TWEDDELL & SLATER
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Unit 2, Mereside
Greenbank Road
Eden Business Park
Gilwilly, Penrith
Cumbria, CA11 9FB

Glamping Pod Development
Ellerbecks, Egremont
CA22 2UA
11.11.2024

DRAINAGE PROPOSAL REPORT

Introduction

A layout of the proposed development and drainage scheme is indicated on appended Tweddell and Slater drawing 8251-C-P-DN-01. Appendix A

The basis of the scheme is for the construction of 4No camping pods at the high level of the site with a stoned porous access track running from the existing field access along the northern boundary of the site. Car parking is provided at the lower part of the site which will also be of stoned porous construction.

Site Investigation

7 No infiltration tests were carried out across the site to evaluate potential for disposal of both foul and surface water to ground. There are no public sewers within an acceptable distance of the site.

Trial pits 1,2 and 7 were to access surface water disposal to ground and 3,4,5 and 6 were to access the feasibility of foul water disposal by infiltration.

The location of these trial pits is shown in Appendix A together with the calculation of the measured infiltration rates.

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In summary, the design infiltration rate for the surface water disposal is assessed at 0.00567m/hr while the area of the foul disposal area is assessed at 51.5s/mm (Vp).

Surface Water Proposal

The camping pods are small being only 14m^2 each. As can be seen on the attached drawing, it is proposed to construct a 7m x 0.45m x 0.6m deep infiltration trench on either side of each pod. Calculations confirming the suitability of this method is included in Appendix B.

As such there will be no hard drainage to the units.

This therefore complies with the hierarchy for surface water drainage disposal with discharge to ground being the preferred method.

Foul Disposal

As shown on the attached plan, it is proposed to discharge foul waste to a septic tank with disposal into the ground in a drainage field.

Due to the cross fall on the field this will be by a lateral linear layout. From the design infiltration rate and a population of 8, the area of the soakaway required is calculated at 103m2. With a trench width of 900mm, this requires a length of 114.5 m. Calculations are appended in Appendix C.

The drainage field does not lie over a ground water protection zone and does not lie within a SSSI, Special Protection Area, Special Area of Conservation or Ramsar Area.

The installation complies with all Environment Agency General Binding Rules for Small Sewage Discharges.

Stuart Mair BSc Hons CEng MICE
Senior Civil Engineer
11th November 2024

APPENDIX A

This drawing remains the property of Tweddell & Slater Limited and is confidential to our client and may not be reproduced or passed on without the written prior permission of both Tweddell & Slater Limited and the client.

Wind Turbines

Existing entrance to site

permeable material

Refuse / recycling

Parking / turning area

Existing fence boundary

New fence boundary

Field Drain Min 114.5m in length

Existing permeable build up

Free draining clean angular gravel surface water soakaways min 7x 0.45 x 0.6m deep

FFL 66.200

P1

P2

P3

P4

TP1

TP2

TP3

TP4

TP5

TP6

TP7

Kingspan 3800L Alpha Septic Tank

58.00

57.50

59.50

60.00

60.50

61.00

61.50

62.00

62.50

63.00

63.50

64.00

64.50

65.00

65.50

66.00

+59.50

+60.50

+61.50

+63.00

+65.00

+65.50

+66.00

1000

900

Proposed Surface Water

Proposed Foul Water

Proposed Treated Foul Water

Site Boundary

Trial Pits / Infiltration Test Locations

PRELIMINARY

Suitability --

Project
Ellerbeck Barns
Egremont

Client
Gemma Waghorn

Drawing
Proposed SW & FW Drainage

Project no	Drawing no	Date	Drawn by	Rev	Scale	Sheet
8251	C-P-DN-01	OCT 24	AJ	A	1:100	A1

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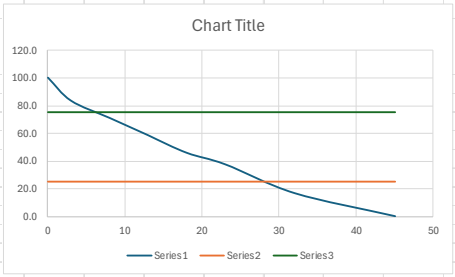
Infiltration Rate Calculations

