

18 February 2021

Fran Muraahi
166 Wellington Street
PUKEKOHE, 2120



Dear Fran,

Re: Soakage Report for 21 Island View Road, Rotorua (Lot 179, DPS 1083)

(1) Introduction

Stratum Consultants Ltd (Stratum) has been engaged by Fran Muraahi to carry out a soakage assessment for the stormwater disposal associated with the proposed development at 21 Island View Road, Rotorua.

This report summarises the tests undertaken and provides recommendations on the size and depth of the soakage system required to dispose of stormwater from a (10% AEP) 1 in 10 year, 60-minute storm event as per the building code.

(2) Site Description

The property is located at 21 Island View Road, Rotorua and legally described as Lot 179, DPS 1083 and is approximately 994m². The site is located approximately 600m south-east of Mount Ngongotaha and within the suburb of Western heights.

The site has as an existing house orientated to the south west of the site with a detached single garage accessed off Island View Road and single carport which is accessed off Ross Road. The property yard is established with grass and gently slopes approximately 4% (1 in 25) down towards Ross Road.

No stormwater reticulated system is available on the site and it is proposed that stormwater be disposed of via on-site soakage.

(3) Existing Information

One percolation test was carried out to establish the stormwater soakage rate for the property. Additional testing has been undertaken for the Geotechnical Assessment Report (Stratum reference: 233840-M-E-C002). We note the following:

- The ground water table was not encountered during site investigations down to 4.5m.
- The borehole logs found that the site is underlain by topsoil to 0.2m below existing ground level (bgl). This was underlain with fine to medium sands, silt and pumice gravel to 4.5m. Sands and Gravels are the more prevalent soils over the depth of testing.

- The proposed soakage design targets the permeable sands and gravels located in the upper 3.5m of soil.
- The general overland flow direction is to the south-east with positive fall available out to Ross Road, hence, a 1:10 year design is considered appropriate.
- The percolation test identifies a soakage rate of 2.11 litres/m²/min.

(4) Soakage Assessment & Recommendations

The soakage assessment consisted of a hand augered borehole to a depth of 3m below the existing ground. A falling head percolation test was undertaken in accordance with E1 - Surface Water (E1/VM1) of the New Zealand building code.

Our on-site percolation test has identified soakage rate of 2.11 l/m²/min. This rate has been reduced by a factor of 0.5 to allow for long term performance of the system and potential reduction in soakage over time due to clogging.

No building plans were available at the time of writing this report and recommendations have been provided below for both soak holes and trenches to allow some flexibility when preparing the building consent drainage plans.

We recommend the following for a new soakage system on the site:

- (i) The soakage system shall accommodate flows for the 1:10 year (10% AEP), 60-minute event.
- (ii) Ensure the base of the soak hole or trench is into the underlying sand and gravel layers. If soils differ from those found in the percolation test then notify the engineer.
- (iii) A single 3.15m deep by 900mm diameter soak hole can dispose of 46m² of hardstand or roof area. A standard soak hole details is attached.
- (iv) A 5m long by 1m wide by 2m deep trench can dispose of 100m² of hardstand or roof area. This equates to 20m² of roof / hardstand area per lineal metre of trench. Where possible the trench is to be located parallel with the ground contour to ensure even loading of the trench occurs. A standard soakage trench detail is attached.
- (v) Suitable grit /leaf and sediment traps be installed at the collection points of the stormwater lines to prevent the capture and transfer of material into the system that may lead to blocking and eventual failure of the soakage system.
- (vi) A suitable form of surcharge relief shall be installed in the pipe system to facilitate surcharge to overland flow in events that exceed the capacity of the soakage system. We recommend pipe breaks at ground level for the downpipe connections to soak holes and a cesspit / relief overflow for the soakage trench system. See attached standard details.
- (vii) The stormwater disposal system is to be maintained as per the attached maintenance table.

- (viii) The soakage system shall be located at least 0.5m from any boundary (provided the neighbouring building is 2.5m from the boundary) and no closer than 3m to any building foundations or retaining walls.

