

Dairy Green Ltd

Practical Engineering Solutions
Consent, Effluent, Stock water, Irrigation
Design through to Installation

18 July 2023

Rikon Projects Ltd

C/o Brock Hamilton
225 Tilverstowe Road
Island Cliff
Oamaru 9491
brock.gem@gmail.com

Dear Brock

Drop Test Results: Rikon Projects Ltd, Effluent Pond, 1 - 2 July 2023

1. Background

As required by the Otago Regional Council, to confirm your effluent pond is not leaking, a drop-down test was carried out between the 1st and 2nd of July 2023.

Site and Set Up

The farm is located 225 Tilverstowe Road, Island Cliff, Oamaru 9491.

Effluent flows by gravity from the cow shed to a sump, it then flows into two sludge beds. Liquid effluent flows through the weeping wall and is pumped into a clay lined storage pond.

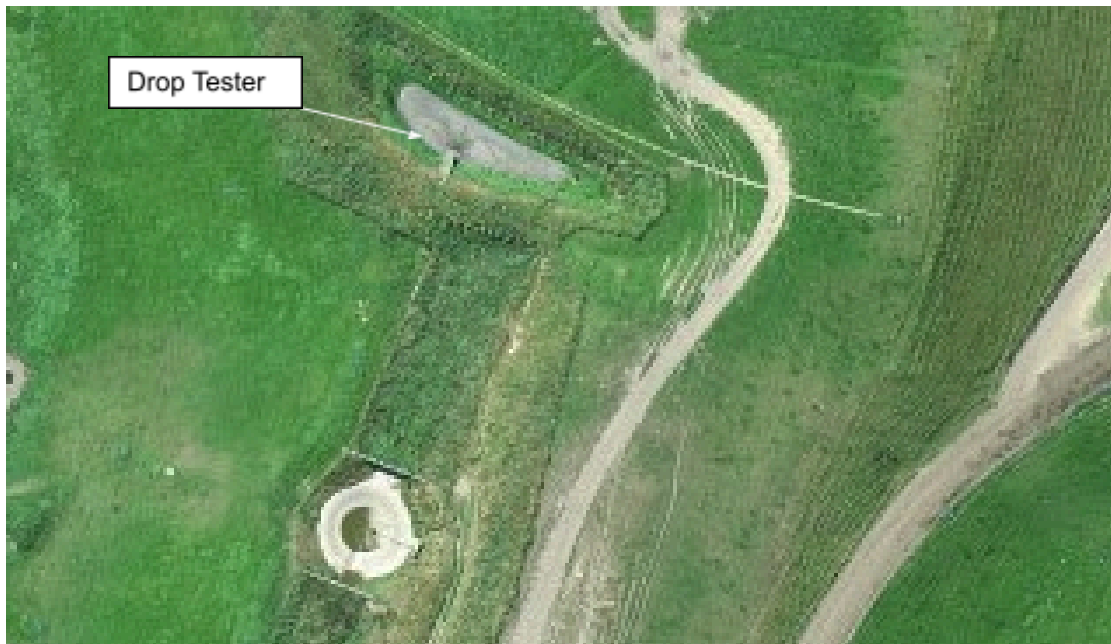
There was no crust on the pond and the surface was not frozen during testing.

The total pond surface area at water level during the test period was 560.1 m² and the total catchment area was 781.5 m².

The total pond catchment area was 39.5 % greater than the wetted area during the test.

The pond is known to have a maximum design depth of 2.8 m including 0.5 m of freeboard. At the time of the test the liquid level was 0.7 m below the maximum design depth, i.e. 91 % full.

Below is an aerial photo that shows the effluent pond. The laser drop test unit was installed at the south side of the pond, as marked.



3. Test Methodology

You were notified when the test was to be run and confirmation was received that there would be no liquid inflow or outflow during the test period.

The monitoring equipment was set up at the pond by Evan Sanderson, as described below. NIWA provide a service of independently hosting all the data collected by the monitoring equipment. The NIWA Neon website was checked to confirm that data was being recorded and sent to the website.

3.1. Water Level Monitoring Unit

A laser distance measuring unit was set up vertically over the pond surface. A reflective disc was placed on the pond surface to ensure constant, repeatable readings.

The laser was set up within a PVC pipe which acts as a stilling well.

Distance readings to the pond surface were taken at 10 second time intervals and sent to NIWA's Neon logging system.

3.2. Meteorological Station

A weather station orientated to the North was also set up and the data it collected sent to NIWA's Neon system at 10 second intervals. It measured:

- Air temperature
- Wind speed
- Wind direction
- Rainfall

3.3 Evaporation Loss Monitoring

To record evaporation and rainfall in real time a bucket was installed suspended from a strain gauge with 9.0 L of effluent in it, on the pond bank.

