

Maximising pasture growth and limiting losses

Measure to manage soil moisture and get the most from your water and nutrients

Handout

Outcomes for the day

- Understand the why, what and how to measure soil moisture
- Learn how to do a rapid performance check of your irrigator
- Be able to scheduling irrigation more accurately to improve water use efficiency
- Assess alternative farm dairy effluent systems

Wednesday, 29 January 2014

Programme

9:45am– 10am	Cup of tea
10am- 10.45am	Measuring and monitoring soil moisture – why, what, how, how to use information and the weather
10.45am– 11.45am	How to do a rapid check of your irrigator performance, water use efficiency, calibration
11.45am- 12.30pm	Scheduling and irrigator performance, what do the numbers mean and how do we use them
12.30pm– 1pm	Farm dairy effluent, weeping walls, clay lined pond and soil moisture
1.00 pm	Lunch-sausage sizzle by Farmlands

Contacts tony.faulkner@gw.govt.nz or ian.gunn@gw.govt.nz or jp.praat@groundtruth.co.nz



groundtruth



PAGEBLOOMER

Handout prepared by:



Wairarapa Moana Fresh Start Project

Wairarapa Moana Fresh Start Project

The Wairarapa Moana Wetlands Project began in 2008 to enhance the native ecology, recreation and cultural opportunities on the public land in the area. The project partners are Greater Wellington, Department of Conservation, Rangitane o Wairarapa, Kahungunu ki Wairarapa, local hapu and South Wairarapa District Council.

They in turn are working with community groups, farmers and environmental and recreational groups to restore our wetland treasure. Everyone recognises you can't succeed in a project this size without all interested parties being involved. The project got a major shot in the arm with a successful bid for funding from the Government's Fresh Start for Freshwater Clean Up Fund to improve the water quality of the edge wetlands. The Ministry for the Environment will contribute \$1 million over three years. This funding will be matched in cash and in-kind by a range of funding partners including Ducks Unlimited, Dairy NZ, Department of Conservation and Greater Wellington Regional Council.

Two key objectives of the fresh start project – improve biodiversity and improve water quality. This Fielday is focusing on water quality.

Working with farmers to make a difference

The project team aim to work in partnership with willing farmers around Wairarapa Moana to find win win solutions that benefit the wetland environment and the farm. There are a range of tools to help with this including riparian fencing and planting, and constructing new wetlands to treat water before it enters the larger natural wetlands. The project can assist with farm assessments and plans to provide information on soils and waterways and options for enhancing management of nutrients, effluent and natural values as part of a profitable farming operation.

The project can provide funding contribution to on-farm work to mitigate nutrients and effluent entering the wetlands and lake. Areas where work will have a major benefit for biodiversity but less for the farm business will get a higher grant rate. Areas where work will have more benefit for the farm business and less for biodiversity will get a lower grant rate.

Focus of Fielday today

The goal of the project is that farmers reduce losses of nutrients to ground and surface water. Key to this is reducing the amount of water draining from the soil as much as possible. Irrigation of water or effluent to soils beyond their ability to retain that water must be avoided. The ability of the soil to hold water is determined by the texture (clay, silt, sand and stone content) of the soil where plant roots are. Fine tuning irrigation around soil water holding capacity, plant requirements and rain fall events is critical. It costs around \$2/mm/ha to irrigate. Measuring soil moisture, scheduling irrigation and operating irrigators efficiently will improve investment returns to farmers and improve water quality. The major determinants are:

-
- Knowing soil moisture levels and what to do with that information
 - Operating irrigators efficiently

This Fielday will focus on measuring and managing soil moisture and irrigator performance



Wairarapa Moana Fresh Start Project

Irrigation management

Management of both water and effluent irrigation systems impacts on water quality. Efficient water use saves power and nutrients and is therefore money in the bank not down the drain. Some of the basics will be covered here and during the Fieldday. There is a large amount of knowledge and skills which can be accessed on this. We have drawn from the "Irrigation Manual" published by Irrigation NZ and "Irrigation Management for Cropping - A Grower's Guide" published by Foundation for Arable Research (FAR) and 'Irrigation Calibration' published by Page Bloomer and Associates Ltd. You can find this and more information at:

<http://www.irrigationnz.co.nz/resources/irrigation-manual/>

http://www.far.org.nz/mm_uploads/Iss_04_Irrigation.pdf

<http://www.pagebloomer.co.nz/resources/irrigation-calibration/>

At the previous Fieldday (12 November, 2013) we demonstrated how you could determine how much water there is in the root zone between field capacity and stress point for your soil using the soil profile builder¹. This is the Readily Available Water and can be estimated as half the soil water stored in the soil between field capacity and permanent wilting point. This may be referred to as the size of the bucket. We also looked at the key question of when should soils under dairy pasture be irrigated? This should occur just as the soil water level reaches stress point. The next question is how do we know when the soil is at stress point.

The diagram illustrates these relationships and shows three irrigation events, changes in soil moisture over time and saturation, field capacity, stress point and permanent wilting point are shown below. Days between irrigation events will vary with site and rainfall.

IRRIG8Lite Calibration Software



IRRIG8Lite software takes the field measurements and calculates the system performance indicators for you. It also provides graphs of the application, and allows you to print various reports.

