200
New Zealand

Project

254 - 276C HOOKER ROAD TAMAHERE WAIKATO FOR KIERAN SPILLANE

Title

GREYWATER DISPOSAL OPTION 2 - ABSORPTION BEDS

Project no.	11111		
Scale	1:7500 @ A3		
Cad file	SK01-C200.DWG		
Drawing no.	SK01-200-2	Rev	A

DATE: 10/29/26 FILE PATH: F:\MAVEN HAMILTON\6. PROJECTS\0. PROJ\HOOKER ROAD PROJECT\7. DRAWING\SK01-C200.DWG

POSSIBLE GREYWATER DISPOSAL	
LOCATION	APPROXIMATE AREA REQUIRED (ha)
DRIPPER LINES	1.44

HOOKER ROAD

CAMBRIDGE ROAD

HOOKER ROAD

COMBINED ONSITE DISPOSAL
DRIPPER LINE OPTION 4

COMBINED ONSITE DISPOSAL
DRIPPER LINE OPTION 3

COMBINED ONSITE DISPOSAL
DRIPPER LINE OPTION 2

WAIKATO RIVER

OFFSITE DISPOSAL
DRIPPER LINE OPTION A

OFFSITE DISPOSAL
DRIPPER LINE OPTION B

OFFSITE DISPOSAL
DRIPPER LINE OPTION C

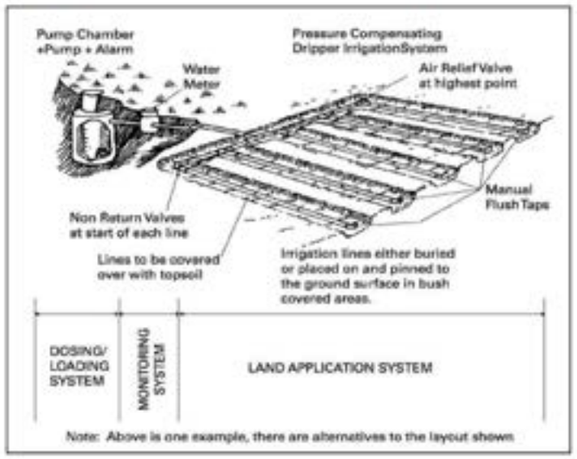
ONSITE DISPOSAL
DRIPPER LINE OPTION 1

20.06m

120m SETBACK FROM
WAIKATO RIVER

WAIKATO RIVER

Figure 9.1: Schematic Diagram of a Pressure Compensating Drip Irrigation System



FOR INFORMATION

NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
3. LEVELS IN TERMS OF THE NZ VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M.BOUNDARIES ARE SUBJECT TO FINAL SURVEY
4. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.
5. THE CONTRACTORS SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.

LEGEND

- EX OVERHEAD POWER
- EX TELECOM
- EX PARCEL BOUNDARIES
- EX MINOR CONTOUR (1m)
- EX MAJOR CONTOUR (5m)

Rev	Description	By	Date
A	FOR INFORMATION	GH	10/2026

	By	Date
Survey	-	MM/YYYY
Design	MR	09/2026
Drawn	MR	09/2026
Checked	SM	09/2026

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New Zealand

Project
254 - 276C HOOKER ROAD
TAMAHERE
WAIKATO
FOR
KIERAN SPILLANE

Title
GREYWATER DISPOSAL OPTION 3 - DRIPPER LINES

Project no.	11111
Scale	1:7500 @ A3
Cad file	SK01-C200.DWG
Drawing no.	SK01-200-3 Rev A

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Input

Event Duration	4	days
No of Showers	100	
Overnight Attendees	15,000	People

Design Criteria

Shower Flow Rate	8	l/min	Based on SNZ HB 44:2001 (Table 3.1 / Demand Rates)
Shower Duration	5	min	

Calculation

Primary Calculation:

Water Volume per Single Shower	40	L/shower		
Shower per hour	12.00			
Total output per shower per Day	5,760	L/day	Assuming 12Hrs of constant shower usage per day	
Maximum daily capacity	576,000	L/day	≈	**576 m³**
Daily Capacity per Hr	24,000	L/hr	≈	**24 m³**
Total 4-day Maximum usage	**2,304,000**	L	≈	**2,304 m³**

Secondary Check:

Total Daily Showers	14,400	showers/day		
Daily water usuage	576,000	L/day	≈	**576 m³**
Daily Capacity per Hr	24,000	L/hr	≈	**24 m³**
Total 3-days usuage at 90% capacity	2,304,000	L	≈	**2,304 m³**

Collection Tank:

Minimum Buffer Time	4	Hrs
Required Buffer volume	96	m³
Option A: 4 X 25m³ Plastic Tanks	100	m³
Option B: 4 X 30m³ Temporary Tanks	120	m³

4.25	DIR =	design irrigation rate	(mm/m2/day)
1.23			
0.3			
1.06			
1			
0.5			

NOTES:

1 For Category 3 to 5 soils (loams to light clays), the drip irrigation system needs to be installed in an adequate depth of topsoil (in the order of 150 – 250 mm of *in situ* or imported good quality topsoil) to slow the soakage and assist with nutrient reduction.

TABLE M1
RECOMMENDED DESIGN IRRIGATION RATE (DIR) FOR IRRIGATION SYSTEMS

Soil Category (see Note 1)	Soil texture	Structure	Indicative permeability (K_{sat}) (m/d)	Design irrigation rate (DIR) (mm/day)		
				Drip irrigation	Spray irrigation	LPED irrigation
1	Gravels and sands	Structureless (massive)	> 3.0	5 (see Note 2)	5	(see Note 3)
2	Sandy loams	Weakly structured massive	> 3.0			4
			1.4 – 3.0			
3	Loams	High/ moderate structured	1.5 – 3.0	4 (see Note 1)	4	3.5
		Weakly structured or massive	0.5 – 1.5			
4	Clay loams	High/ moderate structured	0.5 – 1.5	3.5 (see Note 1)	3.5	3
		Weakly structured	0.12 – 0.5			
		Massive	0.06 – 0.12			
5	Light clays	Strongly structured	0.12 – 0.5	3 (see Note 1)	3	2.5 (see Note 4)
		Moderately structured	0.06 – 0.12			
		Weakly structured or massive	< 0.06			
6	Medium to heavy clays	Strongly structured	0.06 – 0.5	2 (see Note 2)	2	(see Note 3)
		Moderately structured	< 0.06			
		Weakly structured or massive	< 0.06			

NOTES:

1 For Category 3 to 5 soils (loams to light clays), the drip irrigation system needs to be installed in an adequate depth of topsoil (in the order of 150 – 250 mm of *in situ* or imported good quality topsoil) to slow the soakage and assist with nutrient reduction.

2 For Category 1, 2, and 6 soils, the drip irrigation system has a depth of 100 – 150 mm in good quality topsoil (see CM1 and M3.1).

3 LPED irrigation is not advised for Category 1 or Category 6 soils – drip irrigation of secondary effluent is the preferred irrigation method.

4 LPED irrigation for Category 5 soils needs a minimum depth of 250 mm of good quality topsoil (see M5 and CM7.1).

L4.2 Sizing

Trench and bed dimensions shall be determined from the relationship:

$$L = Q / (DLR \times W) \quad \text{Eq. L1}$$

where:

L = length in m

Q = design daily flow in L/day

DLR = design loading rate in mm/d

W = width in m

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Wastewater Treatment Option:

Based on the Category 1 Sand classification and an absorption rate exceeding 500mm/hr, we have provided two design options for the wastewater bed below:

Calculation from Soakage Rate:

