final report

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Application of a novel, cost effective soil moisture technology for effluent irrigation

Milestone 4 Report

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Contents

1 Introduction

This document is the fourth milestone report for the PIP.0158 project looking at the performance of two novel technologies for monitoring soil moisture in effluent irrigation system at T&R Murray Bridge abattoir after 9 months operation in the field. The report covers the field trial period from 1 May – 31st July 2007 (“Quarter 3”).

The abattoir underwent a three week shutdown from 23 June until restart on Monday 16th July. During this time negligible effluent was generated and irrigation activities ceased. From the point of view of effluent irrigation, the timing of the shutdown is optimal.

Climatic conditions were reasonably normal with slightly below average rainfall in May, but reasonably average falls in June and July. Ground conditions were very wet.

Figure 1 presents a survey diagram of the effluent irrigation system at T&R Murray Bridge. The system consists of 4 large pivot irrigators (pivots 1 – 4) through which primary-treated effluent is applied. In Figure 1:

Diviner sites are identified as “D”

Wetting front Detector sites are noted as “W”.

Details on the installation of each technology were provided in Milestone 1 report.

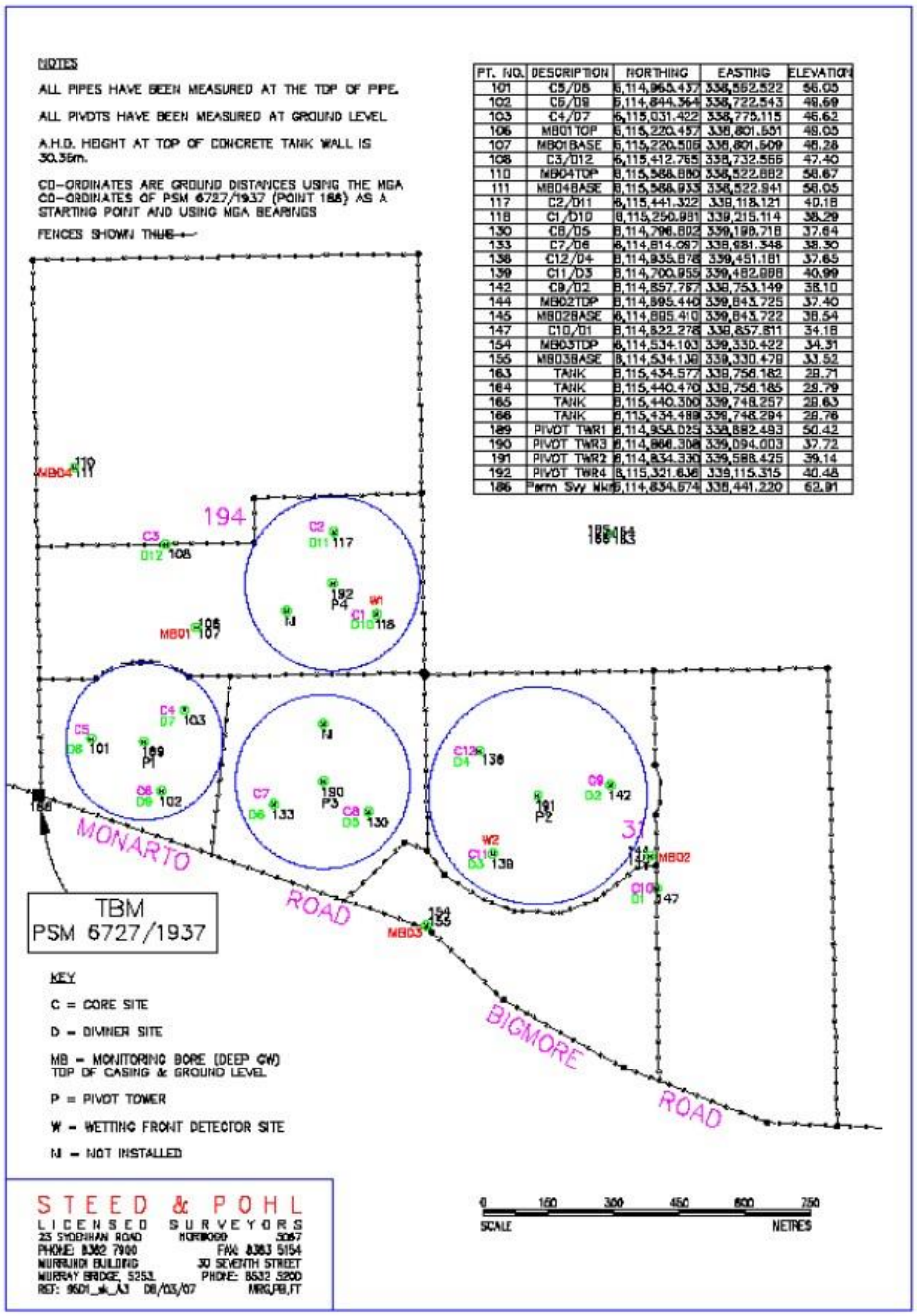

Figure 1. Surveyed locations of monitoring devices on irrigation property

2 Diviner 2000 Results

2.1 Background

Readings of the 12 Diviner soil moisture tubes using the automated Diviner 2000 reader were made throughout the Quarter 3 period, except during the shutdown. The readings from all 12 tubes were downloaded to computer and sent to Phillip Baker of Land Energy.