The setup file "Setup IRRIG8Lite" [Build 1.3 updated 27 Jan 2014] is available for download from: <http://www.pagebloomer.co.nz/resources/irrig8lite/>

A web-based version is in development and should be available in early 2014.

¹ Key Learnings form that Fieldday are available from GWRC

Soil water is an extremely important to plant growth. To optimise growth it is necessary to regularly measure and monitor soil water content. In practise there are two key questions:

- When to turn irrigation on?
- When to turn irrigation off?

Soil water budget

Once the Readily Available Water (RAW) or the depth of the “bucket” has been determined for your soil or soils, a daily soil water balance or budget can be calculated based on the following equation:

$$\text{RAW tomorrow} = \text{RAW today} + \text{irrigation} + \text{rainfall} - \text{evapotranspiration}^*$$

* Assumes no drainage

The soil water balance is calculated in mm of water. Irrigation and rainfall add to the balance and are easily measured. Evapotranspiration is not so easy to measure. This relates to pasture transpiration and subtracts from the balance. Often this is estimated as Potential Evapotranspiration or PET. Pasture uses water as it breathes taking in CO₂ and releasing O₂ while growing in the process we know as photosynthesis. Water evaporates from plant cells and this loss of water is called transpiration. Ninety nine percent of the water taken up by the plant is lost in this way. The amount of water lost by transpiration depends on atmospheric conditions. (An increase in temperature, sunlight and wind speed all cause an increase in transpiration). These parameters can be measured at weather stations. Some calculate PET e.g. Harvest.com. At present PET is not available from GWRC sites. Generally evapotranspiration is assumed to be 5mm/day. However, it does vary as indicated above. The graph below shows evapotranspiration varies from less than 1mm per day in the winter up to almost 6mm/day in late December.