Trial Pit 2

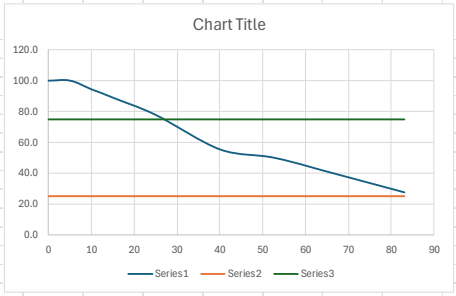
Test 1

water depth (m)	elapsed time (min)	% effective depth		
0.24	0	100.0	25	75
0.2	3	83.3	25	75
0.17	8	70.8	25	75
0.14	13	58.3	25	75
0.11	18	45.8	25	75
0.09	23	37.5	25	75
0.04	32	16.7	25	75
0	45	0.0	25	75



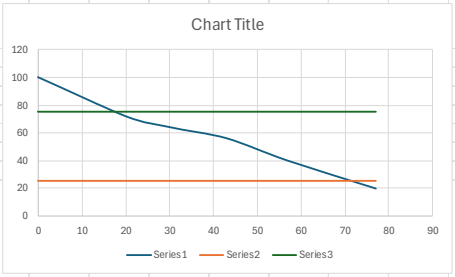
Test 2

water depth (m)	elapsed time (min)	% effective depth		
0.18	0	100.0	25	75
0.18	5	100.0	25	75
0.17	10	94.4	25	75
0.16	15	88.9	25	75
0.14	25	77.8	25	75
0.1	40	55.6	25	75
0.09	53	50.0	25	75
0.07	68	38.9	25	75
0.05	83	27.8	25	75



Test 3

water depth (m)	elapsed time (min)	% effective depth		
0.25	0	100	25	75
0.18	20	72	25	75
0.16	30	64	25	75
0.14	43	56	25	75
0.1	57	40	25	75
0.05	77	20	25	75



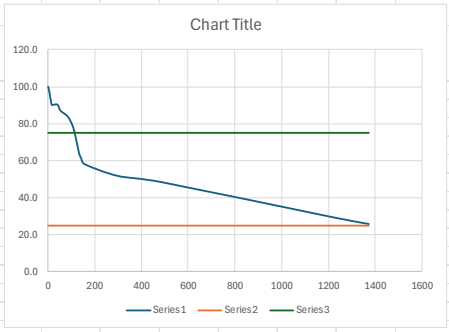
test 1 data							Volume Outflowing between 75% and 25% effective depth:	0.12	m	
depth of pit	0.3				75%	25%	Effective Storage Volume (V_{p75-25})	0.0108	m^3	
min depth to water	0.06			depth	0.18	0.06	Internal Surface Area:	0.23	m^2	
depth of water	0.24			time	6	28	Time of Water Level Fall:	22	min	
							Soil Infiltration Rate	3.4965E-05	m/s	11 s/mm (Vp)
test 2 data							Volume Outflowing between 75% and 25% effective depth:	0.09	m	
depth of pit	0.3				75%	25%	Effective Storage Volume (V_{p75-25})	0.0081	m^3	
min depth to water	0.12			depth	0.135	0.045	Internal Surface Area:	0.198	m^2	
depth of water	0.18			time	28	88	Time of Water Level Fall:	60	min	
							Soil Infiltration Rate	1.13636E-05	m/s	40 s/mm (Vp)
test 3 data							Volume Outflowing between 75% and 25% effective depth:	0.125	m	
depth of pit	0.3				75%	25%	Effective Storage Volume (V_{p75-25})	0.01125	m^3	
min depth to water	0.05			depth	0.1875	0.0625	Internal Surface Area:	0.24	m^2	
depth of water	0.25			time	18	72	Time of Water Level Fall:	54	min	
							Soil Infiltration Rate	1.44676E-05	m/s	25.9 s/mm (Vp)
									Average	25.6 s/mm (Vp)

