

JOURNAL

FOR IRRIGATION PROFESSIONALS

FEATURES

Alternative water sources
Technology applications
in irrigation

DIGITAL TECHNOLOGY IN IRRIGATION

Insights from the experts

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RECYCLED WATER FOR BOTANIC GARDEN
LONG-TIME MEMBER RECEIVES ORDER OF AUSTRALIA MEDAL
MONITORING MICROCLIMATE IN NURSERIES
IRRIGATION IN INDIA AND AUSTRALIA

URBAN

Huge water
savings for
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ON THE FRONT COVER:
Karin Stark (pictured with daughter Noa), director of Farm Renewables Consulting, will be facilitating a renewable energy workshop at the Irrigation Australia Conference.

WELCOME



CHAIR'S MESSAGE

In May 2020, we were all disappointed that our national conference, scheduled for September 2020, had to be delayed due to COVID-19. Who could have anticipated that the delay would ultimately extend across more than two years?

At last we can look forward with certainty to the Irrigation Australia Conference and Exhibition, and the ICID 24th International Congress and Executive Council Meeting in Adelaide during October 2022. I want to express my appreciation for the resilience of the team charged with scheduling and arranging this event, and my thanks to the strong industry support for it – more on the event later in this journal.

At a recent Irrigation Australia board meeting, we noted how Australians' attitudes to water are evolving – a shift that will ultimately have impacts on the irrigation sector. Just a few examples of our changing attitudes include:

- the enforcement of metering of offtake in the Murray–Darling Basin (including both the use of Irrigation

Australia's certified meter installer and validator qualification, and the loss of Irrigation Australia's role supporting governance around metering in NSW)

- a gradual loss of distinction between various grades of water (potable, groundwater, greywater) as water management regulations are simplified to ensure they are readily understood by the public. This change risks reducing public understanding of the 'fit for purpose' concept of water quality
- a growing emphasis on delivering water rights, and the opportunity to benefit from those entitlements, to Indigenous peoples across Australia
- supply chain issues putting at risk products (including food) sourced from overseas, and an increasing awareness of the importance of locally grown foods
- massive Federal Budget commitments to improve Australian water security and open new land for irrigation.

Irrigation Australia's board members are responsible for providing strategic direction for our industry organisation through these exciting and challenging times in the water sector.

Activities such as training courses, member events and conferences are highly visible and well supported by industry. However, it is also important to recognise all the work that goes on away from the limelight, but is essential to our mission of providing value and service for Irrigation Australia members while supporting economic sustainability in Australia.

Irrigation Australia members are encouraged to discuss any issues that affect your activity in our industry with board members, so we can consider these matters when setting the strategic direction for the future.

Andrew Ogden
Chair



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WELCOME



FROM THE CEO

Welcome to the winter edition of the *Irrigation Australia Journal*.

We've been working hard on getting a new and improved website and customer relationship management system (CRM) up and running, as well as preparing for our fast-approaching conference and exhibition. I'd like to take this opportunity to give you some updates.

New customer relationship management system and website

We are delighted to advise that our new CRM and website are now live and we invite members to log in on our [website](#).

Note that your username is now your email address, and if this is your first visit you will need to follow the 'forgot password' link to set your new password. Once logged you will be able to:

- re-join Irrigation Australia if your membership has lapsed
- check your individual member details and edit if necessary
- view your membership of any Irrigation Australia committees
- download your membership certificate
- add your logo and social media profiles
- see events or courses that you have registered for
- see your certifications, and on the My CPD tab you can see a graph of your progress to your CPD goals. You can add CPD points here and download your certificate and logo as well
- place a job advertisement; this is free for members and \$50 if you want to enhance your ad and feature it at the top of the list

- decide if there are matters that you don't want to hear from us about – simply untick the box next to that option under the 'My Preferences' tab
- If you belong to a company

membership, you can click on the link under your name and see information about your membership. If you are a company administrator, you can update these details and add contacts to your membership, and you may now add more than one administrator for your organisation. Contact us if you would like to be a company administrator.

On the website you will see several new features, with some items only accessible by members. To access the training and certification pages via our Centre of Irrigation Excellence menu, you must be logged in. Your information will go into our student management system, which will handle all communications regarding your training.

Selecting the Waterwise menu will take you to the existing Waterwise website (this will be changed over to the new website soon) and here you can register for the Waterwise Irrigation Design Shop (WIDS) program or the Waterwise Garden Irrigator Program (WGIP).

We will soon complete work on the Rainwater Harvesting website, and after our conference in October we will introduce a new events website.

Conference and exhibition

The Irrigation Australia Conference and Exhibition combined with the ICID 24th International Congress and Executive Council Meeting in Adelaide is now only five months away. We will soon

release details of the approximately 150 speakers and topics for both the international congress and the Irrigation Australia conference and we encourage irrigation industry stakeholders to take advantage of this unique opportunity to hear from the most informed international and Australian experts.

There has been significant interest from manufacturers and suppliers in the largest irrigation exhibition in the southern hemisphere and we encourage interested suppliers, manufacturers and service providers to book now to avoid disappointment. Further details on the [event website](#).

Several side events and workshops will coincide with this event, including a renewable energy workshop, Murray-Darling Basin workshop, facilitated by the National Irrigators Council, and an international geosynthetics one-day conference.

Early-bird registrations close on 1 July. Further information about this event can be found at www.icid2022.com.au, and we give you a taste of what's on offer on page 32 of this journal.

We look forward to seeing you there.

Bryan Ward
CEO

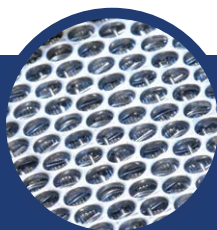


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SHEPPARTON IRRIGATION REGION CASE STUDY: IRRIGATION SYSTEM ASSESSMENT SAVES ENERGY AND STRESS

SNAPSHOT

- Improvements were made to a centre pivot system following an irrigation system check by Agriculture Victoria.
- The system had an oversized pump, which meant operating pressure and energy consumption were high.
- The farmer removed the end gun and replaced nozzles and regulators to increase system capacity, which lowered system pressure and thus energy consumption.
- The changes enabled the farmer to match crop water demand, and irrigation uniformity was improved.

In 2020, an irrigation system check was conducted by Agriculture Victoria on a centre pivot system at Kyabram in Northern Victoria. The centre pivot irrigated approximately 42 ha

to grow maize. Following the assessment, modifications were made to improve energy efficiency by approximately 20 percent. This equates to potential cost savings of \$2,664 per season, or \$40,000 over the life of the system.

The centre pivot was more than 15 years old and had been designed and installed when electricity was much cheaper. An oversized pump had been fitted to allow operation of an end-gun without a booster pump. This meant the operating pressure was excessive, resulting in high energy consumption and operating costs. Energy consumption was found to be 245 kWh/ML.

Following the irrigation system check, the farmer removed the end-gun, which reduced the irrigable area from 42 ha to 36.2 ha. However, because the pump was not fitted with a variable speed drive, the pressure of the system could not be reduced and electricity costs remained high.

Agriculture Victoria conducted an irrigation system check on a centre pivot system in Northern Victoria.



Improved energy efficiency

The solution was to take advantage of the oversized pump by increasing the system capacity of the pivot. This lowered the system pressure, reducing the energy required to run the pump and therefore the electricity costs.

To increase system capacity, the grower replaced 36 nozzles and 15 regulators at a total cost of around \$300. The system capacity was increased from 10 mm/day to 15.7 mm/day. Flow rate increased from 4.3 ML/day to about 6 ML/day, while total head pressure dropped by 7 m to 43.7 m. This reduced the energy consumption from 245 kWh/ML to 203 kWh/ML.

This simple alteration lowered electricity costs because the system pressure was significantly less, and the efficiency of the pump was improved by operating closer to the pump's most efficient flow rate and pressure (Best Efficiency Point).

Improved system capacity

The designed system capacity of the centre pivot was originally 10 mm/day. The recommended system capacity for growing maize in northern Victoria is 14 mm/day. The farmer had previously managed the limited system capacity by sowing about half the irrigable area. Even then it was difficult to meet maize water demand in the middle of summer.

Changing the nozzles and regulators led to an increase in system capacity from 10 mm/day to 15.7 mm/day. This reduced the required operating hours, meaning crop water demand could easily be matched, greatly reducing both crop and farmer stress levels. It also enabled more operating hours with off peak electricity further reducing energy costs.