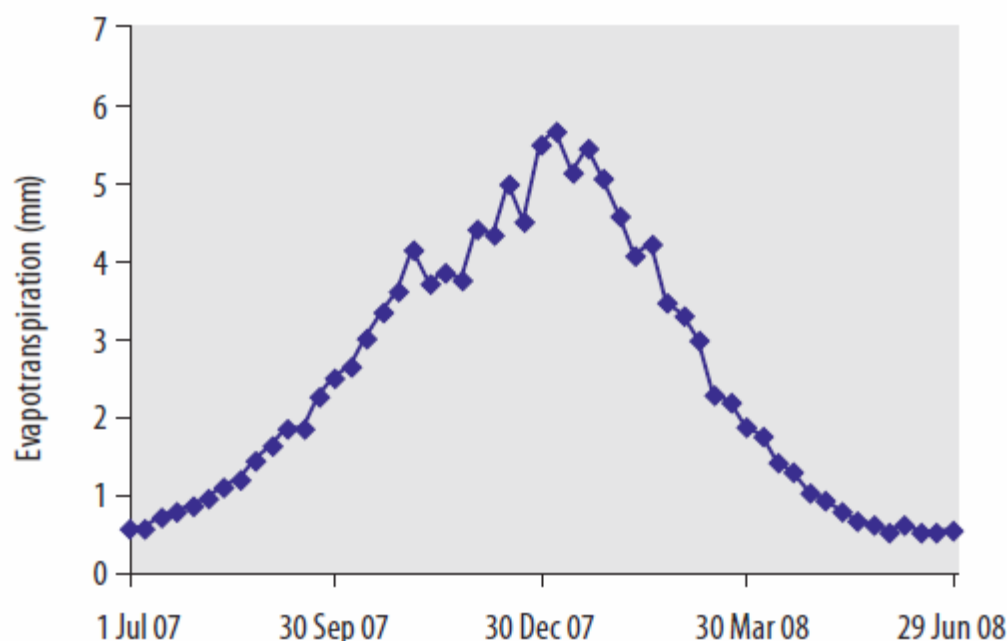
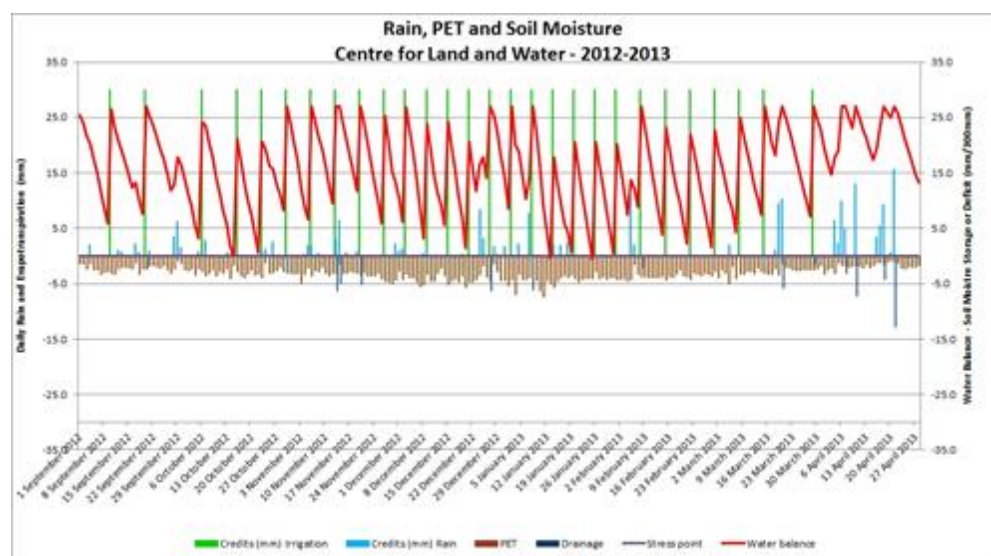
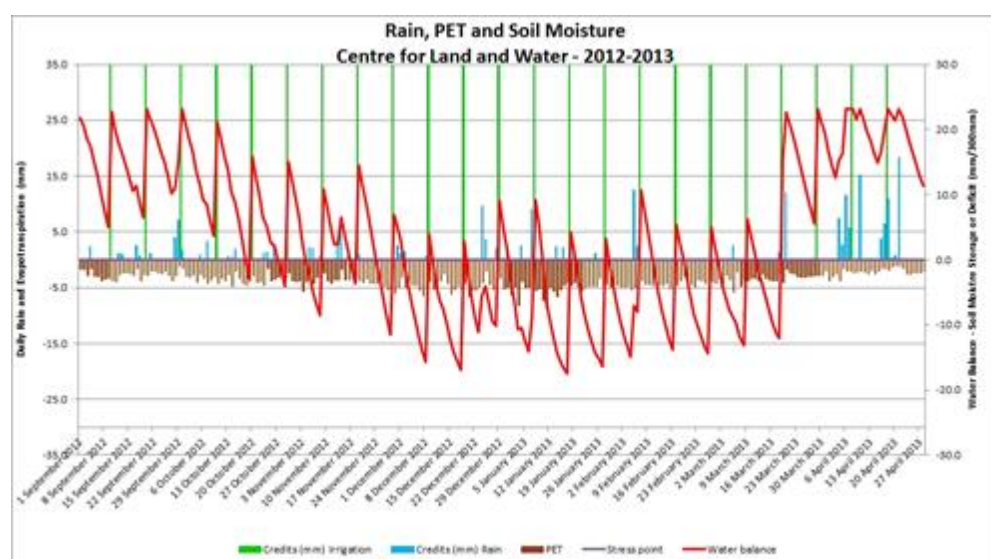
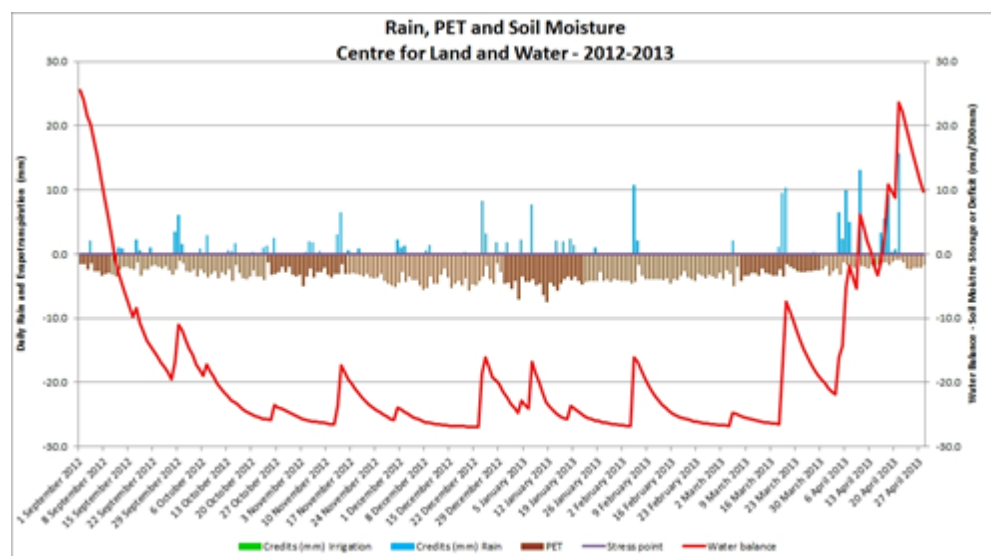


Figure 1 Average evapotranspiration rates (mm) for Lincoln



Wairarapa Moana Fresh Start Project

Example soil water budgets



Measuring and monitoring soil moisture

A soil water budget is inexpensive and reasonably accurate if done carefully. However, errors can accumulate over time, for example in estimating transpiration losses. Soil moisture measurements are a good way to keep the budget on track. Measuring soil moisture has the advantage in that all the variables of soil quality, rainfall, irrigation and pasture uptake are combined in one value. There are many methods for measuring soil moisture including:

-
- Spade (grower judgement)
 - Tensiometer
 - Gypsum Block
 - Aquaflex cables
 - Neutron probe
 - Capacitance meters
 - Time domain reflectometry (TDR)
-

These are described in detail in the Irrigation Manual and FAR publication

Soil moisture meters tell us how wet the soil, not how many mm of water are available. Therefore interpretation or calibration is required.

Mapuna Atea have recently installed a system to monitor soil moisture and other aspects of farm management including climate, effluent application and water flows. Example data is shown in Appendix 1. This information is available live online.

