Smarter Irrigation for Profit – The Value of Water Level Monitoring

What is the research/technology?

Measuring water level in irrigation channels is a simple but effective way to monitor the behaviour of the system. There are a range of different devices available on the market, most of which utilise either ultrasonics, capacitance or a pressure sensor. At Waverley, several Rubicon level sensors have been installed within the distribution channels. Sensors such as these provide a continuous record of water level in the channel and allow the staff to check water levels at critical times without having to waste precious time driving to the site. These devices can also be configured to send a sms text message when critical levels in the channel are reached so that actions can be made in a timely fashion.

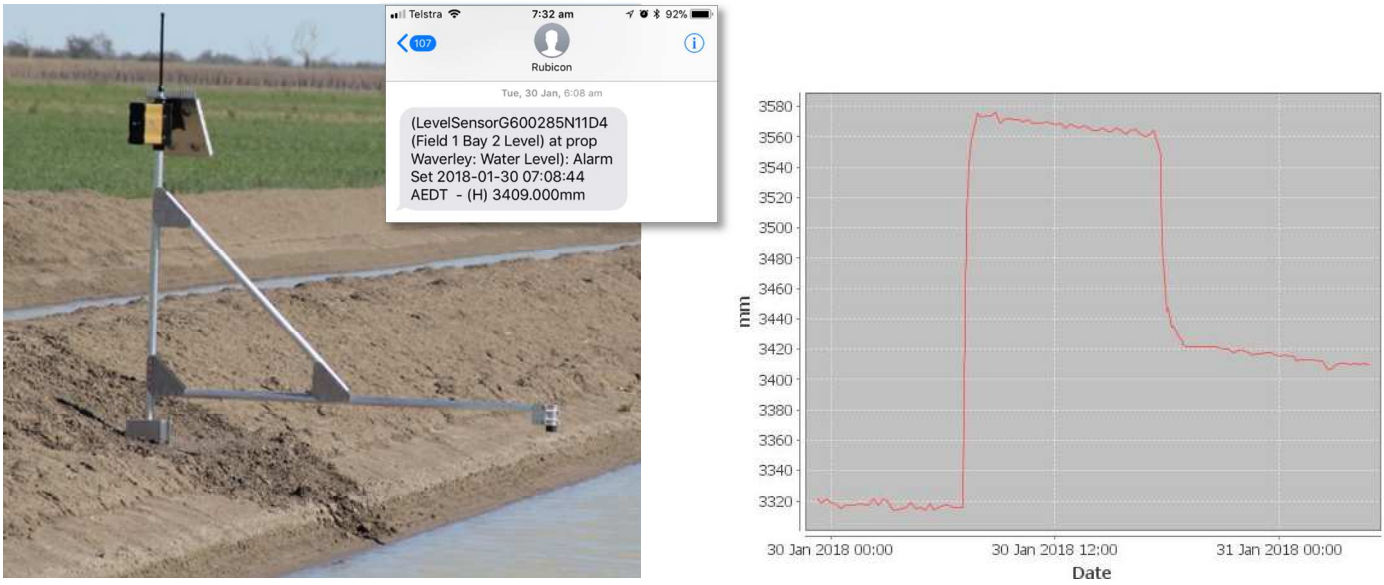

Figure 1 : (a) Rubicon ultrasonic level sensor. (b) text message from level sensor. (c) Level data from Farmconnect

The NCEA is currently investigating other novel techniques to monitor water level, such as the use of cameras and machine vision algorithms. A smartphone will take images at regular intervals, these images will be processed and the resulting water level sent to the grower or to the automation system. Use of cameras offers a number of benefits such as (a) the device is not exposed to channel water (b) is of relatively low cost and (c) images can be viewed manually so that the grower can build trust in the data.

Figure 2 : (a) measuring pipe outlet levels (b) sample images from smartphone cameras

Water Level and Flow?

Flowrates are the key piece of information in order to determine the depths of water applied and to run IrriMATE analysis to evaluate irrigation efficiency and uniformity of applied depths. Reliable flow measurement is difficult both within the supply channels and for individual siphons or furrows. All growers know that flow is a function of water head in the supply channel. Now that levels can be easily measured it is a simple task to accurately estimate flows at both the furrow and whole of set scale.

The relationship between water head and flow is a function of pipe geometry and internal diameter. This head-discharge characteristic is well documented for siphons but must be experimentally determined for alternative pipe designs such as the Islex Smart Siphon as shown below.

The levels of individual pipes may vary so it is recommended that levels are taken of a sample of pipe outlets from the irrigation set of interest. Pipes that are lower the average will have higher than average flows and higher pipes will have lower flows. The significance of pipe level differences diminishes as the magnitude of the channel head increases.