To assist interpretation of the data, Table 1 summarises both the hydraulic load to each Pivot during the Quarter and periods when there was no irrigation.

Figures 2 – 4 present summed output of the sensors for three sites to indicate the nature of the Diviner Output.

Table 1. Pivot Operation Details

Pivot	Hydraulic load (ML/ha in Qtr 3)	Periods of rest (week starting)
1	2.7	7, 14 May + shutdown
2	2.8	Shutdown only
3	1.9	16, 23 July + shutdown
4	2.4	28 May until 16 July

2.2 Results

Figures 2 – 4 present examples of sensor output for three sites. The figures present summed output of the sensors.

Figure 2: Pivot 3, Site D5

Pivot 3 was used for irrigation intensively in the first part of Quarter 3 and then spelled during July.

Figure 2 presents summed soil moisture data for the whole investigation period. The site was moist in the upper profile to wet in the deeper levels in early summer. Increased irrigation application rates in mid January raised profile moisture to wet throughout the soil and subsoil. Reduced irrigation rates in Autumn begin to dry out the surface soils, but rainfall in late April refills the profile to wet, with some drying evident during and after the shutdown (Late June to mid July) when the pivot was rested for grazing.

The high degree of saturation during May created surface runoff from the pivot. This was captured and re-irrigated elsewhere.

Figure 3: Control Reference, Site 12

Soil moisture at this unirrigated reference site progressively increases from dry to wet throughout the period, peaking as a result of significant rainfall at the end of April. Compared to the irrigated sites, the soil is significantly less saturated.

Figure 2. Diviner output for Pivot 3, Site D5.