Soil moisture measurement and monitoring sites

Greater Wellington Regional Council have a number weather and soil moisture measurement sites. For soil moisture, the closest one to South Wairarapa farmers is at Tauherenikau Racecourse. This can be accessed at <http://graphs.gw.govt.nz/land-and-soil-2/>. Detailed soils analysis is available for Tauherenikau meteorological station. Note that readily available water is 7.2mm which is very low reflecting the stony sandy nature of the Greytown silt loam and sandy loam at that site. Mapuna Atea farms on heavy soils including Onoke silt clay and Ahikouka deep silt loam. These are poorly drained and have high readily available water (60-70mm).

A range of weather data is available depending on the site. Most have rainfall, Lake Wairarapa West is the closest to Mapuna Atea being close to the lake at the end of Parera road and about 5 kms to the north west.



Wairarapa Moana Fresh Start Project

Environmental monitoring and research

Air quality

Meteorology

Rainfall

Wainuiomata/Orongorongo

Wairarapa valley

Featherston

Masterton

Papawai

Parkvale

Wairongomai

Lake Wairarapa West

Lake Wairarapa East

Northern and Eastern Wairarapa

Tararua foothills

Tararua ranges

Kapiti coast

Porirua / Pauatahanui

Upper Hutt

Wellington

Lower Hutt

Land and soil

Rivers and streams

Groundwater

Lakes

Wetlands

Recreational water quality

Coasts and estuaries

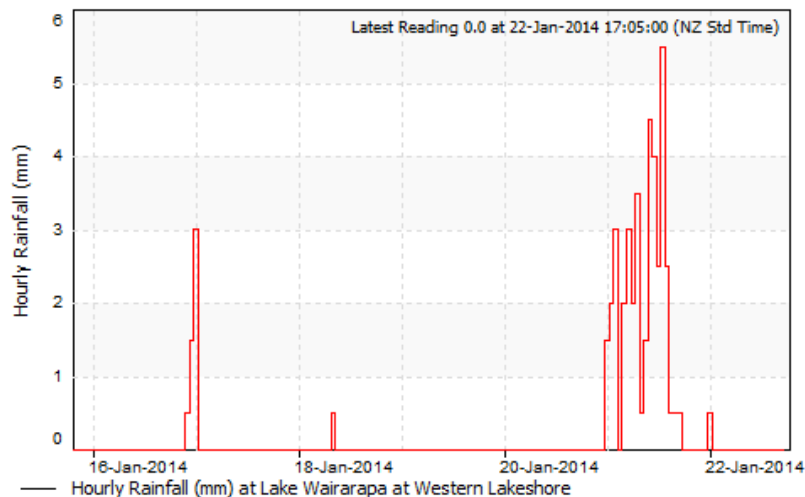
Environmental reporting

Regulatory Reporting

Lake Wairarapa West

This site is located on the western side of Lake Wairarapa and was installed to help understand how much evaporation is occurring and relate this to other lake inflows and outflows. We also measure other meteorological data at this site.

From 15/01/2014 18:09 To 22/01/2014 18:09 Go



Latest rainfall data: 0.0mm on 22/01/2014

Rainfall for last 7 days

Date	Total (mm)
22/01/2014	0.0
21/01/2014	38.5
20/01/2014	1.5
19/01/2014	0.0
18/01/2014	0.5
17/01/2014	0.0
16/01/2014	5.0

[Get these daily totals \(XML\)](#)

Annual statistics

Year	Annual total (mm)	Maximum daily rainfall (mm)	Date of maximum rainfall
2014 YTD	131.5	45	03/01/2014
2013	1468.5	76.5	11/10/2013
2012*	819	57	06/06/2012

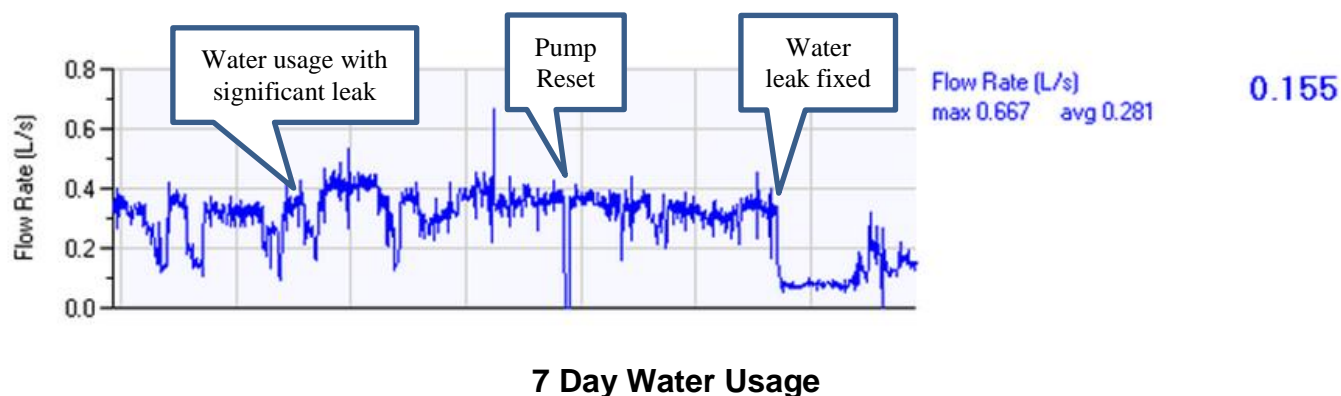
* may represent a partial year of data

From <http://graphs.gw.govt.nz/lake-wairarapa-west-2/>

Alternatively Harvest.com display soil moisture levels for various locations in South Wairarapa.

