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Ecological water and wastewater engineering

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Memorandum

3 August 2017

To: John Shirtcliff
From: Andrew Dakers

Subject: Water Supply and On-site Wastewater Management: Proposed Subdivision of Lot 1 DP 82810

The following brief report is a technical assessment of the water supply and on-site wastewater management service (OWMS) options and compliance issues with respect to your proposed subdivision of Lot 1 DP 82810. It is based on a desktop study based using data obtained from the Canterbury Regional Council GIS mapping service and Landcare soil maps and reports available from S-Map Online.

1 Water supply

Two water supply options have been assessed by ecoEng:

1. Harvesting of roof rainwater to storage
2. Wells to groundwater.

1.1 Roof rainwater

ecoEng used 7 years (2010 to 2016 incl) of monthly rainfall data from Geraldine Forest (**Table A4, Appendix A**) to model rainfall roof runoff yield in order to assess reliability of supply of water for domestic use for three different scenarios:

Scenario 1. Dwelling occupancy 3, water tank storage 45,000L

Scenario 2. Dwelling occupancy 3, water saving with water tank storage 45,000L

Scenario 3. Dwelling occupancy 5, water tank storage 45,000L

Scenario 4. Dwelling occupancy 5, water saving with water tank storage 45,000L

Note: The daily water consumption/occupant used in the model includes water for all internal household activities such as toilet flushing, laundry, kitchen and bathroom. The values used, based on AS/NZS1547:2012, Table H3, were

- Standard – 180L/day per occupant
- Full water saving – 120L/day per occupant

All three scenarios included the following assumptions:

a. Roof area 350m^2
b. 90% recovery to storage of all incident rainfall

The results of the modelling are provided in **Appendix A**.

In summary, over the duration of the 7 years, the storage tank registers "empty" for:

Scenario 1. 2 of the total of 84 months
Scenario 2. 0 of the total of 84 months
Scenario 3. 34 of the total of 84 months
Scenario 4. 7 of the total of 84 months

Conclusion
The harvesting of roof rain water to 45kL of storage will provide a significant water supply to dwellings. The reliability of supply will depend on the number of permanent occupants and whether water saving technologies and behaviour have been adopted within the dwelling.

If water supply is to be supplemented, the options are tankering water into the site, installation of a well or connection to a community water supply.

1.2 Groundwater
As illustrated in **Appendix B**, there are about 19 existing wells within 1km of the proposed subdivision. This is evidence that groundwater is a viable source of drinking water for properties located within the subdivision. In terms of mitigating risks to the groundwater household supply from a nearby on-site wastewater land application systems, the options are one or more of the following

1. Install tertiary (e.g. UV) treatment of the secondary treated domestic wastewater before applying to the land application field
2. Site the wastewater land application system at least 30m downstream (in terms of groundwater flow direction [likely to be south east]) or 50m upstream of all water supply bores
3. Installing a deeper well to intercept lower protected aquifer water

2 On-site wastewater management

There are a range of design options for the management of domestic wastewater within property boundaries. Generally, the best-fit on-site wastewater management service for a specific site will depend on:

- Land area available, particularly for the land application system following treatment
- Soil profile characteristics, and in particular drainage capacity
- Surface and subsurface (interflow) drainage patterns and flood risks
- Highest groundwater depth
- Setback requirements from community water supply sources, private wells, surface water bodies, boundaries, buildings, areas with special cultural and heritage values and contaminated sites
- Ground slope and slope stability.