Pit Dimensions		**Units**
Length:	0.30	m
Width:	0.30	m
Depth:	0.30	m

Trial Pit 3

Test 1

water depth (m)	elapsed time (min)	% effective depth		
0.31	0	100.0	25	75
0.3	5	96.8	25	75
0.29	10	93.5	25	75
0.28	15	90.3	25	75
0.28	25	90.3	25	75
0.28	40	90.3	25	75
0.27	52	87.1	25	75
0.26	83	83.9	25	75
0.24	108	77.4	25	75
0.2	131	64.5	25	75
0.19	141	61.3	25	75
0.18	156	58.1	25	75
0.16	300	51.6	25	75
0.15	485	48.4	25	75
0.09	1232	29.0	25	75
0.08	1372	25.8	25	75



test 1 data

depth of pit	0.31			75%	25%
min depth to water	0		depth	0.2325	0.0775
depth of water	0.31		time	106	1372

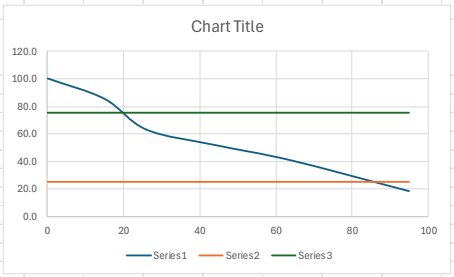
Volume Outflowing between 75% and 25% effective depth:	0.155	m	
Effective Storage Volume (V_{p75-25})	0.01395	m^3	
Internal Surface Area:	0.28	m^2	
Time of Water Level Fall:	1266	min	
Soil Infiltration Rate	6.65396E-07	m/s	490.06 s/mm (Vp)

Pit Dimensions		**Units**
Length:	0.30	m
Width:	0.30	m
Depth:	0.30	m

Trial Pit 4

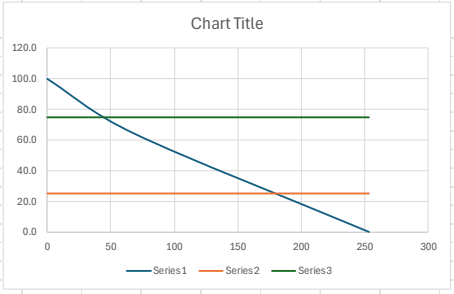
Test 1

water depth (m)	elapsed time (min)	% effective depth		
0.27	0	100.0	25	75
0.23	15	85.2	25	75
0.17	26	63.0	25	75
0.14	44	51.9	25	75
0.11	64	40.7	25	75
0.05	95	18.5	25	75



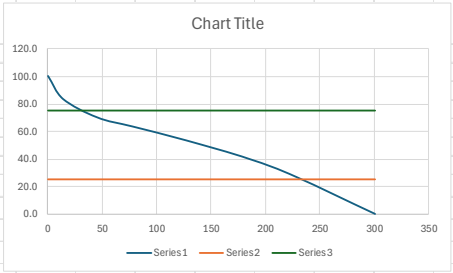
Test 2

water depth (m)	elapsed time (min)	% effective depth		
0.25	0	100.0	25	75
0.16	69	64.0	25	75
0	253	0.0	25	75



Test 3

water depth (m)	elapsed time (min)	% effective depth		
0.3	0	100.0	25	75
0.25	14	83.3	25	75
0.21	45	70.0	25	75
0.19	78	63.3	25	75
0.16	127	53.3	25	75
0.12	185	40.0	25	75
0.08	229	26.7	25	75
0	301	0.0	25	75