Other benefits of measuring farm inputs

Farm water usage – Below are graphs of farm water usage. A water leak was quickly identified from the data coming through and fixed. This saved money, water and potentially improve water quality.



Last 24 hour Water Usage from above

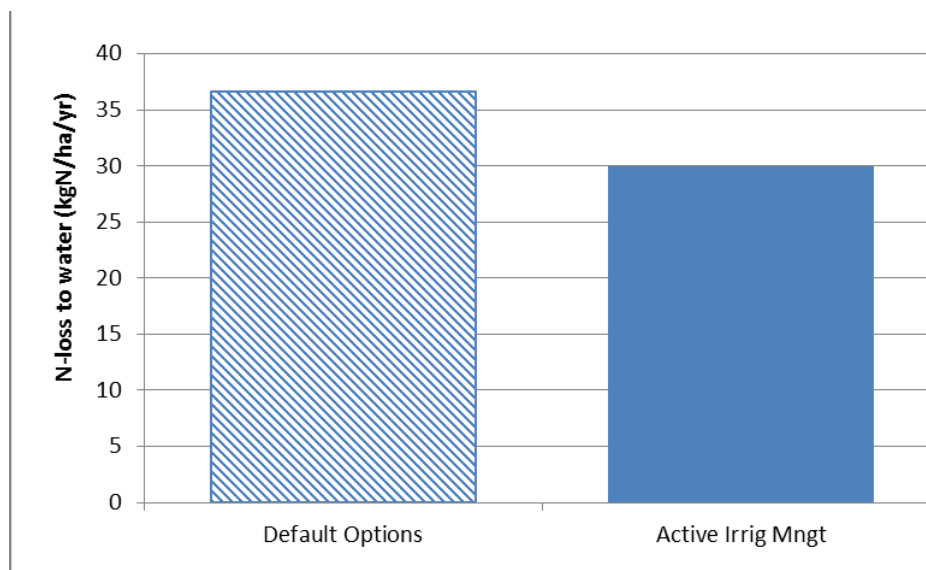
Note that the operation of the effluent can be remotely monitored and controlled (see Appendix 1) so even when Tim is away from the farm he can quickly check that effluent is being applied safely.



Wairarapa Moana Fresh Start Project

End of season irrigation and nutrient losses

Deciding when to turn irrigation off is likely to have a larger impact nutrient loss by leaching than deciding when to turn it on. This is because concentrations of nutrients are potentially highest in the autumn as soil moisture reaches Field Capacity and above after the summer dry period. The drainage which follows will take excess soluble nutrients like nitrates out of the soil profile which may have built up from unused fertiliser and urine patches. The impact can be significant. Analysis with Overseer®, a nutrient balance calculator, shows that changing a centre pivot irrigation system to actively managed irrigation or 'deficit' irrigation at Lincoln University Dairy Farm could reduce nitrogen loss by 23%. Actively managed irrigation is described as the application method and management that results in no direct additional drainage from the irrigation application (i.e. no leakages, overlaps etc.) and presumes no rain within 5 days after application.



From "ASSESSING THE IMPACT OF INPUT CHOICES WITHIN OVERSEER® (V6) ON THE MODELLED N LOSSES TO WATER FOR LINCOLN UNIVERSITY DAIRY FARM (LUDF). Pellow et al., In Proceedings of 26th, Fertiliser and Lime Research Workshop. 2013.

Ideally soil moisture (irrigation application) should be managed to maximise the storage of autumn rains. In practice this requires turning off irrigation earlier to avoid having a full bucket at the end of summer. However, this can be nerve racking when forecast rains are not always accurate. Running farm soils to stress point is risky unless water can be added faster than it is used. This would be possible with centre pivot irrigators but not with travelling irrigators.