Improved application uniformity

The system assessment identified two ways to improve application uniformity: replacement of the static plate sprinkler pack and removal of the end-gun.

Sprinkler pack. As an older system, this pivot was fitted with static plate sprinklers, which are not uncommon in the Goulburn Valley. Static plate sprinklers (see Figure 1) emit several constant streams of water, which means the application rate and depth is very high at the spots where the individual streams hit the ground. This results in poor application uniformity and the high point application rates can cause soil crusting and infiltration problems. The distribution uniformity of this machine was 69 percent, which means higher application areas were receiving 2.2 times the application rate of lower application areas.

Modern moving plate sprinklers (see Figure 2) randomly scatter droplets over a much larger area, dramatically reducing application rate and improving distribution uniformity. A moving plate sprinkler pack, (an 'accelerator pack') was fitted to the pivot. Distribution uniformity improved from 69 percent to an excellent 91 percent, and the farmer found he could apply a much higher application depth without causing runoff.



A moving plate sprinkler nozzle (top) and static plate sprinkler nozzle (above).

End-gun. End-guns have notoriously poor application uniformity. This means some areas of the paddock were receiving much more water than others. The end-gun on this pivot was no exception. The inner half of the end-gun was only applying 12.5 mm, while the outer half was applying 20 mm (60 percent more water), compared to the 14 mm average for the rest of the system. Removal of the end-gun improved the application uniformity of the system, making irrigation scheduling easier, as well as reducing electricity costs of every megalitre of water pumped.

Electricity cost saving assumptions. The changes made to the centre pivot as a result of the irrigation assessment resulted in an energy saving of 42 kWh/ML. If electricity costs 0.25 cents per kWh, this equates to a saving of \$10.50 per ML. If the whole area of the pivot (36.2 ha) was irrigated at a rate of 7 ML/ha, this equates to a saving of 10,648 kWh or \$2,664 per season or almost \$40,000 over a 15-year system life.

Acknowledgment. This case study was originally published by Agriculture Victoria. The original version can be accessed [here](#).

Information. The Agriculture Victoria irrigation services team is currently offering system checks on Centre Pivot and Lateral Move (CPLM) irrigation systems in northern Victoria. Contact Nick O'Halloran on 03 5833 5222.

Nick O'Halloran and Lyndall Ash



TECHNOLOGY: URBAN

HUGE WATER SAVINGS FOR ROYAL CANBERRA GOLF CLUB

SNAPSHOT

- Royal Canberra Golf Club is replacing its irrigation system to save water.
- The 27-hole golf course is irrigated with water from Lake Burley Griffin.
- Certified irrigation designer Peter Brueck from Water Wise Consulting is working on the project together with Dave Horton from D & A Irrigation.
- The new system will be a hard-edge system with 80 km of pipeline and with more sprinklers that cover a more targeted area, placing water where it is needed.
- The new irrigation system coupled with a change in turf grass will deliver 100 ML of water savings per year as well as being flexible, user friendly and saving energy.

To reduce water use, the Royal Canberra Golf Club is replacing its irrigation system as well as the fairway turf on its 27-hole course. Irrigation Australia members Peter Brueck of Water Wise Consulting and Dave Horton of D & A Irrigation are working together to develop a new hard-edge irrigation system.

The history

The prestigious Royal Canberra Golf Club's long history is closely linked with Canberra's water and irrigation history. The club has been around in various forms since 1913, but its first long-term home was at Acton, where it was established in 1926. In 1962, after area was earmarked to be dammed to form Lake Burley Griffin, the club moved to its present site at Westbourne Woods. Here it became custodian of the Westbourne Woods Arboretum, which features over 180 tree species.

The [Canberra Times](#) tells the story of how, in the 1940s, the ACT experienced a prolonged drought, which left the arboretum struggling. The cost of installing and maintaining a pumping and irrigation system was too high to be economical. Dr Max Jacobs, principal of the nearby Australian Forestry School, proposed that a permanent golf course be developed in Westbourne Woods – a solution that could benefit both the golf course and the Woods.

Today the club boasts a 27-hole course, irrigated with water pumped from Lake Burley Griffin. With a view to saving water, the club recently began replacing its irrigation system. Irrigation designer Peter Brueck designed the system, which is being installed by D & A Irrigation.



Water is pumped from Lake Burley Griffin to irrigate the golf course. Photo by Louis Moresi on Unsplash.

A plan to reduce water use

Peter explains that the existing system, which was at least 10 years old, was operational but was starting to develop a few issues.

"Some components were starting to fail. In particular, some older parts of the system weren't fitted with stainless bolts, so they were rusting out," Peter said.

"But the primary reason for replacement was to become more water-efficient – the club is changing to a hard-edge system and is replacing the turf species on the fairways. At the moment, bent grass, a cool-climate species that requires a lot of water in the summer months, is used on the fairways. The club is replacing this with couch."

With a hard-edge irrigation system, the sprinklers are distributed in three or more rows along a fairway, with sprinkler spacing ranging from 14 to 22 m, and the two outside edge rows only water in a 180-degree arc toward the centre rows, so the water only goes where it is needed. The challenge when designing a hard-edge system is to select the correct nozzle combinations so the application rate is constant.

The new design is expected to save the club 50 ML of water per year, with the change in turf species saving an additional 50 ML annually.



D & A staff using a vacuum digger on the golf course during the installation process.

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TECHNOLOGY: URBAN

Installing the system – the logistics

The project is divided into four stages: holes 1-9; holes 10-18; holes 19-27; and the pump station.

D & A Irrigation started the project after Easter in April 2021 to avoid working over the club's busy holiday period. The cooler, wetter months are ideal for this work due to the lower demand on the irrigation system; but the drawback of working through a Canberra winter is that progress is regularly interrupted by heavy frosts that render the course inaccessible. A few frost hold-ups, together with supply chain issues, meant that the first stage took 35 weeks to complete, which was longer than anticipated.

Dave and team are currently up to stage 2 and this is on track to be finished by October. The remaining stages are each expected to take 10 weeks.

The work is planned progressively, which makes it easier for both the club and the irrigation contractor – for example, the contractor might put in mainline pipes for three fairways and install sprinklers on these before moving on to the next section.

"They close a hole down," Dave said. "So we can work on a hole for two to three weeks then move to next hole."

Peter says new pipes were necessary at this course for a few reasons, namely:

- to increase flow across the site
- because much of the existing pipe is PVC with glued and rubber ring joints. By replacing with polyethylene it has fewer joints and by using both electrofusion and butt welding, it effectively becomes a continuous length of pipe
- much of the existing pipe location is unknown and the club's maps are inaccurate
- the location of the existing pipe does not work with the new design
- if the old pipe is used it creates issues for warranty as the contractor will not warrant any of the old system

Replacing the pipe is a big job, with Dave and his team needing to get roughly 80 km of pipe into the ground. Damage to the course is minimised by using a vibratory plough – a machine that can drag pipes of up to 125 mm diameter underground – instead of cutting an open trench. This limits the amount of scarring, making the clean-up process quicker and easier.

Efficient and flexible design

The hard-edge design, together with more sprinklers on the fairways, has several advantages, according to Peter. "The club will be reducing water use by about 20 percent simply by not having sprinklers in the rough. The hard-edge design means that we can target water to where it needs to go."

"For the first nine holes we've installed a similar number of sprinklers to what you'd normally see on an 18-hole course. This shortens the time needed to irrigate, so the



Damage to the course is minimised by using a vibratory plough.

club not only saves water but also power. The shorter irrigation time also makes it easier to restrict irrigation to the evenings."

The existing control system is being replaced with a Rain Bird valve-in-head IC system. Peter finds that the two-wire decoder system allows more flexibility in the design and installation compared with a system that relies on wires extending from the controller to each valve. If changes need to be made, it's a simple system to join into and it eliminates the need for external controllers.

The pump station, to be replaced in the final stage of the project, will comprise at least six pumps with a flow of 90 L per second. The system, which will draw water from Lake Burley Griffin, will be fitted with twin 250 mm diameter automatic cleaning filters. A 0.5 ML storage tank will be installed as a back-up supply in case of water restrictions.