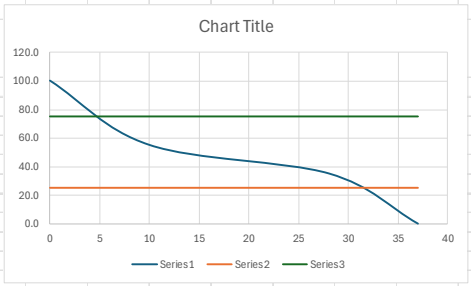


test 1 data								Volume Outflowing between 75% and 25% effective depth:	0.135	m				
depth of pit	0.3				75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.01215	m^3				
min depth to water	0.03			depth	0.2025	0.0675		Internal Surface Area:	0.25	m^2				
depth of water	0.27			time	20	88		Time of Water Level Fall:	68	min				
								Soil Infiltration Rate	**1.18172E-05**	**m/s**		**30.22**	**s/mm (Vp)**	
test 2 data								Volume Outflowing between 75% and 25% effective depth:	0.125	m				
depth of pit	0.3				75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.01125	m^3				
min depth to water	0.05			depth	0.1875	0.0625		Internal Surface Area:	0.24	m^2				
depth of water	0.25			time	45	180		Time of Water Level Fall:	135	min				
								Soil Infiltration Rate	**5.78704E-06**	**m/s**		**64.80**	**s/mm (Vp)**	
test 3 data								Volume Outflowing between 75% and 25% effective depth:	0.15	m				
depth of pit	0.3				75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.0135	m^3				
min depth to water	0			depth	0.225	0.075		Internal Surface Area:	0.27	m^2				
depth of water	0.3			time	30	235		Time of Water Level Fall:	205	min				
								Soil Infiltration Rate	**4.06504E-06**	**m/s**		**82.00**	**s/mm (Vp)**	
											Average	**59.01**	**s/mm (Vp)**	
Pit Dimensions	**Units**													
Length:	0.30	m												
Width:	0.30	m												
Depth:	0.30	m												

Trial Pit 5

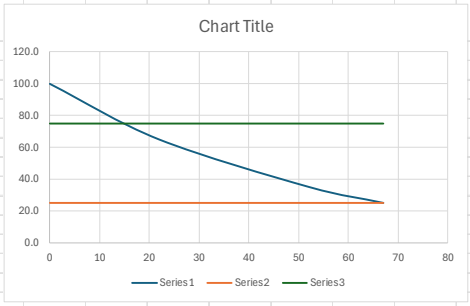
Test 1

water depth (m)	elapsed time (min)	% effective depth		
0.2	0	100.0	25	75
0.11	10	55.0	25	75
0.07	28	35.0	25	75
0	37	0.0	25	75



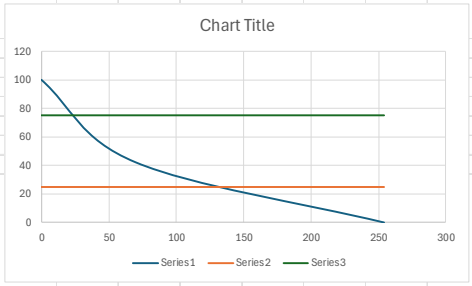
Test 2

water depth (m)	elapsed time (min)	% effective depth		
0.2	0	100.0	25	75
0.13	22	65.0	25	75
0.07	52	35.0	25	75
0.05	67	25.0	25	75



Test 3

water depth (m)	elapsed time (min)	% effective depth		
0.19	0	100	25	75
0.08	70	42.10526	25	75
0	254	0	25	75