For the proposed subdivision ecoEng has cross-checked the specific issues that would constrain or limit the options for compliant on-site wastewater management. The relevant issues are:

1. Lot area is ~0.5ha of flat land, therefore there is adequate land area for a compliant treated wastewater land application system
2. The Landcare soils map suggests the soil series is likely to be moderately draining Mayfield soils. ecoEng has been assured there are free draining subsoils (below 1m) for all sites.
3. There are no community well protection areas that impact on the sub-division
4. Highest groundwater is likely to be more than 2m below ground level, based on local well groundwater data
5. Risks to existing wells can be mitigated with appropriate setbacks

6. Risks to new wells will depend their relative location with respect to wastewater land application fields. There are mitigation measures available to address risks.
7. No surface water bodies at risk
8. No silent files or cultural values registered for this area
9. There is no record of site contamination under the Listed Land Use Register for Lot 1 DP 82810.

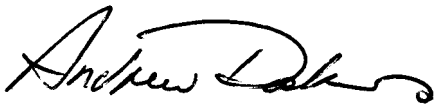
Resources consents to discharge human effluent will be required for all sites within the proposed subdivision. Refer to **Appendix C.** For the above site conditions, the two on-site systems that ecoEng is confident are consentable in terms of Rule 5.9 (ECan LWRP) and the Building Code, and would conform with AS/NZS1547:2012, are:

- Secondary treatment to drip irrigation
- Septic tank with pump dose to a 2A sand bed

The are a number of recent neighbouring human effluent discharge consents have been granted for both of the above two options.

It will be the actual soil profile descriptions and required setbacks (from the nearest bores) that will determine which of the above two options would be the most appropriate for each of the lots within the proposed subdivision.

Yours faithfully



Andrew Dakers
Director and Principal Engineer

3 Appendix A. Rainfall harvesting modelling

The results of the rainfall harvesting modelling are illustration in **Table A1, A2, A3 and A4.**

In summary, over the duration of the7 years the storage tank is “dry” for:

Scenario 1. 2 of the total of 84 months

Scenario 2. 0 of the total of 84 months

Scenario 3. 34 of the total of 84 months

Scenario 4. 7 of the total of 84 months

Table A1. Scenario 1

Summary report												
Average occupancy	3		Water consumption/person/day			180 L/day						
Roof area	350 m^2		Storage volume			45000 L						
Monthly water requirment	16470 L/mth		Ave. monthly yield		23895 L/mth		Rainfall harvest %		90%			
Percentage of months empty and overflow												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
No. months empty	0	0	0	0	0	0	0	0	0	1	1	0
Percent of empty months	0%	0%	0%	0%	0%	0%	0%	0%	0%	14%	14%	0%
No. months overflow	5	4	4	3	4	3	2	2	1	1	3	4
Percentage of overflow months	71%	57%	57%	43%	57%	43%	29%	29%	14%	14%	43%	57%