Huge water savings

Once complete, the new irrigation system together with the new turf will save The Royal Canberra Golf Club around 100 ML of water each year. In an average year, the course currently uses around 300 to 350 ML, so this represents a huge reduction that will reduce the club's costs associated with water and energy as well as making the course more sustainable in the long term.

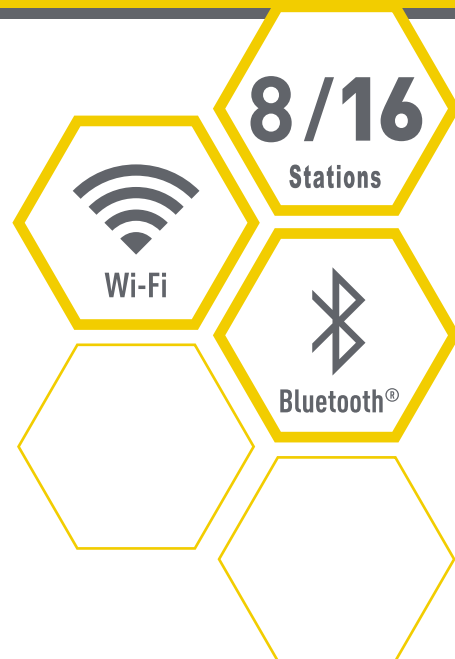
Eve White, Irrigation Australia



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HOW WATER QUALITY SENSORS ARE HELPING WITH PRODUCTION NURSERY DECISIONS

SNAPSHOT

- Understanding water quality in nurseries is important for plant health, optimal use of resources and to minimise environmental impacts.
- This article describes the preliminary results of a project by Greenlife Industry Australia that used water quality sensors and a desktop photometer to monitor water quality and nutrient leaching in a nursery.
- Both pH and electrical conductivity (EC) were measured daily in the dam water used for irrigation and in the runoff water from a production nursery.
- Nitrate and phosphate levels both before irrigation and in the runoff water were also measured to determine how much is leached.
- The town water alkalinity was found to fluctuate and at times the fertiliser solution had to be adjusted to maintain an appropriate calcium to magnesium ratio.
- In one testing round, two-thirds of the applied nitrate was leached in the runoff water being returned to the dam. This has led to the ongoing monitoring of the irrigation water quality and adjustments to the fertigation formula or the irrigation duration.
- During heavy rain, which caused the dam to overflow, nitrates and phosphates in the discharged water remained within acceptable limits.

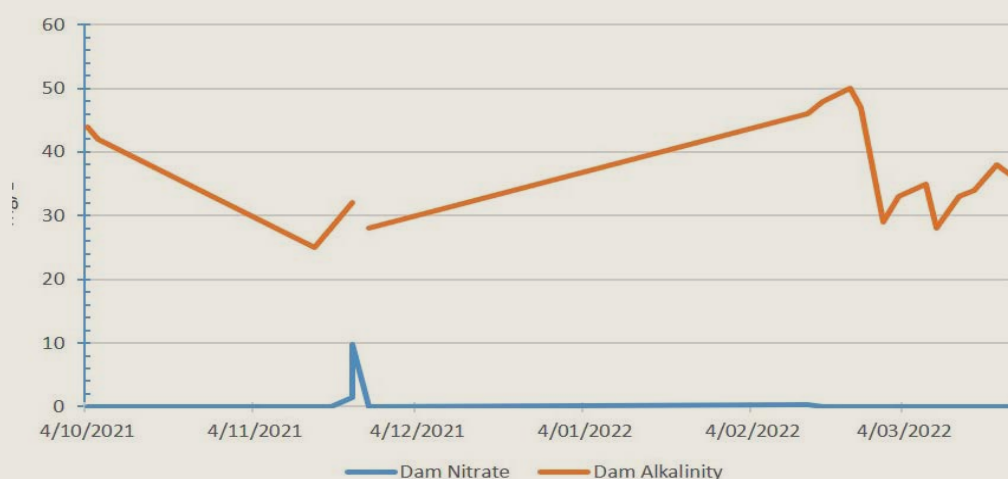
As part of the Smart Farming Partnerships project, delivered by Greenlife Australia (GIA) and funded under the National Landcare Program and Hort Innovation, a combination of water quality sensors and a desktop photometer are highlighting how water quality fluctuates, and how quickly nutrients are leached from containers in a nursery setting. This information is helping the Smart Farming nursery manager to refine daily irrigation requirements and production processes, resulting in healthier plant development and a cleaner local waterway.

Production nurseries that are [NIASA](#) and [EcoHort](#) accredited know that water quality monitoring is a reportable parameter under those programs. Good water quality helps to reduce the negative environmental impacts of runoff into the local waterways during a rain event. So, automating water quality monitoring has many benefits.

Water quality important

In containerised production nurseries, water quality not only influences plant health but can also determine the amount of resources used during production. The amount of dissolved organic and inorganic particles in the water will determine the level of filtration and disinfection required. This in turn influences water treatment times, pump runtimes and energy use needed to process the water before irrigation can occur.

Figure 1. Extract from photometer test data showing the alkalinity and nitrate levels in dam water over a five-month period.
Image: David Hunt, GIA.