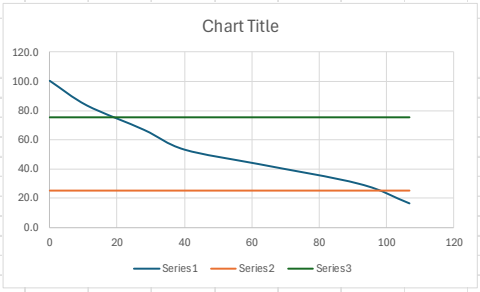
test 1 data							Volume Outflowing between 75% and 25% effective depth:	0.1	m	
depth of pit	0.3			75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.009	m^3	
min depth to water	0.1		depth	0.15	0.05		Internal Surface Area:	0.21	m^2	
depth of water	0.2		time	4.5	32		Time of Water Level Fall:	27.5	min	
							Soil Infiltration Rate	**2.5974E-05**	**m/s**	**16.50 s/mm (Vp)**
test 2 data							Volume Outflowing between 75% and 25% effective depth:	0.1	m	
depth of pit	0.3			75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.009	m^3	
min depth to water	0.1		depth	0.15	0.05		Internal Surface Area:	0.21	m^2	
depth of water	0.2		time	15	67		Time of Water Level Fall:	52	min	
							Soil Infiltration Rate	**1.37363E-05**	**m/s**	**31.20 s/mm (Vp)**
test 3 data							Volume Outflowing between 75% and 25% effective depth:	0.095	m	
depth of pit	0.3			75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.00855	m^3	
min depth to water	0.11		depth	0.1425	0.0475		Internal Surface Area:	0.204	m^2	
depth of water	0.19		time	30	130		Time of Water Level Fall:	100	min	
							Soil Infiltration Rate	**6.98529E-06**	**m/s**	**63.16 s/mm (Vp)**
									Average	**36.95 s/mm (Vp)**

Pit Dimensions		**Units**
Length:	0.30	m
Width:	0.30	m
Depth:	0.30	m

Trial Pit 6

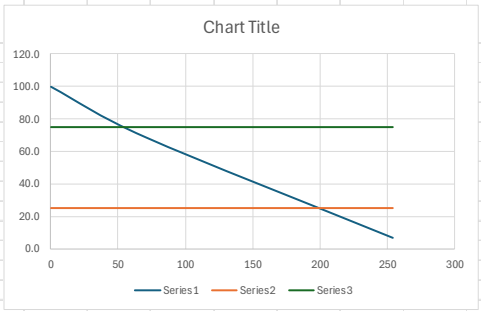
Test 1

water depth (m)	elapsed time (min)	% effective depth		
0.3	0	100.0	25	75
0.25	11	83.3	25	75
0.2	28	66.7	25	75
0.16	40	53.3	25	75
0.13	62	43.3	25	75
0.09	92	30.0	25	75
0.05	107	16.7	25	75



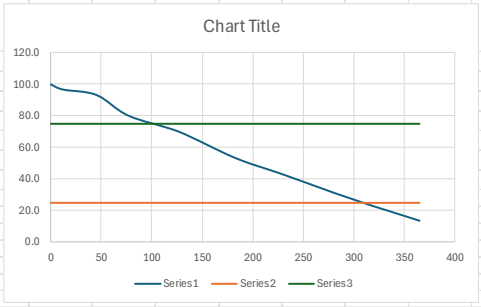
Test 2

water depth (m)	elapsed time (min)	% effective depth		
0.29	0	100.0	25	75
0.2	70	69.0	25	75
0.02	254	6.9	25	75



Test 3

water depth (m)	elapsed time (min)	% effective depth		
0.3	0	100.0	25	75
0.29	12	96.7	25	75
0.28	45	93.3	25	75
0.24	77	80.0	25	75
0.21	126	70.0	25	75
0.16	182	53.3	25	75
0.13	227	43.3	25	75
0.08	300	26.7	25	75
0.04	365	13.3	25	75