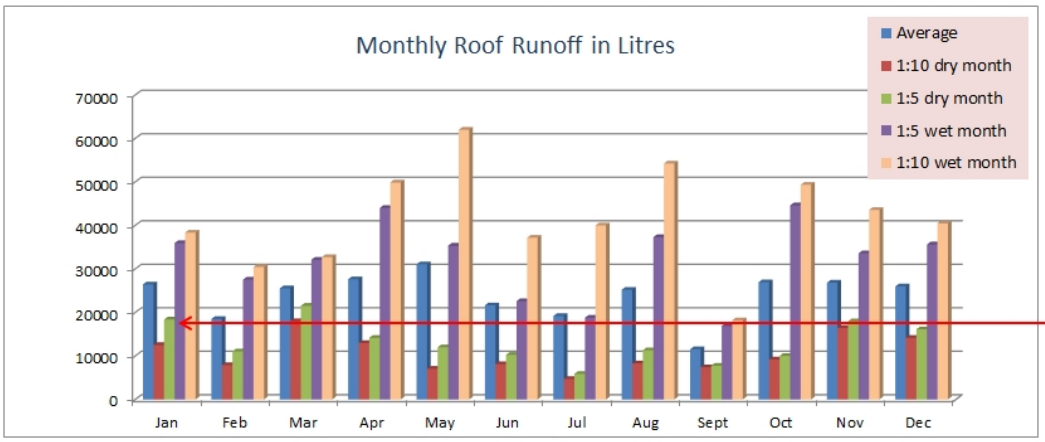


Table A2. Scenario 2

Summary report												
Average occupancy	3		Water consumption/person/day			120 L/day						
Roof area	350 m^2		Storage volume			45000 L						
Monthly water requirment	10980 L/mth		Ave. monthly yield		23895 L/mth		Rainfall harvest %		90%			
Percentage of months empty and overflow												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
No. months empty	0	0	0	0	0	0	0	0	0	0	0	0
Percent of empty months	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No. months overflow	6	5	7	7	5	5	3	3	2	4	6	7
Percentage of overflow months	86%	71%	100%	100%	71%	71%	43%	43%	29%	57%	86%	100%

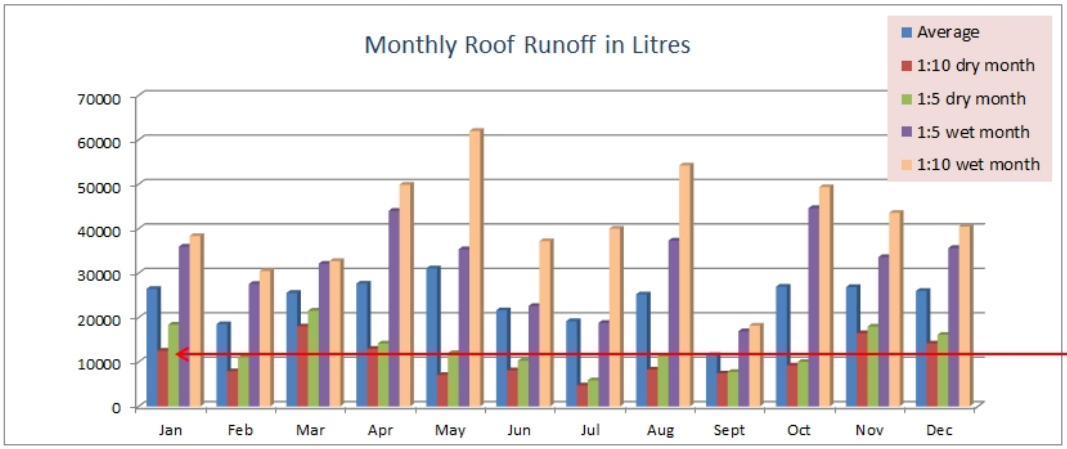


Table A3. Scenario 3

Summary report												
Average occupancy	5		Water consumption/person/day			180 L/day						
Roof area	350 m^2		Storage volume			45000 L						
Monthly water requirment	27450 L/mth		Ave. monthly yield		23895 L/mth		Rainfall harvest %		90%			
Percentage of months empty and overflow												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
No. months empty	2	2	1	2	2	4	4	4	4	3	4	2
Percent of empty months	29%	29%	14%	29%	29%	57%	57%	57%	57%	43%	57%	29%
No. months overflow	1	1	1	1	2	1	0	1	0	1	0	0
Percentage of overflow months	14%	14%	14%	14%	29%	14%	0%	14%	0%	14%	0%	0%