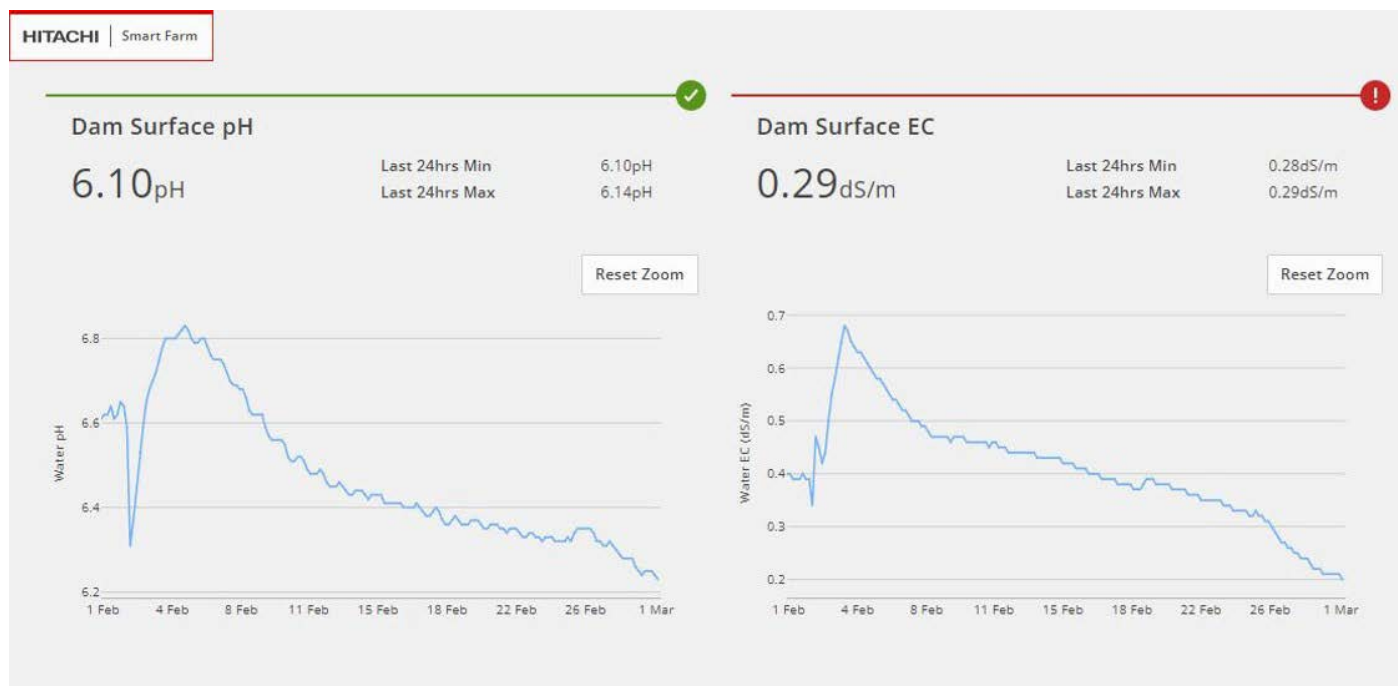


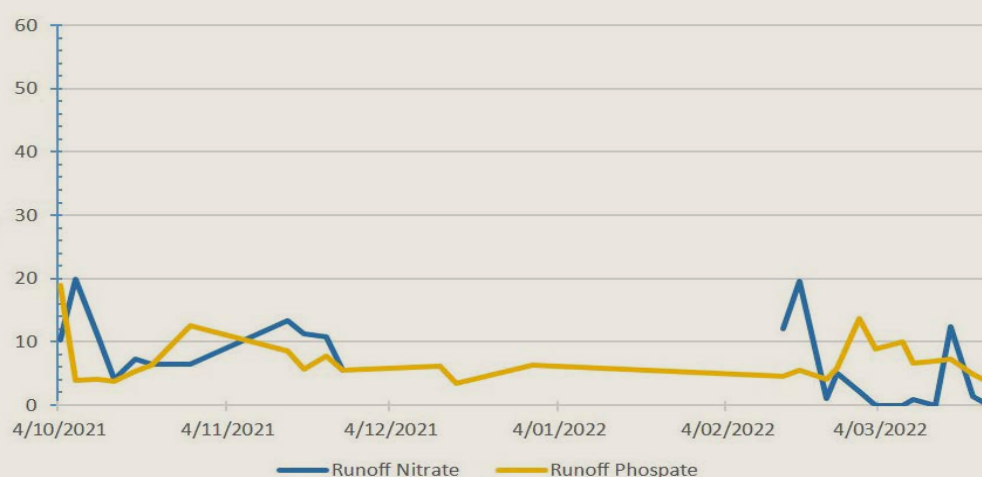
Figure 2. Dam pH and EC readings for February 2022 as displayed on the Hitachi control tower. Image: David Hunt, GIA.

Monitoring water quality

At the Smart Farming production nursery, a combination of permanent in-situ sensors and a desktop photometer is helping the nursery manager to monitor water quality and make production decisions. Although interpreting and integrating the data into daily management decisions is ongoing, preliminary results are highlighting how water quality fluctuates, how quickly nutrients are leached from the containers, and how much water is held within the containers.

Every day the nursery manager checks the dam pH and electrical conductivity (EC) data to ensure the source water is within acceptable limits. The irrigation runoff water is also checked to see if there has been any excessive leaching of nutrients. The weather station is checked to see if there has been a major rain event overnight that may have caused any changes in water quality. If the pH or EC has changed considerably it raises the questions – why, what has happened to cause a change? Is there a potential for this change to impact today's irrigation requirements?

Figure 3. Extract from photometer test data showing nitrate and phosphate levels in irrigation runoff over a 5-month period. Image: David Hunt, GIA.





RESEARCH

The basic water property of pH indicates how acidic or alkaline (or neutral) the water is. EC indicates the combination of the naturally occurring salts as well as added fertiliser components dissolved in the water. These are monitored because pH and EC will influence whether the water needs to be adjusted before use, or if a proportion of town water should be used to suit the fertigation solution. This is especially important if irrigation runoff is captured and reused, or if there is a potential for other contaminants and nutrients to be washed onto the property from upstream or the surrounding area.

If there are any concerns about water quality, water samples are taken for further testing with the desktop photometer, which measures the concentration of organic and inorganic compounds in the water. The results are used to determine what course of action is needed, e.g., change the water source to town water, or adjust the fertigation solution. One unforeseen benefit of this process is that now, before town water is to be used, a quick test is done to identify the pH, EC, and alkalinity or the concentration of carbonates and bicarbonates dissolved in the town water that can affect the plants' uptake of calcium and magnesium. These tests have shown that the town water alkalinity regularly fluctuates and at times requires the fertiliser solution to be adjusted to maintain an appropriate calcium to magnesium ratio for plant uptake and to reduce scale build up in the irrigation system.



. Dam overflowing after a major rain event. Image: Henry Hyde, AHR.

Water samples are also taken to monitor the nitrate and phosphate levels at certain points to help identify how much is applied to the containers and how much is leached from the containers. Water tests at the storage tank after disinfection provide the starting point for the fertiliser formula. Water tests of samples taken at the sprinklers confirm how much is applied, while tests of the runoff water after an irrigation event indicates how much is being flushed from the growing areas.

Outcomes

In one testing round it was identified that 30 ppm of the nitrate was being emitted at the sprinklers, but 20 ppm was recorded in the runoff water being returned to the dam. This has led to the ongoing monitoring of the irrigation water quality and adjustments to the fertigation formula or the irrigation duration to reduce leaching and ensure the fertiliser remains in the containers longer for plant uptake. How these adjustments are affecting fertiliser usage or plant development is still being assessed by the nursery manager.

Another example of the benefits of water quality monitoring was highlighted during the recent flooding rains. The heavy downpour and large volume of water running onto the nursery from the surrounding area caused the dam to overflow. However, by tracking the water quality, the nursery manager knows that the levels of nitrates and phosphates in the discharged water was within acceptable limits and would not have any impact on the local waterway.

Ongoing work

Over the next 12 months, it is expected that through ongoing water quality monitoring and in combination with the other plant monitoring sensors onsite, production systems and practices will be refined further. It is anticipated that this information will provide a better understanding of how water quality is influencing resource use and will allow resource use and costs to be quantified for each production cycle.

Further reading

Rolfe, C., Yiasumi, W., & Keskula, E., 2000. *Managing water in plant nurseries*. 2nd Ed. ISBN: 0734711808. NSW Agriculture. (3rd Edition available)



This project has been funded by Hort Innovation using the nursery research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Acknowledgment. Thanks to Greenlife Industry for permitting us to reprint this article. The original version can be found on their [website](#).

David Hunt, GIA Smart Farming Project Officer

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Digital technology in irrigation: insights from the experts

With digital agriculture a hot topic right now, we decided to talk to some people in the know about how technology can help with irrigation decisions, as well as current trends and future predictions. *Irrigation Australia Journal* put the same questions to three experts who work at the cutting edge of technology development.

We spoke to Peter Buss, manager of R&D at Sentek, an Adelaide company that specialises in technology for a range of crops; John Pattinson, chief development officer at Goanna Ag in Goondiwindi, Queensland, with expertise in the cotton industry; and Steve Attard, managing director of Agritech Solutions in the Burdekin region of Queensland, where sugarcane is a major irrigated crop.

We asked all three for their opinions on: how growers can benefit from technology; recent advances in technology; what obstacles they see to technology uptake; and their predictions for the next five years.

PETER BUSS, MANAGER R&D AT SENTEK

Benefits to growers. You can't manage what you can't measure. In this age, we need to be measuring what we do with water – otherwise we are very likely to over-irrigate or under-irrigate.

For the last 31 years, Sentek has been developing technology that tracks the water use of crops every ten minutes at multiple depths within the soil profile. The technology gives the grower a picture of daily water use, plant water stress, and how plant water use interacts with weather conditions.

Technology can tell the grower how much and when to water. How much depends on depth of roots; multisensory probes have sensors at multiple depths that show where the roots are. This helps the grower use less water and energy (for pumping) by avoiding pushing water and fertiliser beneath depth of roots. The information provided by the sensors can help optimise both inputs (water, energy and fertiliser) and outputs (yield and quality).

Recent progress. There is a lot on offer now in terms of soil moisture monitoring equipment. Growers have taken it up worldwide because pressure on water is increasing and will continue to increase with population growth.

Obstacles. There has been significant uptake of digital technology recently, but it needs to be facilitated by education. Many different systems exist, but if you sell a probe to a grower without explaining how to use it, it becomes a white elephant. An education component is important – and the best person to do this is the local agronomist. We also put education videos on our website; once people see case studies showing how the technology can help, they get it.



Peter Buss of Sentek

APPLICATIONS IN IRRIGATION

The next five years. In the next five years or so, I think digital technology will become a household item for growers, like a tractor or mobile phone – all growers will use sensors.

In terms of technological developments: at the moment, probes automatically send data to the cloud. The grower can log in and see live data on phone. We've added other elements to this: soil salinity and soil temperature data, weather forecasts, and satellite imagery that shows which areas of the crop are doing better or worse to help pick up irrigation distribution issues and other problems.

Ultimately other sensors will join the network – for, example, plant sensors and sensors that measure irrigation variables like pressure and flow. Soil, plant, weather, irrigation data, and possibly electricity prices, will all be combined. Artificial intelligence will look through all this to help the grower make the best irrigation decisions.