(5) Conclusions

Providing the above recommendations are carried out, it is our opinion that the specific designed soakage system is a suitable method of disposing of stormwater from hard and soft surfaces at this location.

(6) Limitations

There will be occasions when the rainfall event exceeds the capacity of the soakage system. As such, there will be some runoff from the site or ponding until the soakage system recovers. The floor level of any building is to be above the surrounding ground levels and the ground shaped to prevent any ponding water entering the building. In addition, overland flow paths should be free from obstruction to prevent inundation of buildings.

This report has been prepared for Fran Muraahi and the territorial authority for the proposed development at 21 Island View Road, Rotorua. It is not to be relied upon or used out of context by any other person without reference to Stratum Consultants Ltd. The reliance by other parties on the information or opinions contained in the report shall, without prior review and agreement in writing, be at such parties' sole risk.

The following information is attached:

- Percolation Test
- Soakhole design
- Soakage trench design
- Standard Soakhole & Trench Detail
- Maintenance Table
- Hirds Data
- New Zealand Building Code – Percolation Testing Extract

If you have any further queries, please contact the undersigned.

Yours faithfully
Stratum Consultants Ltd



Prepared by:
Craig Pollard
Civil Engineer

Client: Fran Muraahi
Project Title: Soakage Assessment

Page: 1
No of Pages: 6

Site Address: 21 Island View Road
City: Rotorua
File Number: 233840-R-E-S002

Date Started: 15/02/2021
Date Finished: 15/02/2021
Logged By: SG



Test Location Sketch

Notes: Sketch of approximate locations only - not to scale



Client: Fran Muraahi
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Checked:



Stormwater Disposal - Percolation Test Results

Borehole No : 1

Test: 1

Depth (m)	Groundwater	Graphic Log	DESCRIPTIONS	Water level versus time			
0.0m			(TOPSOIL) □□□ SILT minor fine - medium sand, dark brown, dry - moist, low plasticity.				
0.5m		•••	SAND fine - medium minor silt, light orangish brown, moist, poorly graded.				
1.0m		•••	SAND fine - medium, grey, moist, poorly graded.				
1.5m		×××	SILT minor fine - medium sand, light orangish brown, moist, low plasticity.	Time (minutes)	Level Drop (mm)	Cumulative Level Drop (mm)	Augered Hole depth (1): 3000 mm
		×××		0.0	0	0	
		×××		1.0	100.00	100.00	
		×××		2.0	100.00	200.00	
		×××		3.0	160.00	360.00	
		×××		4.0	300.00	660.00	
		×××		5.0	240.00	900.00	
2.0m		•••	SAND fine - coarse minor silt, light orangish brown, moist, poorly graded.	6.0	170.00	1070.00	Presoak hole depth (2): 3000 mm
		•••		7.0	140.00	1210.00	
		•••		8.0	230.00	1440.00	End test hole depth (3): 2190 mm
		•••		9.0	150.00	1590.00	
		•••		10.0	40.00	1630.00	Auger Diameter: 100 mm
2.5m		•••	SILT minor fine - medium sand, light orangish brown, moist, low plasticity.	11.0	100.00	1730.00	
		•••		12.0	80.00	1810.00	Water level drop: 2190 mm
		•••		13.0	50.00	1860.00	
		•••		14.0	50.00	1910.00	Av test depth (2+3)/2: 2595 mm
3.0m		•••	SAND fine - coarse, light greyish brown, moist, poorly graded.	15.0	50.00	1970.00	
		•••		16.0	60.00	2010.00	Depth of topsoil: 200 mm
		•••		17.0	40.00	2050.00	
		•••		18.0	40.00	2110.00	Permeable Depth (av - topsoil): 2395 mm
		•••		19.0	40.00	2150.00	
		•••		20.0	40.00	2190.00	modified Hole Diameter: 108 mm
3.5m		•••		21.0	40.00	2190.00	
4.0m		•••					Water Volume Lost: 19.9 litres
4.5m		•••					Hole Surface Area: 0.45 m ²
5.0m		•••					Total time of test: 21 min
Notes:				when time 0 to 21 min permeable depth is 2395 to 205 mm surface area is 0.45 m ² Soakage rate 2.11 litres/m²/min			
Tests carried out in accordance with Section E1 of the NZ Building Code							