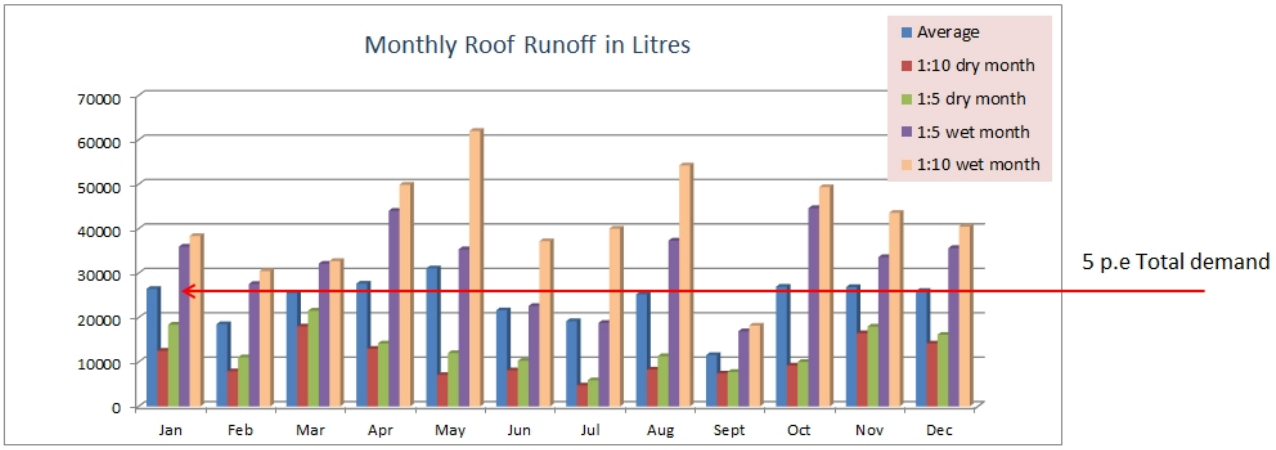


Table A4. Scenario 4

Summary report												
Average occupancy	5		Water consumption/person/day			120 L/day						
Roof area	350 m^2		Storage volume			45000 L						
Monthly water requirment	18300 L/mth		Ave. monthly yield		23895 L/mth		Rainfall harvest %		90%			
Percentage of months empty and overflow												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
No. months empty	1	0	0	0	0	0	1	1	2	1	1	0
Percent of empty months	14%	0%	0%	0%	0%	0%	14%	14%	29%	14%	14%	0%
No. months overflow	4	4	4	2	4	3	2	2	0	1	3	3
Percentage of overflow months	57%	57%	57%	29%	57%	43%	29%	29%	0%	14%	43%	43%