JOHN PATTINSON, CHIEF DEVELOPMENT OFFICER, GOANNA AG

Benefits to growers. At Goanna Ag we work mainly in cotton. Growers want to know: how do I make the best irrigation decisions with my finite amount of water? Science-backed technology can make the decision-making process easier by combining information from different sources to tell growers when to water.

John Pattinson
of Goanna Ag.



We combine data from four sources: evapotranspiration models, soil moisture probes, satellite imagery and, our key ingredient: canopy temperature sensors.

For canopy temperature sensors to be useful, we need three things: the hardware (a cheap sensor that reads the temperature every five minutes); knowledge about the plant's biological optimum; and information about how many hours the plant can tolerate above that threshold.

But we also need the data from the soil probe – particularly around the time of the first irrigation of the season. In our area, for cotton, this is from mid-November through to Christmas. This is when the plant is driving its roots down, so we need to know what the water is doing within the soil profile.

Outside of this period, though, the temperature sensor can provide the information we need by telling us how much moisture stress the plant is under. Since we know how much stress the plant can tolerate, we can use this data to determine when to irrigate – not so late that the crop gets too stressed but not too early, which means the grower is watering unnecessarily.

Recent progress. The main thing that's changed in the work we're doing is the integration of various tools, with the key ingredient being the canopy sensor. Connectivity has improved a lot over the last few years too, making it easier for growers to use digital technology.

Obstacles. There are fewer and fewer obstacles in our area of work. Our technology is already being used in more than one third of the 600,000 ha of cotton in Australia. It just takes some time to get it to everyone. As more consultants become comfortable with the science behind the technology that's available, the technology will be used. To this end, a collaborative approach with consultants is important.

The next five years. First, we need to get away from looking at this from a field-centric point of view and look at things holistically across the farm – look at where the water is and where fields are experiencing stress.

Second, user interfaces will become more user friendly. Currently, growers still have to do some interpretation of graphs to make decisions. I think we're heading towards a simpler interface – where an app tells the grower when to water, with the graphs and all the data there in the background if they want to see it.

Third, connectivity is continuing to improve, which will make it easier to get the data out of the field.

Fourth, I don't yet know how this will look but I think there will be a consolidation of experience and skills – a dominant platform will emerge, with different companies such as ours providing 'content'.

DIGITAL, AI AND REMOTE TECHNOLOGY

STEVE ATTARD, MANAGING DIRECTOR OF AGRITECH SOLUTIONS

Benefits to growers. We're based in the Burdekin region of Queensland and work mainly with furrow irrigation in sugarcane. There are two main ways that farmers can benefit from the use of technology in this context.

First, irrigation run times are planned to suit availability of labour, which, in this region, is in short supply. Run times are typically 12 or 24 hours, even though water may have reached the end of the furrow well before this time. Automating irrigation systems allows pumps to be turned on and off, or valves to be opened and closed at any time. This saves labour, water and energy.

Second, web-based sugarcane crop models that incorporate different variables, such as local weather data, irrigation date and amount applied, and estimate crop water requirement, help farmers maintain the right water balance for individual fields. This is a step up from using a probe in every field – or the more common approach of using a single probe to make decisions for multiple fields. It allows more precise watering.

Recent progress. One is automation: the use of pump controllers, actuators, to open and close valves automatically, and end-of-row sensors to detect the advance of irrigation water. This technology is now being

used over a couple of thousand hectares in the Burdekin region. Software also now lets the automation technology communicate with the crop model.

As well as automation, we're seeing increasing use of crop modelling and satellite imagery. Satellite imagery can provide valuable information about crop performance within different fields and can help farmers identify and address problems earlier rather than later if a crop is struggling.

Obstacles. First, not everyone understands what the technology can do, or trusts it yet: Is it robust and will it add value to me? People need to see proof that it can help them make irrigation decisions. But the problem with providing proof is that many irrigators have limited data about the efficiency of their current irrigation practices. Without this baseline data, it's difficult to quantify the benefits of making changes.

The next five years. The biggest weakness has been that many farmers rely on a single decision-making tool – for example, a soil moisture probe. If we can incorporate multiple lines of evidence, this gives us more confidence in our decision making, and I think this is where we're headed with technology. We'll see satellite imagery and plant sensor data linked in with other sources of data to help with irrigation management.



Steve Attard of Agritech Solutions develops technology to improve furrow irrigation in sugarcane.

CSIRO and Wine Australia improving irrigation efficiency in vineyards

There are more than 150,000 ha of irrigated vines in Australia. Accuracy of irrigation management is currently limited by observation, soil moisture sensing, weather and historical irrigation records. This leads to inefficient irrigation, which may cause excessive growth or moisture stress, leading to lower yield or quality.

Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Wine Australia have developed an improved method of measuring plant water status in vines to help growers make informed decisions about irrigation. They are currently seeking partners to commercialise the technology.

CURRENT APPROACHES – LIMITATIONS

The adoption of soil moisture sensors in vineyards has helped with irrigation scheduling, providing an estimate of the water available to the vine, but it does not provide a direct or 'real-time' measure of plant water status. Another problem is that soil moisture cannot easily be used to assess stress during the application of deficit irrigation.

Plant-based sensing provides the additional information required, but such sensors are typically expensive, short lived and difficult to operate reliably. Thermal sensors overcome these problems and point-based thermal sensors are starting to be used to assess plant-water status, but, as suggested by the name, these only provide data for a very small area of the canopy.

A NEW APPROACH

The ProxiCrop solution is a low-cost thermography-based sensor that can reliably measure a large area of canopy throughout the season, removing the limitations of current point-based thermal sensors.

The technology matches a low-cost, low-res thermal camera with a simple RGB camera to take regular images of the canopy. Overlaying a thermal image and a regular picture of the same area allows machine learning techniques to determine which parts of the thermal image are canopy – to be included in the analysis – and which details should be excluded because they are not part of the canopy (e.g., sky, grass).



ProxiCrop is a low-cost thermal-based sensor that can reliably measure a large area of canopy throughout the season. Photo by Giacomo Betti.

DIGITAL, AI AND REMOTE TECHNOLOGY

The data goes to the cloud, where automated algorithms analyse images and estimate canopy temperature. This measurement can then be used in existing ag tech solutions based on canopy temperature, or combined with climate data to estimate vine water status. The compiled data is then transferred to an ag tech platform and combined with other information to display to the grower.

Trials have been conducted in the Barossa Valley and Langhorne Creek and a prototype dashboard is in place with API access for integration.

SEEKING COMMERCIAL PARTNERS

CSIRO and Wine Australia are seeking interest from potential partners to commercialise ProxiCrop. Commercial partners might license it in its current form and/or seek to co-develop a commercial hardware product with CSIRO, which could integrate with existing systems or include

development of novel algorithms for a unique product and/or service.

There is a sizeable opportunity to co-develop products and services using the technology. There is also potential to translate the technology into other areas of irrigated horticulture, where irrigation efficiency is a crucial factor in business improvement.

This opportunity might suit an ag tech company wanting to combine grape vine water status data with other measures on their platform, or a technology hardware manufacturer to partner on the development of in-field grape vine units.

Acknowledgment. This is an adapted version of an article on the AgriFutures growAG [website](#).

Information. For more information about this opportunity, email: Susan.Hani@csiro.au.

Monitoring microclimate in vineyards: a case study

The Yield is an Australian agricultural technology company that uses microclimate sensors and gridded weather data to monitor the local climate experienced by high-value plants such as tree crops, vines, nuts and herbs.

The Yield then combines this weather and growing conditions data with customer data to predict microclimate up to three days in advance, and to help the grower with on-farm decision making including harvest timing, optimising labour resources and equipment, and activities such as irrigation and spray.

John and Julie Summers, who operate a mixed farm, including 43 ha of wine grape vineyard, at Padthaway, South Australia, have partnered with The Yield and have been using their crop recommendation and harvest prediction tools for more than three years now.

MORE SUSTAINABLE FARMING

As is often the case for Australian farmers, John and Julie face complex daily decision-making around how best to produce high quality, healthy produce, given the condition of the plant, soil well-being and daily soil moisture levels. It's a very technical process and requires a strong working knowledge of the various sciences involved, along with the many parameters with which to measure how it is all going each day.

"Our Cardiness Vineyard enjoys a reliable, high quality underground source of drip water irrigation. The supply is finite, however, so we aim to use only what our vines need

each day throughout the wine grape growing season," John said.