Client: Fran Muraahi

Project Title: Soakage Assessment

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Site Address: 21 Island View Road

City: Rotorua

Date: 16/02/2021

File Number: 233840-R-E-S002

By: CP



Soakhole Capacity Spreadsheet - Borehole 1

Flow Rate into soakhole = 0.639 l/s
Soakage rate of soil = 2.11 l/m²/min
Soakage reduction factor = 0.50 (RDC)
Design Soakage rate = 1.06 l/m²/min
Diameter of Hole = 0.900 m
No Rings (@0.45m high) = 7.000 Depth of Soak hole 3.15

Time	Water Depth start (m)	Surface area (wet) m ²	Soakage rate (l/s)	Storage Rate (l/s)	Water Depth finish (m)
0	0	0.636	0.0112	0.6281	0.059
1	0.059	0.803	0.0141	0.6251	0.118
2	0.118	0.970	0.0171	0.6222	0.177
3	0.177	1.136	0.0200	0.6193	0.235
4	0.235	1.301	0.0229	0.6164	0.294
5	0.294	1.465	0.0258	0.6135	0.351
6	0.351	1.629	0.0287	0.6106	0.409
7	0.409	1.792	0.0315	0.6077	0.466
8	0.466	1.954	0.0344	0.6049	0.523
9	0.523	2.115	0.0372	0.6020	0.580
10	0.580	2.276	0.0401	0.5992	0.637
11	0.637	2.436	0.0429	0.5964	0.693
12	0.693	2.595	0.0457	0.5936	0.749
13	0.749	2.753	0.0485	0.5908	0.805
14	0.805	2.910	0.0512	0.5880	0.860
15	0.860	3.067	0.0540	0.5853	0.916
16	0.916	3.223	0.0567	0.5825	0.971
17	0.971	3.379	0.0595	0.5798	1.025
18	1.025	3.533	0.0622	0.5771	1.080
19	1.080	3.687	0.0649	0.5743	1.134
20	1.134	3.840	0.0676	0.5717	1.188
21	1.188	3.993	0.0703	0.5690	1.242
22	1.242	4.144	0.0730	0.5663	1.295
23	1.295	4.295	0.0756	0.5636	1.348
24	1.348	4.446	0.0783	0.5610	1.401
25	1.401	4.595	0.0809	0.5584	1.454
26	1.454	4.744	0.0835	0.5557	1.506
27	1.506	4.892	0.0861	0.5531	1.558
28	1.558	5.040	0.0887	0.5505	1.610
29	1.610	5.187	0.0913	0.5479	1.662
30	1.662	5.333	0.0939	0.5454	1.714
31	1.714	5.478	0.0964	0.5428	1.765
32	1.765	5.623	0.0990	0.5403	1.816
33	1.816	5.767	0.1015	0.5377	1.866
34	1.866	5.911	0.1041	0.5352	1.917
35	1.917	6.053	0.1066	0.5327	1.967
36	1.967	6.195	0.1091	0.5302	2.017
37	2.017	6.337	0.1116	0.5277	2.067

38	2.067	6.477	0.1140	0.5252	2.117
39	2.117	6.617	0.1165	0.5228	2.166
40	2.166	6.757	0.1190	0.5203	2.215
41	2.215	6.896	0.1214	0.5179	2.264
42	2.264	7.034	0.1238	0.5154	2.313
43	2.313	7.171	0.1263	0.5130	2.361
44	2.361	7.308	0.1287	0.5106	2.409
45	2.409	7.444	0.1311	0.5082	2.457
46	2.457	7.580	0.1334	0.5058	2.505
47	2.505	7.715	0.1358	0.5034	2.552
48	2.552	7.849	0.1382	0.5011	2.600
49	2.600	7.982	0.1405	0.4987	2.647
50	2.647	8.115	0.1429	0.4964	2.694
51	2.694	8.248	0.1452	0.4941	2.740
52	2.740	8.380	0.1475	0.4917	2.787
53	2.787	8.511	0.1498	0.4894	2.833
54	2.833	8.641	0.1521	0.4871	2.879
55	2.879	8.771	0.1544	0.4848	2.924
56	2.924	8.900	0.1567	0.4826	2.970
57	2.970	9.029	0.1590	0.4803	3.015
58	3.015	9.157	0.1612	0.4780	3.060
59	3.060	9.285	0.1635	0.4758	3.105
60	3.105	9.411	0.1657	0.4736	3.150