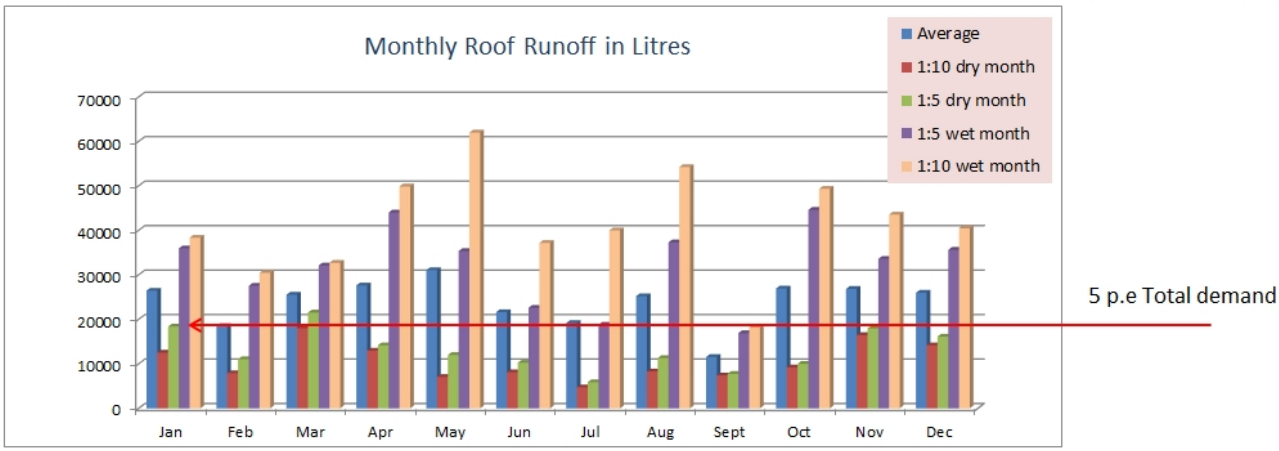


Table A5. Monthly Rainfall. Geraldine Forest

Rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	ANNUAL
2010	115.0	30.5	42.5	53.1	316.0	60.5	60.5	135.0	25.5	31.5	56.5	100.0	1027
2011	55.0	94.5	103.5	55.5	65.5	19.5	21.5	16.5	24.5	173.5	112.5	116.5	858.5
2012	86.0	100.0	104.5	43.0	32.5	43.0	227.0	228.0	57.0	145.5	83.5	67.0	1217
2013	111.0	56.5	67.0	172.5	117.5	186.5	18.0	52.5	59.0	63.0	62.0	146.5	1112
2014	72.0	59.5	74.0	149.0	60.5	72.5	32.5	33.0	28.5	33.0	59.5	39.0	713
2015	17.0	53.5	80.5	103.0	7.5	69.0	10.5	48.0	40.5	26.0	46.0	60.0	561.5
2016	132.0	17.0	96.0	38.5	91.5	30.0	56.5	47.5	22.0	126.5	177.0	49.0	883.5

4 Appendix B. Groundwater wells

There are 19 wells with 1km radius of the proposed subdivision shown on the ECan GIS mapping service. The well depths range between 5m to 10m depth. Refer to **Figure B1**.

Figure B1. Groundwater wells with 1km radius

5 LWRP Rule 5.8

Table 6. Permitted Activity Conditions. The discharge of wastewater from a new, modified or upgraded on-site wastewater treatment system. LWRP Rule 5.8

The discharge of wastewater from a new, modified or upgraded on-site wastewater treatment system onto or into land in circumstances where a contaminant may enter water is a permitted activity, provided the following conditions are met:			
Condition	**Criteria**	✓ ×	**Note Reference**
1	The discharge volume does not exceed 2 m^3 per day; and	×	Risks can be mitigated
2	discharge is onto or into a site that is equal to or greater than 4 hectares in area; and	✓	
a	The discharge is not located within an area where residential density exceeds 1.5 dwellings per hectare and the total population is greater than 1000 persons; and	?	Open to interpretation. Risks can be mitigated
3	The discharge is not onto or into land:		
a	where there is an available sewerage network; or	✓	
b	that is contaminated or potentially contaminated; or	✓	
c	that is listed as an archaeological site; or		
d	in circumstances where the discharge would enter any surface waterbody; or	✓	
e	within 20 m of any surface waterbody or the Coastal Marine Area; or	✓	
f	within 50 m of a bore used for water abstraction; or	?	Site dependent. Risks can be mitigated
g	within a Community Drinking-water Protection Zone as set out in Schedule1; or	✓	
h	where there is, at any time, less than 1 m of vertical separation between the discharge point and groundwater; and	✓	
4	The treatment and disposal system is designed and installed in accordance with Sections 5 and 6 of New Zealand Standard AS/NZS 1547:2012 – On-site Domestic Wastewater Management; and	✓	
5	The treatment and disposal system is operated and maintained in accordance with the system's design specification for maintenance or, if there is no design specification for maintenance, Section 6.3 of New Zealand Standard AS/NZS 1547:2012 – On-site Domestic Wastewater Management; and	✓	
6	The discharge does not result in wastewater being visible on the ground surface; and	✓	
7	The discharge does not contain any hazardous substance.	✓	