The process to capture levels is the same regardless if the system is a sPTB, Smart Siphon or standard over the back siphon. The NCEA have measured heads using a range of devices including Total Stations, dumpy levels, lasers and clear plastic tubes all with favourable outcomes.

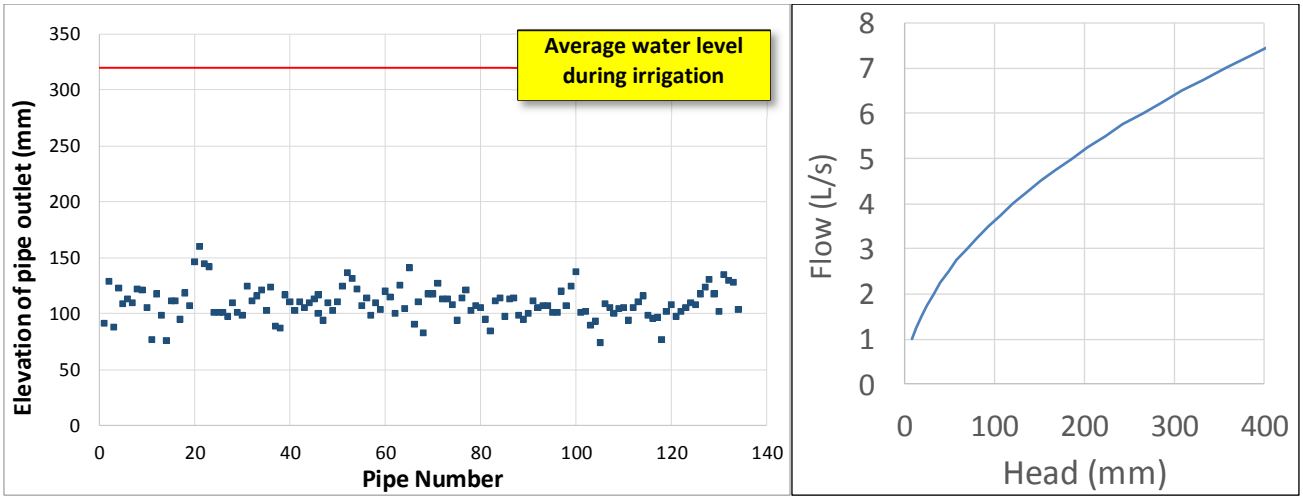

Figure 3 : (a) Water level compared to head level at Keytah Smart Siphon Gang 6 and (b) rating curve for corresponding pipes in that gang

How will it benefit me?

Water level measurements are crucial for an autonomous system but also provide valuable information for any surface irrigation system. They allow remote checking of channels and can be set to send alarms before channels overtop. Water level measurements also provide a way to easily capture the volumes and flows applied to each set within the field.

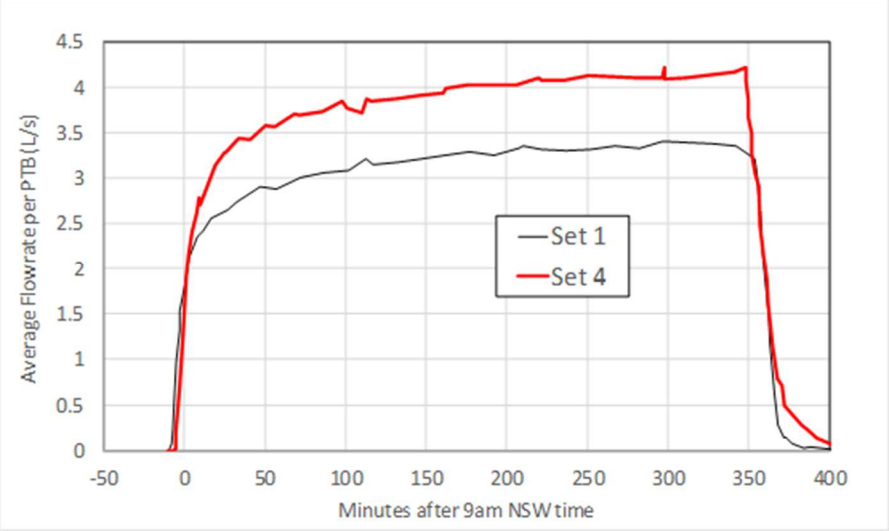

Figure 4 : Flowrates within two bays at Waverley predicted by head level measurements

Smarter Irrigation for Profit Project
Autonomous Irrigation : Dr Malcolm GILLIES, NCEA @ USQ. gilliesm@usq.edu.au ph 07 4631 1715