Determining the daily water needs of the vines is complicated by the different soil profiles throughout the farm. Varying levels of sand and clay among blocks means that irrigation requirements differ around the farm.

In 2019, the Summers started using The Yield. Most apps of this kind give an average forecast across a larger gridded area, which doesn't necessarily reflect the true conditions for specific locations within a property. Using its microclimate sensing system (MCSS), The Yield takes measurements every 15 minutes in different locations within a farm and compares and combines this information with data from the gridded system to provide accurate forecasts for different areas within a farm.

Topographical variations mean that some blocks are particularly susceptible to frost. With the app, which can be customised, John and Julie are pre-warned of possible temperature extremes and can plan ahead to mitigate crop damage due to frost or hot weather heat spikes.

ENHANCED DECISION MAKING POWERED BY DATA AND INSIGHTS

The solution provides valuable data and insights to power John and Julie's decision-making regarding on-farm activities. John reports that it allows them to stay well ahead of what their vines actually require, rather than being reactive and sometimes behind the game.

APPLICATIONS IN IRRIGATION

John and Julie
Summers'
Cardiness Vineyard



John says the soil moisture and temperature data coming from varying depth probes within the platform is very interesting, particularly in terms of how it correlates with what the vines are telling them visually.

"Block 4 (with a lighter soil profile) showed a very rapid response from irrigation - almost to full depth. While Block 2 (with a limestone over higher clay profile) showed very slow penetration from watering. This is very meaningful – it shows we need to adjust our watering of different blocks accordingly," he said.

The onsite weather station and 14-day gridded weather forecast feature have also helped John and Julie to determine irrigation levels, relative to vine requirements, and at certain stages of the growth cycle. They can now more effectively balance the vine requirements, weather and irrigation, and plan accordingly.

Acknowledgement. This is an adapted version of an article from on The Yield [website](#).



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THE BIG ISSUE

WHY URBAN GREENING ISN'T A PANACEA FOR EXTREME WEATHER UNDER CLIMATE CHANGE

Urban greening is often touted as a way to tackle both heatwaves and floods in cities. This includes through green roofs, living walls, vegetated urban spaces, private and community gardens, habitat corridors, bushland and parks.

But our [latest research](#) shows that, for most cities worldwide, urban greening can either subdue floods or mitigate heat. It generally cannot do both in one city.

As the climate changes, cities around the world are enduring both heatwaves and floods more frequently. Perth, for example, sweltered through a record-breaking heatwave last month, with six days in a row over 40°C. A few months earlier, Perth recorded its wettest July in decades, with 18 straight days of rain.

Our findings ensure we can plan urban greening projects more effectively to suit cities. So let's take a closer look at these findings, and the benefits Australia can derive from urban greening.

What we found

Temperatures in cities are often several degrees higher than rural areas, due to the 'urban heat island' effect, where the predominance of concrete and steel absorb and retain heat, and there is a lack of cooling by water evaporating from plants.

These same heat-intensifying features are also often responsible for flash flooding in cities, as sealed surfaces

can't act like a sponge to soak up and store rain, unlike the soil they've replaced.

To find out whether the benefits of urban greening on cooling and flood prevention hold true, we analysed global climate models and weather information from 175 cities around the world spanning 15 years of daily observations, from 2000 to 2015.

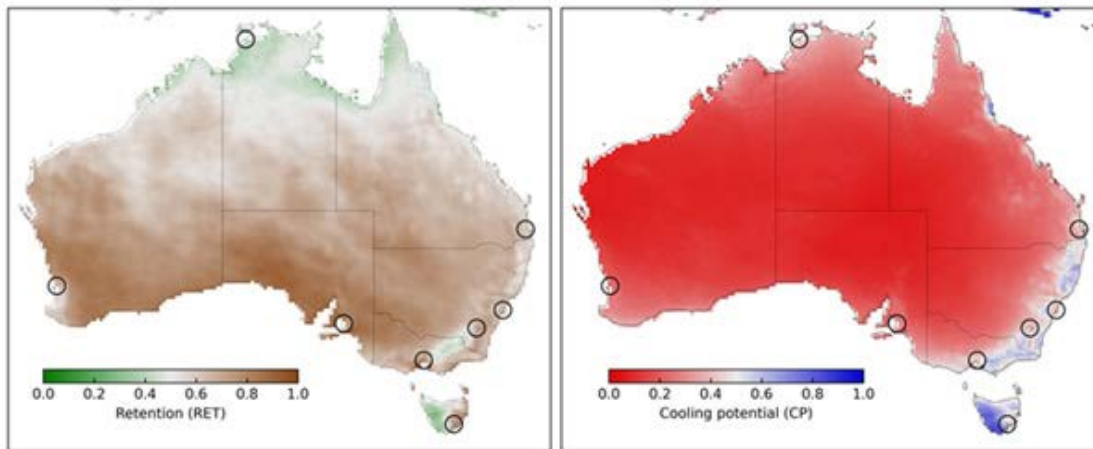
Our results, published in the journal *Nature Communications*, show the greatest cooling potential occurs where abundant rainwater is available for plants to transpire (release water vapour during photosynthesis). This is common for cities around the Equator and in much of northern Europe.

The cooling potential of urban greening varies with the seasons – it's more effective if periods of higher rainfall coincide with summer.

In contrast, the greatest potential for water retention by soils, which is crucial for flood prevention, occurs in drier areas where there's plenty of energy from sunshine, but rainfall is more limited. These areas are common in North Africa, Australia and the Middle East.

Such areas have higher average water retention in the long term, and its potential varies less from season to season. This is because large rainfall events that exceed the storage capacity of the soils and result in water runoff are less common.





Global map of the relative hydrological (water retention) as well as thermal (cooling potential) benefits of urban greening. Black dots are cities where our study analysed long-term weather data. A higher value closer to 1 means more cooling or more retention. See more detail [here](#) ,

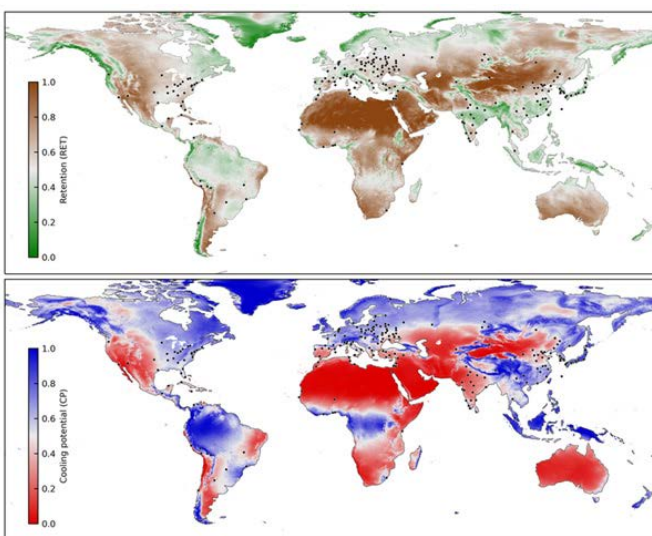
What do the findings mean for Australia?

While our findings suggest urban greening can't reduce both flooding and heat in many, if not most, of the world's cities, parts of southeast Australia are among the rare exceptions. This includes parts of Melbourne and Hobart.

Melbourne, for example, can endure urban heat island-induced temperature increases of 3°C. [City greening initiatives](#) are an important way to mitigate this heat.

On the other hand, Canberra, Adelaide, Perth and Brisbane are 'water-limited', which means urban greening is ineffective at reducing the urban heat island effect. However, because much of Australia has a relatively dry climate which is good for water retention, large-scale urban greening initiatives can help reduce flash flooding in these cities.

For example, Brisbane has lots of sunshine in summer, providing ample energy for evaporation, which often exceeds the amount of available summer rains.



Water retention (top) and cooling potential (above) of urban greening for Australia. The location of state capitals is highlighted.

Darwin is Australia's only state capital that, according to our modelling, would not derive strong stormwater or cooling benefits from urban greening. This is because Darwin

is in an area that transitions between the arid Australian interior and the more humid tropical climates to the north. It doesn't benefit from the high cooling or water retention performance that comes with either extreme.

Where to from here?

While it seems we can't assume urban greening can mitigate cooling and flooding at the same time, it's still an excellent strategy to address either in many places.