4. Results Recording

Recording of results was carried out to comply with Otago Regional Council, Final Plan Change 8 Part B: Animal waste storage and application, schedule 18, Schedule of pond drop test requirements and criteria.

Recording details are summarized below:

- The minimum test period has to be 24 hours.
- An anemometer is installed for the duration of the test and only data obtained when the wind speed does not exceed 50 kilometres per hour (14 m per second) at the test site is used in the test results.
- Readings are to be taken every 10 seconds.
- For maximum accuracy the wind velocity has to be very low, in the order of 1m/s. This is because wind at the test site has been observed to have two effects, the first being to cause waves and the second to push water to one side of the pond from the other, (a seiche effect). The accuracy of the laser distance recorder is such it will detect changes as small as 0.2 mm. To accurately determine the true pond level requires calm conditions at the start and end of the test period. The wind velocity outside the start and finish periods has no effect on the test results.
- When a period of 24 hours or more has lapsed the information is downloaded and the results interpreted.

- The GPS location of the pond and equipment set up is recorded. For this test the equipment was located at E1419908 N5022218, at the south side of the pond.

Laser at the south side of the pond.



5. Results Summary

The results for the test are summarised in Table 1 and discussed below. The plot of wind speed and pond height shows that at times wind speeds exceeded 14 m per second, the cumulative total was in the order of 11.5 minutes. The test was run for a total of 34 hours, 11 minutes and 20 seconds which more than compensates for the time that wind gusts exceed 14m/s. A period was identified at the start and end of the test period when the pond surface was stable and accurate height readings were established.

The start time was assumed to be at 9:34:40 hours on the 1 July 2023.

The distance from the laser to the reflective disc on the pond surface was 379.0 mm and the wind speed 1.8 m/sec.

The finish time was assumed to be at 19:46:00 hours on the 2 July 2023.

The distance from the laser to the reflective disc on the pond surface was 384.2 mm and the wind speed 1.7 m/sec.

The total time elapsed was 34 hours and 11 minutes, 20 seconds.

The laser measured a change in distance to the pond surface of 5.2 mm increase. Therefore, the pond surface fell 5.2 mm over the test period.

The total rainfall recorded by the evaporation bucket during the test period was 1.7 mm. This rainfall depth was used in the calculations and not corrected for the 39.5 % larger pond catchment because the graph for the pond level only changed by approx. 1.7mm over the time of the rain event, (ignoring wind effects). This isn't surprising as the bank batters are covered in long grass and 1.7mm is a minimal amount of rain.

The change in level in the evaporation bucket on site for the test period was calculated as a 2.9 mm decrease in level. This is the net result of rainfall less evaporation, evaporation must have been $2.9 \text{ mm} + 1.7 \text{ mm} = 4.6 \text{ mm}$.

During the test period the pond should have risen 1.7 mm due to rainfall and fallen 4.6 mm due to evaporation, a net change of 2.9 mm decrease. The change in pond height was a decrease of 5.2 mm. The difference of 2.3 mm is assumed to be leakage and equates to 1.6 mm in 24 hours.

The following table summarises the results.

TABLE 1: DROP TEST RESULTS SUMMARY, Rikon Projects Ltd, Effluent Pond

Start Time	1 July, 9:34:40	
Finish Time	2 July, 19:46:00	
Total Time	34 hrs, 11 minutes, 20 seconds	
Start Depth (mm)	379.0	
Finish Depth (mm)	384.2	
Change in Depth (mm)	- 5.2	
Rainfall (mm)	+ 1.7	
Evaporation (mm)	- 4.6	
Net Change in Depth After		
Rain and Evaporation (mm)	- 2.3	
Net Change per 24 Hours (mm)	-1.6	
Pond Level, % of Design Depth	91	
Net Change if Pond at 75% of	-1.3	
Design Height. (mm/24hrs)		

6. Conclusion

The pond complies with the requirements of the Otago Regional Council, Final Plan Change 8, Part B: Animal waste storage and application, Schedule 18, Schedule of pond drop test requirements and criteria, with a leakage rate of less than 2.0 mm/24 hours.

The pond is suitable for storing effluent as the infiltration rate from the pond is less than 2.0 mm per 24 hours.

Yours faithfully

JOHN SCANDRETT

Agricultural & Engineering Consultant

Appended

Depth and wind speed graph for the test period.

Depth and rainfall/evaporation graph for the test period.

Depth and wind speed for the start of the test period.

Depth and wind speed for the end of the test period.