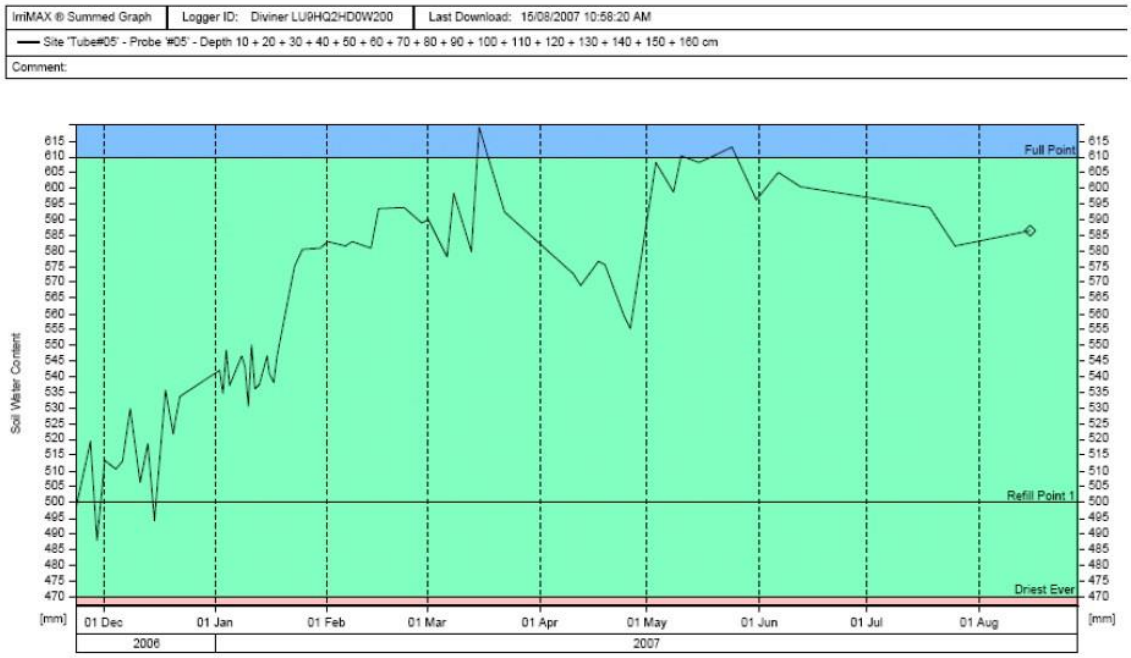

Figure 3. Diviner output for Control Area north of Pivot 4, Site D12.

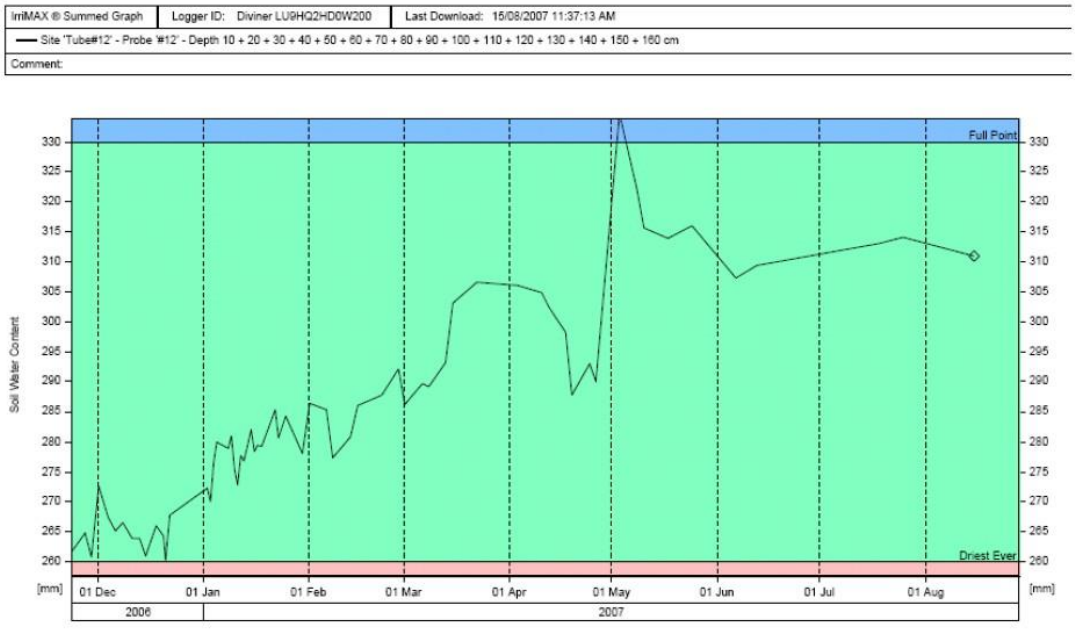

Figure 4. Diviner output for Pivot 2, Site D3.