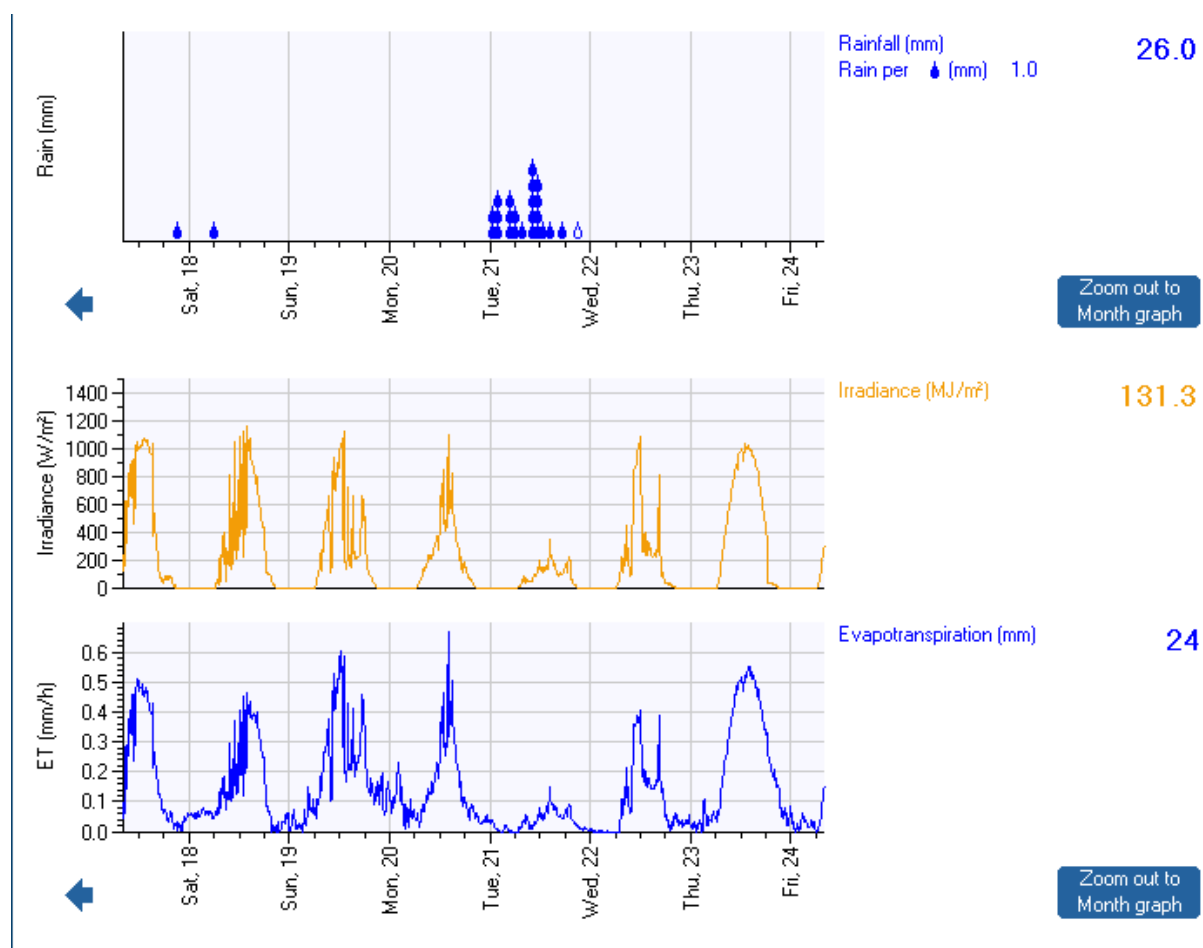
Want to be involved in the Wairarapa Moana Wetlands project to get your farm assessed for potential projects?

Either email tony.faulkner@gw.govt.nz or ian.gunn@gw.govt.nz or phone 06 826 1563 for Tony or 06 826 1561 for Ian