The above calculation shows that the average flowrate into the design soakhole that can be sustained without overflow is : 0.639 litres per second

The maximum area to be reticulated to each soakhole is therefore calculated as follows:

Rainfall Intensity (10% AEP 60min) = 55.2 mm/hour
C Value for Paved / Roof Areas = 0.90
C Value for Grassed Areas = 0.3

Max Paved / Roof Area per soakhole = 46.3 m²
Max Grassed Area per soakhole = 138.9 m²

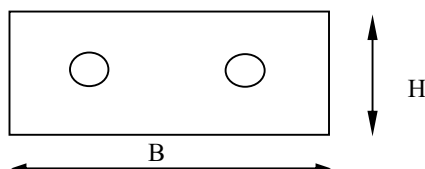
 Stratum CONSULTANTS Experience. Knowledge. Better Outcomes.	CLIENT	Fran Muraahi			PAGE	5 of 6
	PROJECT	Soakage Assessment				
	ADDRESS	21 Island View Road				
	CITY	Rotorua				
	FILE No.	233840	DATE	16/02/2021	BY	CP

Soakage / storage Analysis

Building & Carpark

Soakage Trench Detail

Width b = 1 m
Height H = 2.0 m
Length L = 5 m
Pipe Dia = 0.16 m
No Pipes = 2 No
Trench Vol. Ratio = 0.33



PIPE STORAGE = 0.20 m³
TRENCH STORAGE = 3.27 m³
TOTAL STORAGE CAPACITY = 3.47 m³

Site Details

Site Area = 100 m²
Runoff coefficient = 0.9
Return Period = 10 years

Site Soakage Rate = 1.06 l/m²/min

Site Soakage Area = $B \times L + 2(H) \times L = 25 \text{ m}^2$
SITE SOAKAGE CAPACITY = 26.41 l/min

Design Storm Analysis

Duration min	Intensity mm/hr	Q l/sec	Runoff m ³	Storage		TOTAL	Check
				Stored m ³	Infiltrated m ³	STORAGE m ³	Storage > Runoff
10	125.00	3.13	1.88	3.47	0.26	3.73	OK
20	93.00	2.33	2.79	3.47	0.53	4.00	OK
30	77.30	1.93	3.48	3.47	0.79	4.26	OK
60	55.20	1.38	4.97	3.47	1.58	5.05	OK

* Intensities taken from Niwa RCP8.5 which equates

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Site Address: 21 Island View Road
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File Number: 233840-R-E-S002