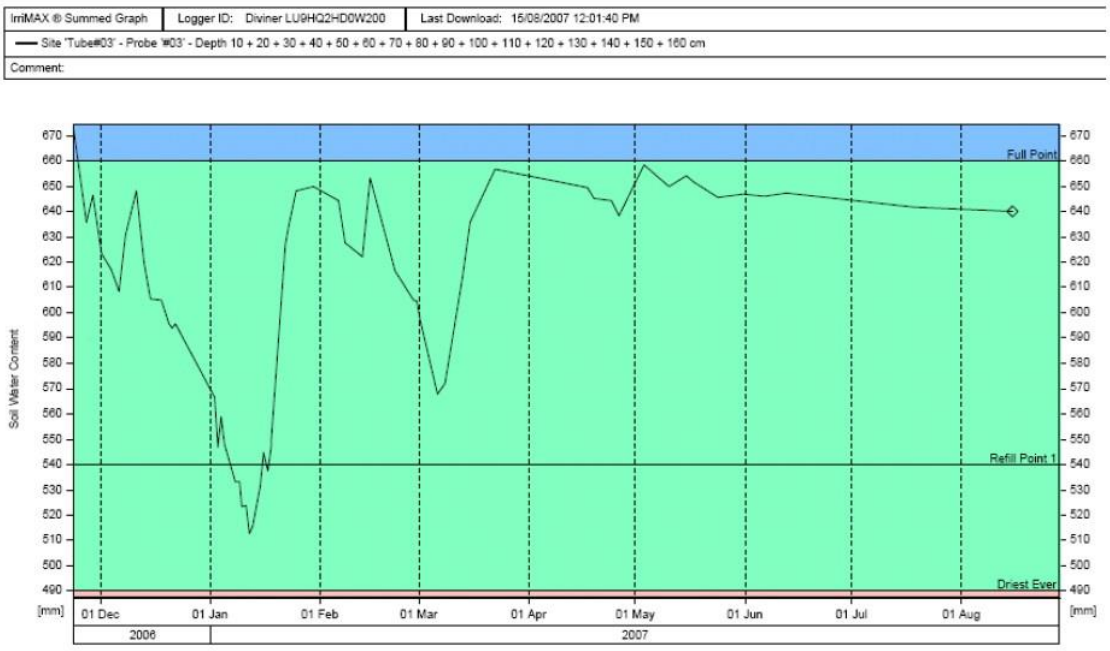

Figure 4: Pivot 2, Site 3

Pivot 2 is irrigated consistently during the Quarter until shutdown in late June. Moist to wet conditions in the soil are maintained into autumn, due to limited crop water uptake into April, continuing through to August with some drainage and redistribution apparent as a result of irrigation suspension during the shutdown.

3 Wetting Front Detectors Results

Two pairs of wetting front detectors (WFD) were installed in mid December 2006. The top cup is at 30 cm bgl (below ground level); the base cup was installed at 60 cm bgl.

During Quarter 3, the detectors continued to show that the ground was saturated in the top 60 cm for Pivots 2 and 4, despite the 3-week shutdown.

In view of the time required to reset, and the uniformity of output, it has been decided to discontinue use of the WFD and concentrate instead on the Diviner system as mentioned in the Milestone 3 report.

4 Conclusions

The main findings at this point in the investigation are:

In general the soil becomes wet to very wet for the pivots during this winter period, despite the shutdown.

The impact of heavy irrigation and rain periods on soil moisture is clearly observed by the Diviner technology

The two reference sites converged to approx. 300 mm summed water soil content during winter, although the variation in moisture at different depths indicates the variation in soil between the two sites.

The Diviner data support the water balance estimations.

The Wetting Front Detector technology is overwhelmed by the quantity irrigated and too sensitive to be useful, despite its sensitivity.