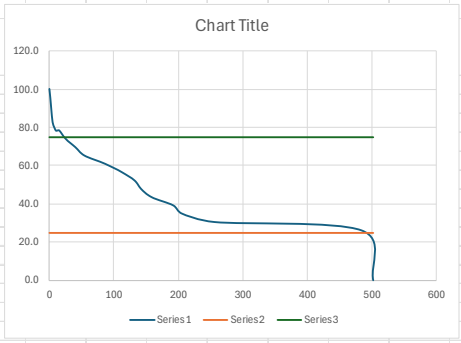
test 1 data							Volume Outflowing between 75% and 25% effective depth:	0.15	m			
depth of pit	0.3			75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.0135	m^3			
min depth to water	0		depth	0.225	0.075		Internal Surface Area:	0.27	m^2			
depth of water	0.3		time	20	99		Time of Water Level Fall:	79	min			
							Soil Infiltration Rate	**1.05485E-05**	**m/s**	**31.6**	**s/mm (Vp)**	
test 2 data							Volume Outflowing between 75% and 25% effective depth:	0.145	m			
depth of pit	0.3			75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.01305	m^3			
min depth to water	0.01		depth	0.2175	0.0725		Internal Surface Area:	0.264	m^2			
depth of water	0.29		time	55	200		Time of Water Level Fall:	145	min			
							Soil Infiltration Rate	**5.68182E-06**	**m/s**	**60**	**s/mm (Vp)**	
test 3 data							Volume Outflowing between 75% and 25% effective depth:	0.15	m			
depth of pit	0.3			75%	25%		Effective Storage Volume ($V_{p75\text{-}25}$)	0.0135	m^3			
min depth to water	0		depth	0.225	0.075		Internal Surface Area:	0.27	m^2			
depth of water	0.3		time	100	310		Time of Water Level Fall:	210	min			
							Soil Infiltration Rate	**3.96825E-06**	**m/s**	**84**	**s/mm (Vp)**	
									Average	**58.53**	**s/mm (Vp)**	

Pit Dimensions		**Units**
Length:	0.30	m
Width:	0.30	m
Depth:	0.30	m

Trial Pit 7

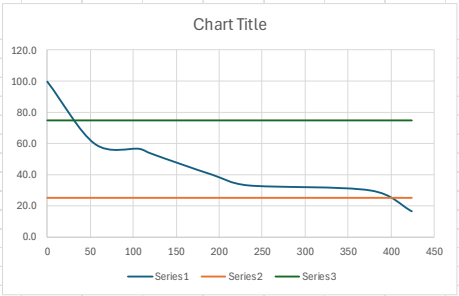
Test 1

water depth (m)	elapsed time (min)	% effective depth		
0.23	0	100.0	25	75
0.19	5	82.6	25	75
0.18	10	78.3	25	75
0.18	15	78.3	25	75
0.17	25	73.9	25	75
0.16	40	69.6	25	75
0.15	54	65.2	25	75
0.14	86	60.9	25	75
0.13	112	56.5	25	75
0.12	132	52.2	25	75
0.11	142	47.8	25	75
0.1	158	43.5	25	75
0.09	192	39.1	25	75
0.08	206	34.8	25	75
0.07	256	30.4	25	75
0.06	484	26.1	25	75
0	502	0.0	25	75



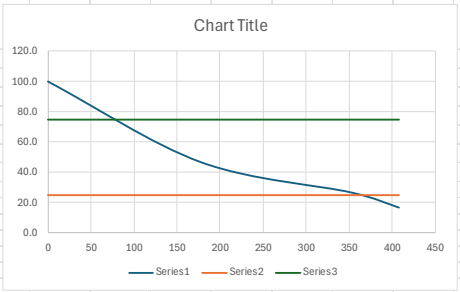
Test 2

water depth (m)	elapsed time (min)	% effective depth		
0.3	0	100.0	25	75
0.18	55	60.0	25	75
0.17	107	56.7	25	75
0.16	122	53.3	25	75
0.12	192	40.0	25	75
0.1	233	33.3	25	75
0.09	376	30.0	25	75
0.05	424	16.7	25	75