Urban greening also has other positive benefits – it provides habitat, filters air and has demonstrable effects on people's well-being.

However, there are important cost-benefits of these kinds of schemes to consider, both environmentally and economically.

Urban spaces are expensive, and many greening strategies require more complex engineering than traditional buildings. Also, the cooling benefits can only be significant in some areas if irrigation is used, and this is impossible to do sustainably in many parts of the world.

Policymakers worldwide can use our results as a first-pass guide for more local feasibility studies on urban greening. While it's a crucial planning and climate change adaptation tool, urban greening has to be understood within specific local conditions – one size does not fit all.

Councils, governments, planners and developers need to be fully aware of the benefits and pitfalls before embarking on urban greening projects.

Acknowledgment. This article was originally published in [The Conversation](#), 21 February 2022.

THE CONVERSATION

Mark O. Cuthbert, Principal Research Fellow & Reader, Cardiff University; Denis O'Carroll, Professor & Managing Director, UNSW Water Research Laboratory, UNSW Sydney; and Gabriel C. Rau, Assistant Professor, Institute of Applied Geosciences, Karlsruhe Institute of Technology.

Recycled water for Royal Botanic Gardens Victoria, Cranbourne

SNAPSHOT

- A new \$3.35 million recycled water treatment plant and pipeline is providing water to the Australian Garden within the Royal Botanic Gardens Victoria, Cranbourne (RBGVC), saving 35 ML of potable water each year.
- This was a long-term vision: the irrigation system was installed 20 years ago with the goal of one day sourcing recycled water.
- Water is delivered to the gardens from a local treatment plant to the garden, where it undergoes further treatment, as the nutrient levels are too high for the native plants.
- In this article, Warren Worboys describes the planning, the water treatment process and the irrigation system used in the RBGVC's Australian Garden.

Back in 2002, during the millennium drought, the initial planning of the Australian Garden at the Royal Botanic Gardens Victoria, Cranbourne (RBGVC), took place. At this time water conservation was highly topical and the designers had the foresight to develop the irrigation system with the goal of one day being able to source recycled water.

Twenty years later, their vision has been realised: a new \$3.25 million recycled water treatment plant and pipeline will save 35 ML of potable water each year. The pipeline began delivering recycled water to the award-winning Australian Garden in February. The garden features more than 100,000 plants representing 1,900 different species, including more than 400 rare or threatened species.

In this article, garden curator, Warren Worboys, talks about the project and how recycled water fits into the irrigation plan within the garden.



The Australian Garden at the Royal Botanic Gardens Victoria, Cranbourne, features more than 100,000 plants representing 1,900 species.

A LONG-TERM VISION

During both stages of the construction of the Australian Garden (detailed planning for Stage 1 commenced in 2002 and planning for Stage 2 continued in 2009), the irrigation system was installed with the goal of one day being able to source recycled water. Thus, the potable water servicing our drinking fountains and food outlets is supplied from a separate ring main to the large ring main that provides our irrigation water.

During Stage 1 planning and construction there was no requirement for different coloured pipework but during Stage 2 we installed purple pipe with the goal of eventually connecting to recycled water.

This forward planning meant that the only change we needed to make to existing infrastructure was the redirection of the potable supply, which originally serviced the irrigation, through to our water treatment plant, thus providing us with the emergency back-up supply.

The design capacity of the water treatment plant was based on more than 10 years of water consumption records using our Rain Bird SiteControl irrigation control system.

WATER TREATMENT PROCESS

A one-kilometre pipeline delivers Class A treated water from a local region delivery main from the Eastern Treatment Plant, south-east of Melbourne, to the garden. Since the nutrient levels in this water are too high for regular application to Australian native plants, further treatment is needed on site.

Raw water received from the supply pipeline is stored in a 50 kL poly tank. From here it is pumped through a sand filter to remove large particulates and fed into another 50 kL tank. Water is pumped from this tank through a bag filter and preliminary filter cartridges then under high pressure through a three-stage reverse osmosis system. Water is treated with automated chlorine dosing and pH is adjusted and the water fed into a 500 kL storage tank to service the garden's irrigation. Rainwater from the shed roof is also pumped into the 500 kL tank to support planning permit requirements to avoid water run-off from the site.

Brine waste from the treatment process is disposed of under licence in an existing sewage waste pipeline.

A SCADA unit with computer interface provides the direct human control and monitoring of the process, including the chemical dosing stages, backwashing of filters, filter condition monitoring, and pump and valve operation. It also provides an interface for remote monitoring of the system and facilitates remote notification/alerts should any operational parameters be breached, – e.g., low water levels, faulty chemical dosing, valve and motor malfunctions. The water treatment plant's operation is checked daily by a horticulturist who has been appointed irrigation officer and has a strong interest in the system.



Warren Worboys checking the reverse osmosis progress on a wet panel in the water treatment plant shed. Photo by Mathew Lynn (RBGV).

With good collaboration between water treatment specialists Waterform (who have a design and construct contract) and the gardens staff, the shed and treatment process has been designed to minimise potential OH&S issues, including working at heights from ladders, heavy lifting (200 L chemical drums), handling of the chemicals and general plant malfunctions.

BACK-UP PLAN

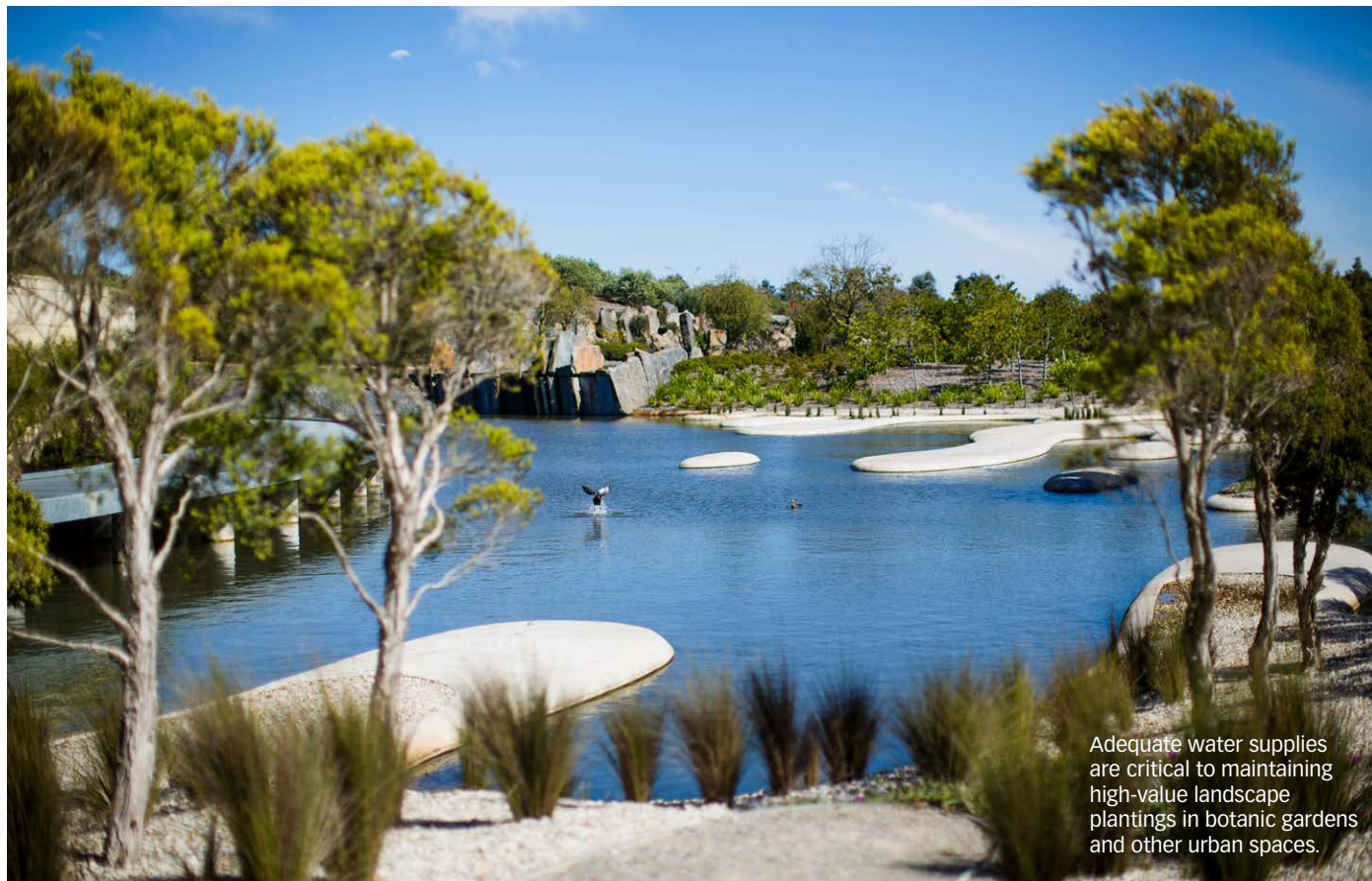
The Cranbourne Gardens site is subject to 'brown-outs' (significantly reduced electricity supply without a complete failure), and to complete power failures, so we recognised from the outset that back-up plans were necessary. Fortunately, a large potable water main runs through the site so potable water supply pressure is very good.