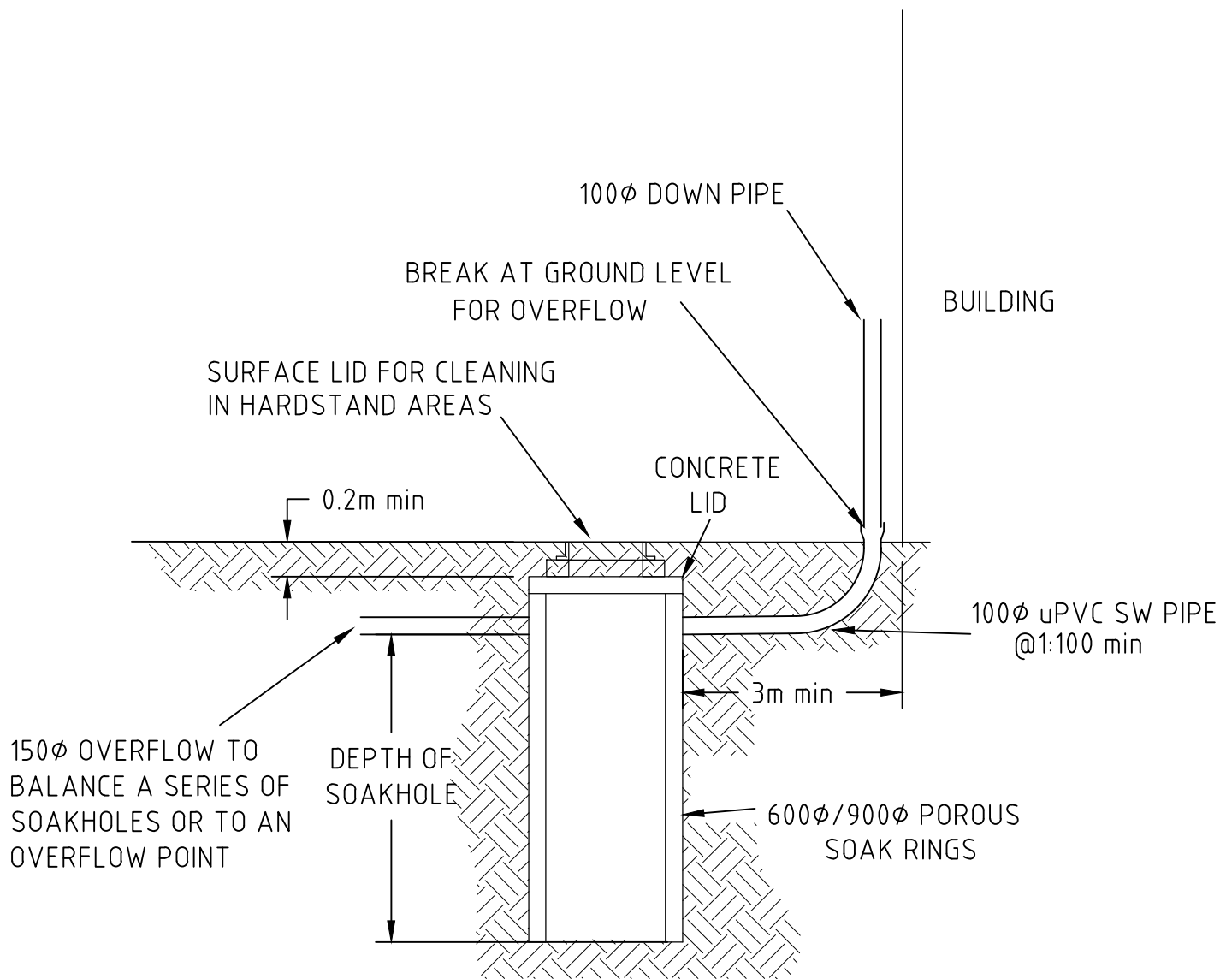
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Date: 12/02/2021
By: CP



HIRDS V4 Intensity-Duration-Frequency Results
Site name: 21 ISLAND VIEW ROAD ROTORUA
Rainfall intensities (mm/hr) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	70.7	52.8	44	31.6	21.8	11.3	7.21	4.51	2.73	2.02	1.62	1.36
2	0.5	78.3	58.4	48.7	34.9	24.2	12.5	7.97	4.95	3.01	2.22	1.78	1.5
5	0.2	105	78	64.9	46.4	32	16.6	10.5	6.5	3.94	2.91	2.33	1.96
10	0.1	125	93	77.3	55.2	38	19.6	12.4	7.68	4.64	3.43	2.74	2.3
20	0.05	147	109	90.4	64.4	44.3	22.8	14.4	8.88	5.37	3.96	3.17	2.66
30	0.033	160	119	98.4	70.1	48.2	24.8	15.7	9.62	5.82	4.28	3.43	2.87
40	0.025	170	126	104	74.2	50.9	26.2	16.6	10.2	6.13	4.52	3.61	3.03
50	0.02	178	132	109	77.5	53.2	27.3	17.3	10.6	6.39	4.7	3.76	3.15
60	0.017	184	136	113	80.2	55	28.3	17.9	11	6.6	4.86	3.88	3.25
80	0.012	195	144	119	84.7	58.1	29.8	18.8	11.5	6.94	5.1	4.07	3.41
100	0.01	203	150	124	88.1	60.4	31	19.5	12	7.2	5.29	4.23	3.54
250	0.004	237	175	145	103	70.1	35.9	22.6	13.8	8.28	6.08	4.86	4.06



