Dairy Green Ltd
Practical Engineering Solutions
Consents, Effluent, Stock water, Irrigation
Design through to Installation
Irrigation NZ Accredited Designer

4 March 2019

South Pro Maitland Ltd
C/o Grant & Camille Taylor
371 Piako Road
RD 1
Hamilton 3281

Dear Grant

Drop Test Results: South Pro Maitland Ltd sludge beds, 27 February - 1 March 2019.

1. Background
The discharge consent for the property is 20146428

As required by Environment Southland, to confirm your sludge beds are not leaking, a drop down test was carried out between the 27 February - 1 March 2019.

Site and Set Up
The farm is located at 133 Garden Gully Rd, Maitland.

Effluent flows by gravity from the dairy shed to a stone trap and pump sump. It is then pumped to two sludge beds. Liquid effluent flows through the weeping walls and in to a synthetically lined storage pond.
The sludge beds were emptied in the last 12 months and again a few days prior to the test being carried out. There was no crust and the surface was not frozen during testing.

The sludge beds where isolated by not allowing any inflow and by not pumping out during the test period.

The dimensions of the sludge beds at the water level during the test period were:
North 12.0m
East 31.2m
South 16.0m
West 31.2m

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The dimensions of the sludge beds at the top bank level during the test period were:
North 18.3m
East 33.4m
South 18.6m
West 33.4m

The total pond catchment area was 46% greater than the wetted area during the test.

The maximum design depth for the sludge beds is the weeping wall height of 1.4m. At the time of the test the liquid level was 1.2m deep, i.e. 86% full.

Below is an aerial photo that shows the sludge beds, pond and dairy shed. The laser drop test unit was installed at the south side of the sludge beds, 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. 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.

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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 Vaisala 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 in real time a 10 litre bucket (evaporation pan) with a diameter of 250mm was suspended from a strain gauge. The bucket was rinsed and then filled with 9.0L of effluent, it was situated on the sludge beds bank. The bucket weight is recorded every 10 seconds.

4. Results Recording

Recording of results was carried out to comply with the Appendix P of the Environment Southland Land and Water Plan, recording details are summarized below:

- The minimum test period has to be 48 hours.
- Readings are to be taken every 10 seconds.
- For maximum accuracy the wind velocity has to be less than 1.0m/sec. This limit has been set because wind at the test site has been observed to have two affects, 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 0.2mm. To accurately determine the true pond level requires calm conditions at the start and end of the test period.
- When a period of 48 hours or more has elapsed the information is down loaded and the results interpreted.
- The GPS location of the pond and equipment set up is recorded. For this test the equipment was located at **E**1295945, **N**4905662, at the south side of the pond.

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Laser at the south side of the sludge beds.

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 caused waves on the pond surface. However 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 23:01:10 hours on the 25 February 2019.
The distance from the laser to the reflective disc on the pond surface was 271.4mm and the wind speed 0.7m/sec.

The finish time was assumed to be at 01:23:50 hours on the 1 March 2019.
The distance reading was 267.7mm and the wind speed 0.8m/sec.

The total time elapsed was 74 hours and 22 minutes, 40 seconds.

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The laser measured a change in distance to the pond surface of a 3.7mm decrease. Therefore the pond surface rose 3.7mm over the test period.

The total rainfall recorded by the evaporation bucket during the test period was 12.2 mm. The rain fell over a total of 26.5 hours, although the initial rain event of 5.2mm fell in 2 hours.

The amount of additional rainfall that would reach the sludge bed wetted area is difficult to calculate because of the very long grass surrounding the sludge bed. The sludge beds did not appear to rise in response to rainfall by any significant amount more than the actual depth of rain that would have fallen on the wetted area.
The 12.2mm rainfall depth was used in the calculations and not corrected for the 46% larger pond catchment as this is what the data suggests. Because there is some uncertainty about this the changes in pond height relative to evaporation were studied in detail outside the rain period and recorded below and the assessment of pond performance considered this information along with the overall test period result.

For the total test period the change in level in the evaporation bucket on site was calculated as 3.5mm increase in level. This is the net result of rainfall less evaporation, evaporation must have been 12.2mm rainfall – 3.5 mm net result = 8.7mm evaporation.

During the test period the pond should have risen 12.2mm due to rainfall and fallen 8.7mm due to evaporation, a net change of 3.5mm increase. The change in pond height was an increase of 3.7mm. The difference is -0.2mm.

From the start of the test period at 23:01:10 hours on the 25th until 9:20:50 hours on the 26th the pond fell 0.7mm and the evaporation bucket fell 0.45mm. Typically there is minimal evaporation at night time as was observed here and the pond performance was close to that expected, within 0.25mm and within measuring error.
For the rest of the 26th through to 5:02:00 hours on the 27th the pond fell 3.1mm and the evaporation bucket 4.7mm. It is not unusual for the evaporation bucket to lose more height during daytime than an effluent sludge bed.

For the rest of the 27th, through the rain period, until 19:22:20 hours on the 28th the pond rose 8.1mm and the evaporation bucket rose 9.0mm.

For the remainder of the 28th until the end of the test at 1:23:50 the pond fell 0.6mm and the bucket fell 0.2mm. From considering the pond performance outside the rain event it can be concluded the pond is not leaking at any significant rate, if at all.

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TABLE 1 : DROP TEST RESULTS SUMMARY, South Pro Maitland

Start Time	25 February, 23:01:10
Finish Time	1 March, 01:23:50
Total Time	74 hours, 22 minutes, 40 seconds
Start Depth (mm)	271.4
Finish depth (mm)	267.7
Change in depth (mm)	-3.7
Rainfall (mm)	+12.2
Evaporation (mm)	-8.7
Net Change in Depth After	
Rain and Evaporation (mm)	-0.2
Net Change per 24 Hours (mm)	-0.06
Pond Level, % of Design Depth	86
Net Change if Pond at 75% of	
Design Height. (mm/24hrs)	

6. Conclusion

The sludge beds comply with the requirement of the Environment Southland Land and Water Regional Plan for effluent discharge (Rule 35 b. iii.), with a leakage rate of less than 1.6mm / day. The pond is suitable for storing effluent as the infiltration rate from the sludge beds is less than 1.6mm per 24 hours.

Yours faithfully

JOHN SCANDRETT
Agricultural & Engineering Consultant

Appended

Depth and wind speed graph for the test period.
Depth and rainfall 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.

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