6 Appendix C. Capability Statement, A J Dakers

Andrew Dakers (BE, ME) is Director and Principal Engineer with ecoEng Ltd, based in Christchurch. His first professional appointment (1972) was as an engineer with the Ministry of Agriculture and Fisheries, responsible for providing engineering backup to the Advisory Services for farm wastewater, water supply and irrigation services. From 1979 to 1999 he was a fulltime member of the academic staff at Lincoln University where he was Senior Lecturer, Assistant Head and then Head of Department in the Department of Natural Resource Engineering. Since 1999 he has been involved in private engineering consulting with expertise in agricultural irrigation and wastewater systems, small scale domestic wastewater, stormwater and water supply systems mostly in New Zealand but also in Cook Islands and Fiji. He has been involved in infrastructure assessment in small tourist towns. It recent years he has specialised in providing consultancy services for on-site wastewater management services. He has extensive experience in site and risk assessment, modelling, design, resource consenting, scope of works specifications, tender review, auditing, environmental impact assessment, installation supervision, preparing servicing and maintenance programmes and reporting for on-site wastewater management systems. He has completed full site and soils assessment, designs and consenting services for more than 700 sites for individual homes, residential sub-divisions, schools, marae, commercial buildings and remote sites (DOC); the majority in the Canterbury region). Between 2006 to 2012 Andrew was contracted to the Christchurch City Council to carry out detailed engineering evaluation of land application options for the Lyttelton Harbour catchment communities, Akaroa township and Duvauchelle settlement. Since 2006 he has been engaged for more than 500 in-country work days in Cook Islands and Fiji on village scale wastewater and water supply projects. In February 2016 Andrew was engaged to assess current dairy waste management practices associated with the Myanmar Dairy Excellence Project, MDEP project, providing an evaluation of the environmental risks and possible practical options for improved practices and technologies consistent with MDEP primary objectives (10 days in-country). He was a key member of the Centre for Environmental Training (CET) team and since 2003 to 2013, has been involved as both organizer and senior tutor in more than fifty 1, 2 and 3 day in-servicing training course on on-site wastewater engineering in Australia, New Zealand and the Cook Islands. From 2013 to 2016 Andrew has run more than 12 customized in-service 1 to 2 day training for the on-site wastewater industry practitioners. He was an invited member of the industry committee to develop on-site wastewater training unit standards for the Water Industry Training of the Agriculture ITO (2006). Andrew is called on by Local Government and Consultants to review specific site assessment procedures and designs of on-site wastewater management services. Since early 2009 he has been an appointed member of the Management Audit Group for the On-site Effluent Treatment (OSET) National Testing Programme (based in Rotorua). Andrew is the instigator and convenor of the On-site Wastewater Stakeholders Platform (OWSP) Canterbury. He is a member of Water NZ and Small Wastewater and Natural Systems Special Interest Group (SWANS-SIG) and is a past Board Member of the International Ecological Engineering Society (IEES).

July 2017

7 Appendix D. SBCG Producer Statement

Licence Number: PSA/2015/37
Doc # 02171470.doc

1 June 2017

Andrew Dakers
63 Bowenvale Avenue
Cashmere
CHRISTCHURCH 8022
Email: andrew@ecoeng.co.nz

Dear Andrew Dakers

PRODUCER STATEMENT AUTHOR – Acceptance on the SBCG register

Your application for acceptance onto the Southern Building Controls Group (SBCG) Producer Statement Register has been accepted for:

PS1 - Producer Statement Design
PS2 - Producer Statement Design Review
PS3 - Producer Statement Construction
PS4 - Producer Statement Construction Review

Your Producer Statement Author number is PSA/2015/37 and should be quoted on all producer statement documentation that you submit. Your expiry date is 17 February 2018.

Please ensure you note your expiry date and if you wish to remain on the Register complete and return a SBCG33 Renewal Form (www.sbcg.co.nz) at least one month prior to your expiry date. It is important that you also provide details and evidence of further training undertaken (Certificates of Attendance, Registration etc.) and any additional information that may support or affect your renewal application e.g. information on any claims against the author.

Please note that if you wish to apply for a different producer statement type or add to your area of expertise a complete new application will be required.

If you have any enquiries regarding this please contact Deborah Wilson (SBCG Register Maintenance Officer) on (03) 211 1451.

Yours faithfully

ICC BUILDING REGULATION SERVICES TEAM
(On behalf of the SBCG)