150 ϕ HIGH LEVEL OVERFLOW TO BE PROVIDED TO COUNCIL DRAINS WHERE POSSIBLE & AGREED

SOAKHOLE DETAIL: 15m OR MORE FROM BANK

DRAWN:	CC	FRAN MURAAHI			
CHECKED:		21 ISLAND VIEW ROAD			
DESIGNED:		ROTORUA			
OFFICE:	ROTORUA	TYPICAL SOAKHOLE DETAIL			
SCALE:	NTS				
ORIGINAL DWG. SIZE	A4				
A	FEB 21	CP	ISSUED FOR INFORMATION	DRAWING No.	SHEET No. ISSUE
No.	Date	By	Issue/Revision	233840-R-E-D100	01 A

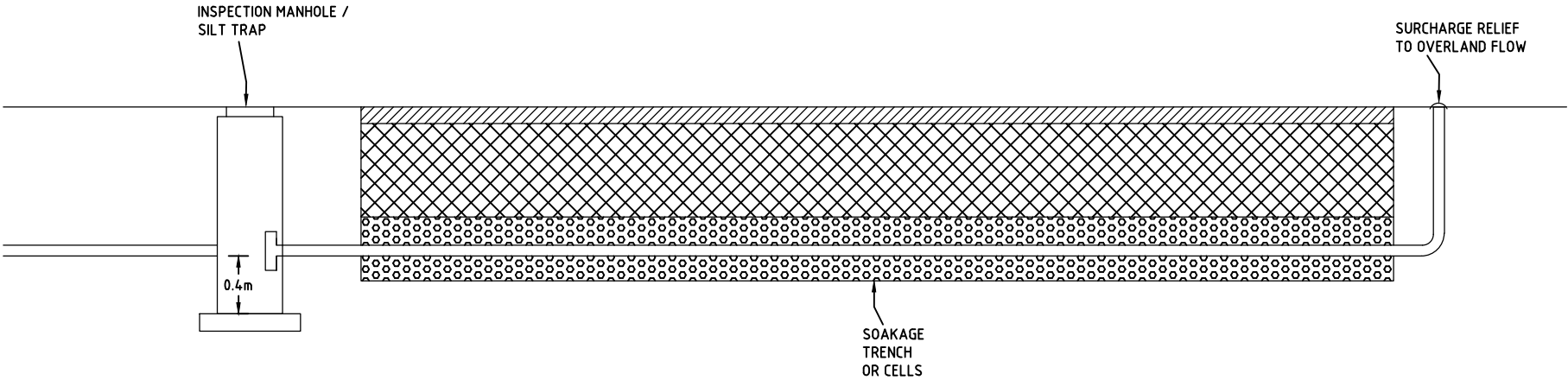


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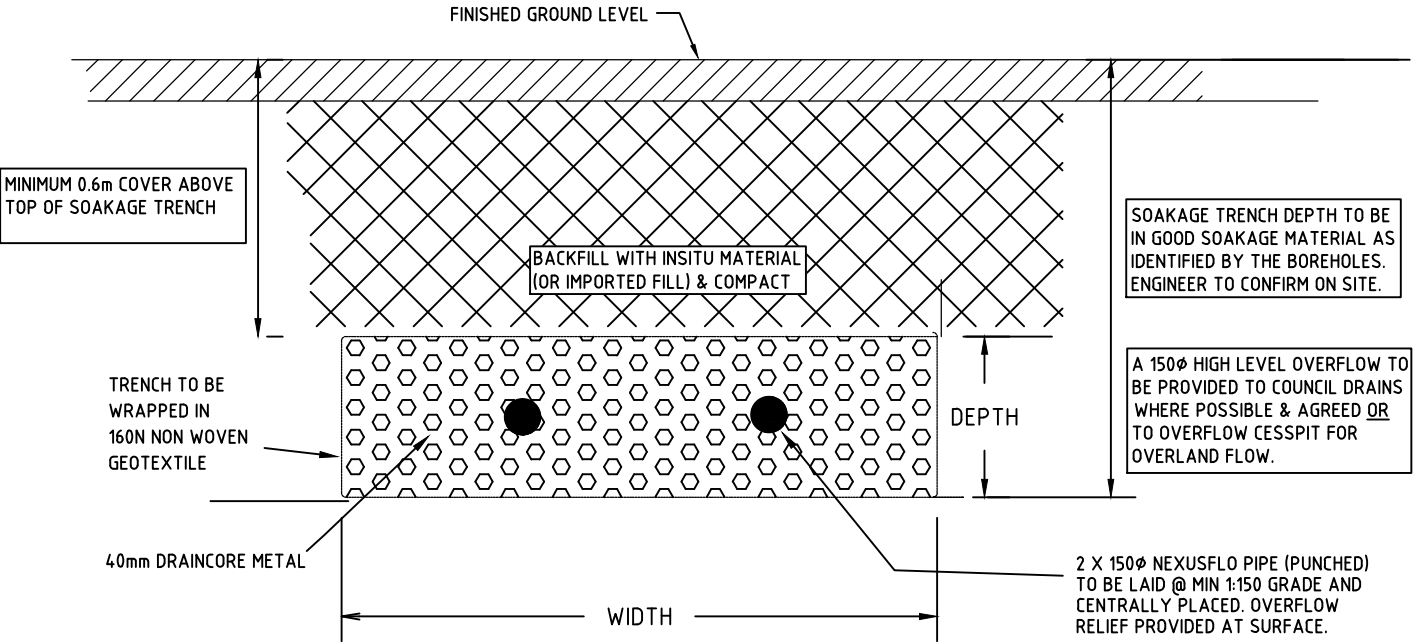
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OFFICE OF ORIGIN - ROTORUA Ph 07 347 7840			
No.	Date	By	Issue/Revision
A	FEB 21	CP	FOR INFORMATION

NOTES/KEY:



TYPICAL SOAKAGE TRENCH - PROFILE



TYPICAL SOAKAGE TRENCH - SECTION

FRAN MURAAHI
21 ISLAND VIEW ROAD
ROTORUA

TYPICAL TRENCH
DETAIL



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SCALE:	N.T.S	ORIGINAL DWG. SIZE	A3
DRAWING No.	233840-R-E-D100	SHEET No.	02
		ISSUE	A

Table 1: Maintenance Recommendations

Component	Recommended Actions	Who?	Frequency
Tank hatches and covers	Inspect for correct fit and seal. Particularly important for underground tanks to prevent ingress of contaminated surface water and entry by children.	Owner	Monthly
Overflow, outlet pipes & orifices	Inspect for blockage and clean of necessary. Check flap valves and/or vector screens.	Owner	3 Monthly
In-line leaf and debris diverters	Inspect and clear away any accumulated leaves or debris	Owner	
Roof, gutters, down pipes & gutter screens	Inspect and remove debris and accumulated sediment. Prune any overhanging branches. If the roof and gutters need to be cleaned, the flow into the raintank should be temporarily diverted to prevent ingress of dirty water to the tank.	Owner Owner	
Tank	Inspect the tank for leaks, sediment build up and structural integrity. A professional tank cleaning contractor should be employed to clean out the tank when the sludge level gets close to the pump inlet. Most raintanks have a design life of 25 years or more. Tanks older than 25 years should be regularly assessed and replaced if necessary.	Owner/ Professional	
Roof, gutters, down pipes & gutter screens	Inspect and remove debris and accumulated sediment. Prune any overhanging branches. If the roof and gutters need to be cleaned, the flow into the raintank should be temporarily diverted to prevent ingress of dirty water to the tank.	Professional	6 Monthly

COMMENT:

1. The low pressure air test is highly susceptible to temperature fluctuations during the test period. A 1°C change during the 5 minute test period will cause a pressure change of 30 mm water gauge or 60% of the permitted change.
2. Failure to soak ceramic and concrete pipes can cause highly variable results.