Units	Soakage rate (m/day)		Soakage rate (mm/hr)	
	CIRIA 113	Hvorslev	CIRIA 113	Hvorslev
1	10.28	2.22	428.33	92.50
2	3.06	1.08	127.50	45.00
3	6.97	1.76	290.42	73.33
4	5.01	2.37	208.75	98.75

Option 1: Secondary Wastewater Treatment - Trench

Q (Design Daily Flow in)	576,000	L/day		
DLR (Design loading rate)	400	mm/day		(Assumed based on Category 2 soil)
Minimum Bed Width	1	m		
Required Total Length	1,440	L		
No of beds	75	No's		
Length Per Bed	19.2	m	≈	20 m

Secondary Check:

Net Surface Area	20	m²	(Bed Width X Bed Length)
Net Absorption Rate	1,500	m²	(Net Surface Area X No of Beds)
Design Loading Rate (DLR)	384	mm/day	(Daily Design Flow/Net Absorption Rate)

Area:

Bed Width	1 m	Minimum Spacing	1 m	
Bed Length	20 m	Minimum Spacing	1 m	
Total Area per bed (including spacing)		42 m²		
Total Gross area		3,150 m²	≈	0.32 ha

Based on As NZS 1547-2012 Section L4.2 Sizing: Assuming the width of bed as 1.0m wide, 20m long and 0.6m deep bed with 1.0m seperation between the bed would require a maximum of 75beds over a gross land area of 0.32ha

Option 2: Secondary Wastewater Treatment - Absorption Beds

Q (Design Daily Flow in)	576,000	L/day		
DLR (Design loading rate)	400	mm/day		(Assumed based on Category 2 soil)
Minimum Bed Width	1.8	m		
Required Total Length	800	L		
No of beds	40	No's		
Length Per Bed	20.00	m	≈	20 m

Secondary Check:

Net Surface Area	36	m²	(Bed Width X Bed Length)
Total Absorption Area	1,440	m²	(Net Surface Area X No of Beds)
Design Loading Rate (DLR)	400	mm/day	(Daily Design Flow/Net Absorption Rate)

Area:

Bed Width	1.8 m	Minimum Spacing	1 m	
Bed Length	20 m	Minimum Spacing	1 m	

Total Area per bed (including spacing)	58.8	m²	
Total Gross area	2,352	m²	≈ 0.24 ha

Based on As NZS 1547-2012 Section L4.2 Sizing: Assuming the width of bed as 1.8m wide, 20m long and 0.6m deep bed with 1.0m seperation between the bed would require a maximum of 40beds over a gross land area of 0.24ha

Option 3: Secondary Wastewater dripper lines Treatment

DIR =	50	mm/m²/day	≈	0.050	m/m²/day
Infiltration Rate =	40	mm/hr	≈	0.96	m/m²/day
Volume per day =	576	m³/day			
Required Irrigation Area	11,520	m²	≈	1.15	ha
Minimum spacing between lines	1	m			
To convert the area to KMs	11.5	kms			
Maximum Length of each line	40	m	≈	0.04	km
Total Number of lateral runs	288	Parallel lines			
No of Zones Required	3				
Dipper Lines per Zone	96	Parallel lines			

Based on As NZS 1547-2012: Assuming a 40m long dripper line with 1.0m seperation between the lines would require a maximum of 360 parallel line over a gross land area of 1.44ha

Option 4: Sprinkler Treatement

Flow Rate per Sprinklers	0.5	m³/hr	≈	8.33	L/min
Approximate spraying Diameter	25	m		Radius = 12.5	m
No of sprinklers required	48	No's			
Total Area Calculations:					
Total Area Coverage per Sprinkler	156.25	m²	≈	160	
Total Gross Area	7680	m²	≈	0.77	ha

Assuming an individual sprinkler flow rate of 0.5m³/hr and an effective spray radius of 12.5m, the network requires a total of 24 sprinklers, covering a gross surface application area of approximately 0.77 ha.