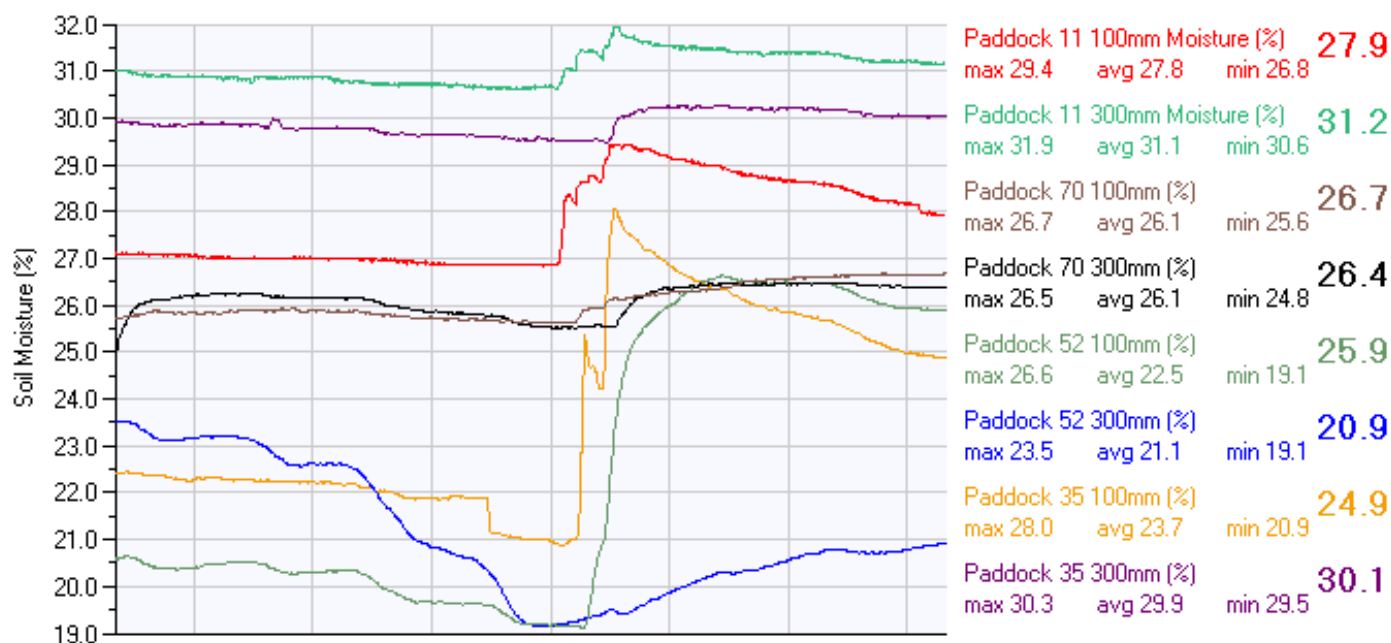


Wairarapa Moana Fresh Start Project

Appendix 1 Data for Mapuna Atea from Harvest.com / AgHub



Soil



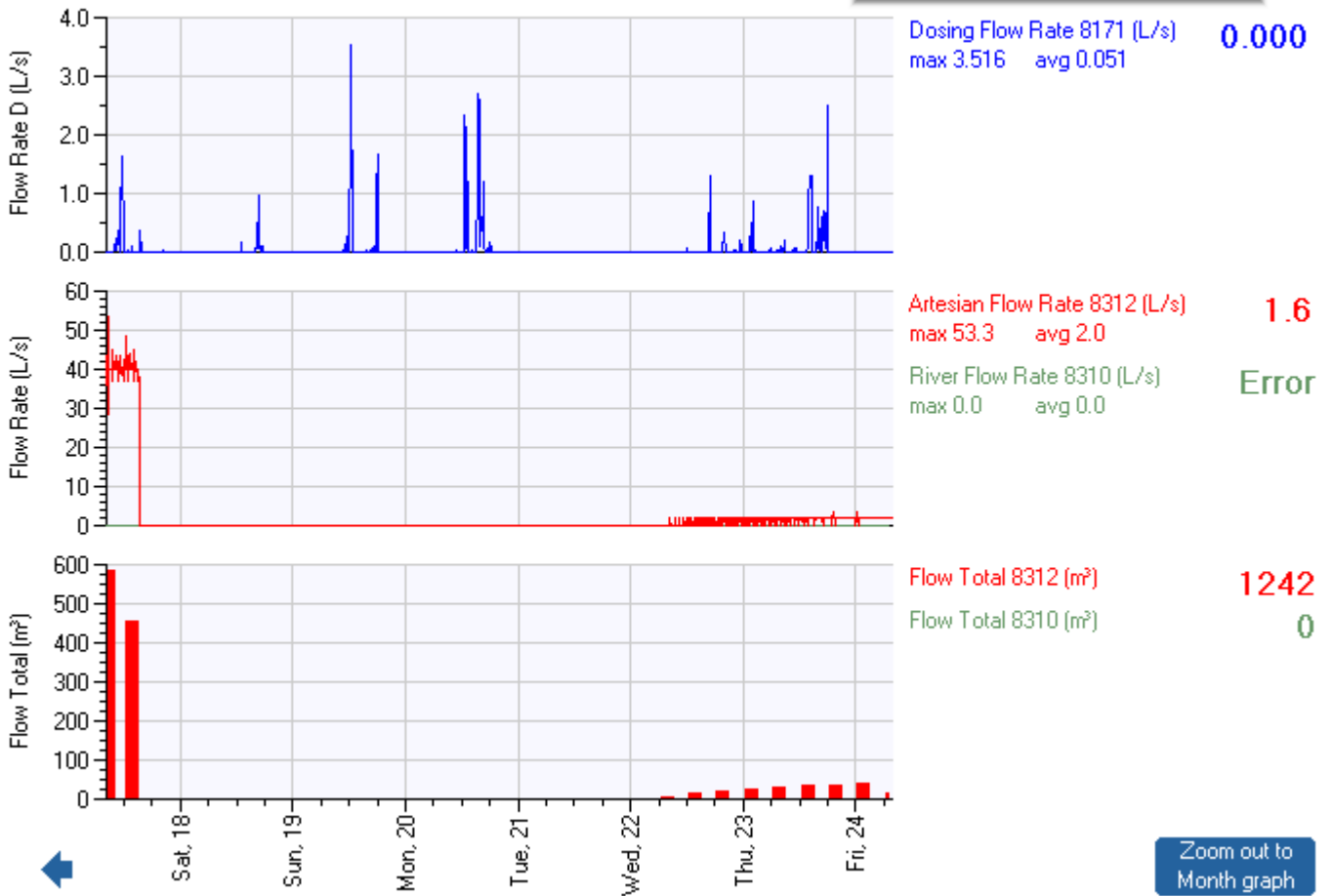
Note – Paddock 35 is unirrigated



Wairarapa Moana Fresh Start Project

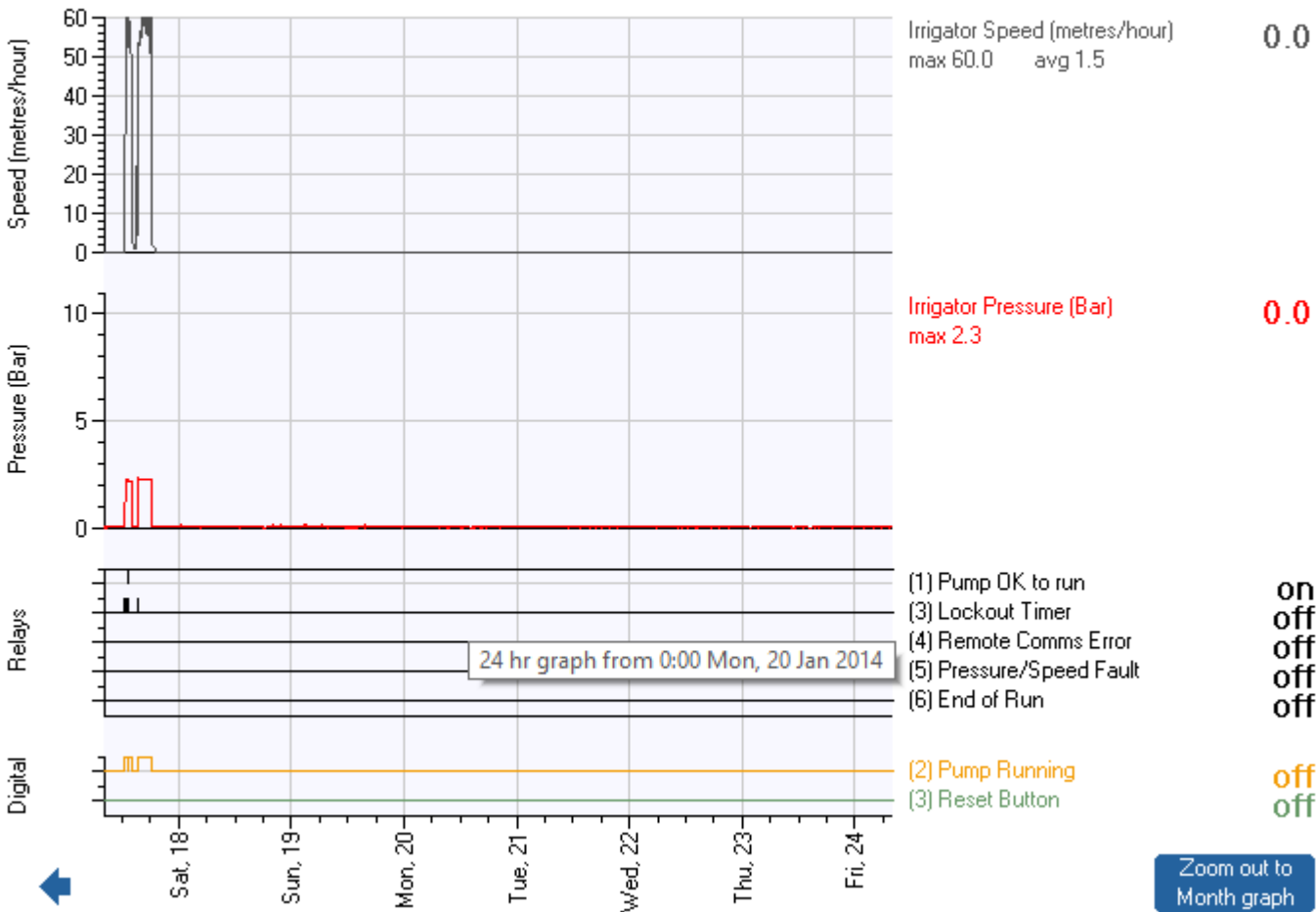
Water Irrigation

24 hr graph from 0:00 Thu, 23 Jan 2014



Dosing flow rate is farm water use by cows,
 Artesian flow rate flow of water out of bore. Artesian minus shed and farm use equals irrigated amount by small pivots
 River flow rate is water usage for the big pivot
 Flow total is total usage of each source

Effluent Irrigation



Irrigation Manager Training - Wairarapa

Training for Irrigation Managers - Improve Your Irrigation Skills and Knowledge

Where: Taratahi Agricultural Training Centre

When: 9am - 5pm Thursday 13th March 2014

Cost: IrrigationNZ Members \$195 +GST and Non-members \$250 +GST

Closing Date: Friday 7th March 2014

Numbers limited to 24

Notice of withdrawal: 7 days – 50% registration refunded or transferable to another person, 3 days – no refund – transferable to another person

Presenters: Dan Bloomer (Page Bloomer Associates) & Paul Reese (IrrigationNZ)

This one day course provides a mix of classroom learning and in the paddock practical application.

Topics include:

Irrigation Regulation

What you need to know and how it affects your business. How do the RMA, Consents and Plan Rules fit together?

Irrigation Scheduling

Builds on your knowledge of soils, water and climate. How should we schedule irrigation applications? Including explanation and demonstration of the tools available to help.

Operation and Maintenance

The safety and efficiency of your irrigator and your staff depends on regular maintenance and correct procedures being followed. How you go about developing procedures specific to your farm is explained. After an 'irrigator walk' we begin building an operations & maintenance manual specific to your property.

Irrigator Calibration

Data collected during the 'irrigator walk' is analysed using tools developed to check the performance of irrigators. This is a practical application that you can directly use on your farm.

Take Home Resources and Support

An 'irrigation Toolkit' including a suite of resource booklet guides is provided to take home for your reference and further learning.

Farmers Mutual Group (FMG) has seen the benefits of training and enthusiastically sponsors these courses.

Contact: Geoff Copps

Sector Development Manager - Primary

Grow Wellington Ltd

316 Queen Street, P.O. Box 920, Masterton 5810, New Zealand
DDI +64 6 370 3290 Fax +64 4 382 0098 Mob +64 21 638 629

geoff.copps@growwellington.co.nz

www.growwellington.co.nz



Wairarapa Moana Fresh Start Project