8.3 High pressure air test

- a) Pressurise pipeline to 25 kPa.
- b) Wait at least 2 minutes to ensure temperature stabilisation.
- c) Disconnect air supply.
- d) Measure the time taken (minutes) for the pressure to drop to 17 kPa.
- e) The pipeline is acceptable if the time taken exceeds that given for the appropriate pipe size in Table 6.

Table 6: Time For Pressure Drop Versus Internal Pipe Diameter
Paragraph 8.3 e)

Internal pipe diameter (mm)	Time for permissible pressure drop (minutes)
90	3
100	3
150	4
225	6

9.0 Disposal to Soak Pit

9.0.1 Where the collected *surface water* is to be discharged to a soak pit, the suitability of the natural ground to receive and dispose of the water without causing damage or nuisance to neighbouring property, shall be demonstrated to the satisfaction of the *territorial authority*.

COMMENT:

Means of demonstrating the suitability of the ground are outside of the scope of this Verification Method. Disposal of *surface water* to a soak pit may also require a resource management consent.

9.0.2 Field testing of soakage shall be carried out as follows:

- a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered in the bore test hole then this depth shall be taken as the depth of the soak pit.
- b) Fill the hole with water and maintain full for at least 4 hours, (unless the soakage is so great that the hole completely *drains* in a short time).
- c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.
- d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

9.0.3 The soak pit shall be designed utilising soakage and storage in accordance with 9.0.5 and 9.0.6 to ensure that *surface water* is discharged without overflowing. The rainfall intensity used in the design of the soak pit shall be that of an event having a duration of 1 hour and a 10% probability of occurring annually. Either local rainfall intensity curves produced by the *territorial authority* or rainfall frequency duration information produced by NIWA shall be used to determine the rainfall intensity.

COMMENT:

This Verification Method does not cover the design of soak pits with overflows discharging to *outfalls*. Such soak pits are often provided to retain water until peak flows in the *outfall* have passed and it is normally considered sufficient to design them for an event having a 10 minute duration and a 10% probability of occurring annually.

9.0.4 The soak pit shall comprise either a rock filled hole (see Figure 13 (a)) or a lined chamber (see Figure 13 (b)). Both of these options shall be enclosed in filter cloth

complying with AS 3706.1. The filter cloth shall have a mass per unit area of 140 grams/m² and a minimum thickness of 0.45 mm.

9.0.5 The volume of storage required in the soak pit, V_{stor} (m³), shall be calculated by:

$$V_{\text{stor}} = R_c - V_{\text{soak}}$$

where

R_c = run-off discharged from catchment to soak pit in 1 hour (m³).

V_{soak} = volume disposed of by soakage in 1 hour (m³).

and

$$R_c = 10CIA$$

where

C = run-off coefficient (see Table 1).

I = rainfall intensity (mm/hr) based on 1 hour duration of an event having a 10% probability of occurring annually.

Amend 5
Jul 2001

A = area (hectares) of the catchment discharging to the soak pit.

and

$$V_{\text{soak}} = A_{\text{sp}} S_r / 1000$$

where

A_{sp} = area of the base of the soak pit (m²).

S_r = soakage rate (mm/hr) determined from 9.0.2.

COMMENT:

Generally where the test results show a soakage rate of greater than 500 mm/hour, soakage rather than storage will be the main mechanism to remove the water. Where the soakage rate is significantly less than 500 mm/hour, storage will become the dominant factor. Intermediate soakage rates will require a design utilising both in the proportions necessary to ensure the water will dissipate before it overflows from the pit.

9.0.6 Where the soak pit comprises a rock filled hole (see Figure 13 (a)) then the volume of the hole shall be calculated as V_{stor} divided by 0.38.

Amend 10
Jan 2017