Test 3

water depth (m)	elapsed time (min)	% effective depth		
0.3	0	100.0	25	75
0.14	178	46.7	25	75
0.08	353	26.7	25	75
0.05	408	16.7	25	75



test 1 data								Volume Outflowing between 75% and 25% effective depth:						0.115	m		
depth of pit		0.3				75%	25%	Effective Storage Volume ($V_{p75\text{-}25}$)						0.01035	m^3		
min depth to water		0.07			depth	0.1725	0.0575	Internal Surface Area:						0.23	m^2		
depth of water		0.23			time	30	500	Time of Water Level Fall:						470	min		
								Soil Infiltration Rate						**1.60974E-06**	**m/s**	**245.22**	**s/mm (Vp)**
test 2 data								Volume Outflowing between 75% and 25% effective depth:						0.15	m		
depth of pit		0.3				75%	25%	Effective Storage Volume ($V_{p75\text{-}25}$)						0.0135	m^3		
min depth to water		0			depth	0.225	0.075	Internal Surface Area:						0.27	m^2		
depth of water		0.3			time	30	400	Time of Water Level Fall:						370	min		
								Soil Infiltration Rate						**2.25225E-06**	**m/s**	**148.00**	**s/mm (Vp)**
test 3 data								Volume Outflowing between 75% and 25% effective depth:						0.15	m		
depth of pit		0.3				75%	25%	Effective Storage Volume ($V_{p75\text{-}25}$)						0.0135	m^3		
min depth to water		0			depth	0.225	0.075	Internal Surface Area:						0.27	m^2		
depth of water		0.3			time	80	370	Time of Water Level Fall:						290	min		
								Soil Infiltration Rate						**2.87356E-06**	**m/s**	**116.00**	**s/mm (Vp)**
															Average	**169.74**	**s/mm (Vp)**
Pit Dimensions		**Units**															
Length:	0.30	m															
Width:	0.30	m															
Depth:	0.30	m															

APPENDIX B

Soakaway Calculations

Location :

Ellerbeck Barns, Egremont, CA22 2UA

Flood Zone 1

Proposed : 4 No timber pods

Climate Change Allowance:

Pod lifetime : ~ 30 Years (lifetime up to 2060)

Use central allowance for the 2050s epoch (2022 to 2060)

The catchment area is "South West Lakes Management Catchment"

1:100 year storm Climate change allowance = 30%

1:30 year storm Climate change allowance = 25%

Calculating size of soakaway required for each pod:

Roof Area of 1 pod = 19m^2 (0.002ha)

Ground infiltration rate = 1.6x10-6 m/s or 0.00576 m/hr (see infiltration calculations)

For a graveled soakaway and with reference to Flow Calculations below size of soakaway required =

14m long x 0.45m wide x 0.6m deep

Or

7m long x 0.45m wide x 0.6m deep along each side of the pod

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	30	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.600
CV	1.000	Include Intermediate Ground	x
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	Cover Level (m)	Depth (m)
SOAKAWAY	0.002	66.000	0.600

Simulation Settings

Rainfall Methodology	FSR	Summer CV	1.000	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	1.000	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.000	Analysis Speed	Detailed	Check Discharge Rate(s)	x
Ratio-R	0.300	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	10	0	100	30	10	0
30	25	10	0				

Node SOAKAWAY Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00576	Invert Level (m)	65.400	Depth (m)	
Side Inf Coefficient (m/hr)	0.00576	Time to half empty (mins)	740	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	0.450	Number Required	1
Porosity	0.40	Pit Length (m)	14.000		

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

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Results for 1 year +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SOAKAWAY	152	65.514	0.114	0.1	0.2950	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
240 minute winter	SOAKAWAY	Infiltration	0.0

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Results for 30 year +25% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	SOAKAWAY	420	65.836	0.436	0.1	1.1301	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
600 minute winter	SOAKAWAY	Infiltration	0.0

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Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	SOAKAWAY	645	65.999	0.599	0.1	1.5542	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
960 minute winter	SOAKAWAY	Infiltration	0.0

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APPENDIX C

Field Drain Calculations

Using infiltration test results located at the proposed drainage field:			
Average Vp of TP 4, 5 & 6	**51.50**	**s/mm**	
Population (P)	**8**	**(Max x2 People per Pod)**	
Calculating Drainage Field Area			
For Septic Tank = P x Vp x 0.25 =	**103.00**	**m^2**	
Calculating Length of Trench Required			
For trench width 0.9m =	**114.44**	**m**	