The automated system of the treatment plant allows for potable water to be fed directly into the 500 kL tank via a pipe with an air break should the tank go down to a pre-set level.

In a worst-case scenario, if the site has no electricity to operate the automated system, the pipework design within the water treatment plant allows us to install a removable spool which then allows us to bypass the treatment plant system and supply potable water direct to the irrigation system at mains pressure, avoiding the necessity for any pumping. Existing check valves provide the necessary protection to the potable water main.

Further insurance has now been installed in our depot, in the form of a large generator that will supply electricity to our whole of site, including the treatment plant and our Orchid Conservation Laboratory, which has invaluable collections of rare and endangered native orchids in production and storage.

ALTERNATIVE WATER SOURCES FEATU



Adequate water supplies are critical to maintaining high-value landscape plantings in botanic gardens and other urban spaces.

ENVIRONMENTAL CONSIDERATIONS

The Garden is constructed on a sand dune area, so most of the 'natural soils' are well drained and surface water goes directly into the groundwater. The natural groundwater has been recorded as having as little as 12 ppm of salts from the sand-filtering effect, so it is important to minimise the amount of irrigation water going into the natural and artificial water bodies in the landscape. We ensure that water and fertiliser are applied at rates that will be absorbed by the plants to minimise the potential of it reaching the deeper groundwater.

We also have a bio-filter wetland constructed as part of the lake system. The plants growing in this lake filter out excess nutrients from horticultural applications and from birds that use the lakes.

IRRIGATION SYSTEM

Our irrigation is operated with a Rain Bird SiteControl system, which provides us with excellent water consumption and distribution control and monitoring. Across an area of over 17 ha of garden, landscaped car park and nursery, we have 412 separate solenoid valves, which control a diversity of sprinklers and drippers applying water to garden areas as small as six square metres; this level of precision is required to apply the correct volumes of water

to particular plant species/hydrozones, thus optimising our water application and consumption.

Every spring the horticultural staff undertake audits of their garden curatorial areas to ensure that the irrigation application systems are functioning correctly and adjusted if required. Water application rates are regularly reviewed, and modified as needed, to ensure that water is applied just before plants reach wilting point. Water application regimes are reviewed twice a week in summer and once a week in winter, taking in to account the weather records from a Bureau of Meteorology registered weather station we operate on site, and evapotranspiration records from the BoM website. Available soil moisture levels are also monitored to complement the irrigation system.

DROUGHT-PROOFING FOR THE FUTURE

The importance of adapting to climate change is recognised by botanic gardens [around the world](#). Adequate water supplies are critical to maintaining high-value landscape plantings in botanic gardens and other urban spaces. For RBGVC's Australian Garden, smart irrigation decisions made twenty years ago have paid off, facilitating the transition to a reliable, drought-proof water supply into the future.

Warren Worboys, Curator, Horticulture, Royal Botanic Gardens Victoria, Cranbourne

How rainwater harvesting has changed over the last two years

When many people think of rainwater harvesting, they probably picture a tank collecting water off the roof; it seems hard to imagine how such simplicity can be improved on. In fact, the technology has evolved significantly over 20 years. Particularly in the last two years, the technology has gone ahead in leaps and bounds.

Two areas that have seen significant advances are the use of smart phone technology and pump and mains switching devices. This article by Mike Thompson, Chair of Rainwater Harvesting Australia, takes a look at these technologies.

SMART PHONE TECHNOLOGY

Innovative sensor technology and smart remote monitoring now allow users to view tank data on the web or via mobile phone. Information including inflows, water use, storage volumes, functionality maintenance data and service logs are trackable and manageable at the click of a button. At regular intervals, a sensor within the tank sends out ultrasonic waves, which bounce off the water, and this information is used to calculate the water level. The data is sent to a database, which sends water level data to an app that can be accessed at any time.

This technology can improve the effectiveness of rainwater harvesting by telling the user how much water is in the tank, how much is being used, and whether the system is functioning correctly.

PUMP AND MAINS SWITCHING DEVICE TECHNOLOGY

New technology in rainwater harvesting not only makes it easier to collect water but also saves energy. On average it costs more than 2 KWh/KL to deliver mains water to a house but delivering rainwater from a tank next to a house, can cost as little as 0.35 KWh/KL (long-term average). This energy saving has been achieved by the evolution of technology in water pumps and mains water switching devices.

The introduction of variable speed pumps to rainwater harvesting is a game changer. Previously, variable speed pumps were used only in large irrigation and industrial situations where the demand can be variable. As an example, a pump could increase its speed to deliver the correct flow rate at constant pressure from five sprinklers to 20 sprinklers and anywhere in between. Decreasing the speed of the pump, decreases the power consumption and thus saves energy. This technology is now used in domestic rainwater tank situations where the pump varies its speed depending on whether it is filling a toilet, a washing machine or watering the garden.



Recent technology, such as Kingspan's Smart Tank and Blue Mountain Co's Tank Gauge Plus (inset), allows users to monitor tank data remotely.

Several surface-mounted variable-speed pumps are available, but submersible pumps have advantages: they are quieter and out of the way of children, animals and thieves. Technology in this area is progressing, with the DAB EsyBox Diver being the first submersible variable speed pump on the domestic market. This pump is also unique in that it allows remote pump monitoring via a phone app.

Energy savings have also been achieved by clever design of the mains switching device. The original devices used energy to power a solenoid valve that switched to mains water when the rainwater tank was out of water. Now this can be done with a fully hydraulic device like the Beltrami AcquaSaver. This device uses simple engineering principles of pressure to move the valve from rainwater to mains and back again when it rains. No electrical power is required. Other manufacturers have also improved their designs to lower energy consumption and deliver water to the household. A great example of this is the development of the Davey Rainbank2.

LOOKING TO THE FUTURE

Rainwater harvesting is an essential component of the water solution in Australia, providing an estimated 274,000 ML of water annually. According to the Australian Bureau of Statistics (ABS), one in four Australian houses has a rainwater tank. The ABS estimates rainwater provides 177,000 ML, or 9 percent of residential water in Australia worth \$540 million.

The Australian rainwater harvesting industry is spawning innovative ideas, designs and technologies. We expect this good work to continue now and into the future.

Mike Thompson, Chair, Rainwater Harvesting Australia



ALTERNATIVE WATER SOURCES FEATU

Hartfield Park managed aquifer recharge – successes and lessons learnt

The Shire of Kalamunda is located approximately 24 km east of Perth, Western Australia. The shire manages Hartfield Park, a large multi-use reserve that accommodates sporting and recreation facilities and encompasses an area of protected native bushland. Since 2015, a project has been running to test the feasibility of a managed aquifer recharge (MAR) scheme to provide irrigation water for Hartfield Park. This article describes the stages and outcomes of the project and the valuable lessons learnt for future MAR schemes.

GROWING WATER DEMAND

In Perth's drying climate, groundwater levels are in decline, and water allocation limits have been imposed. Annual rainfall is less than evaporation and this has resulted in reduced streamflow and groundwater levels. At the same time, demand for water has been increasing, with a growing population and demand for community sporting fields and recreational spaces.

These issues were at the core of the Shire of Kalamunda's Hartfield Park MAR project, which was developed to provide irrigation water for Hartfield Park regional open space. The project was developed in consultation with the Department of Water and Environmental Regulation (DWER) and the Water Corporation.

THE SOLUTION: MANAGED AQUIFER RECHARGE (MAR)

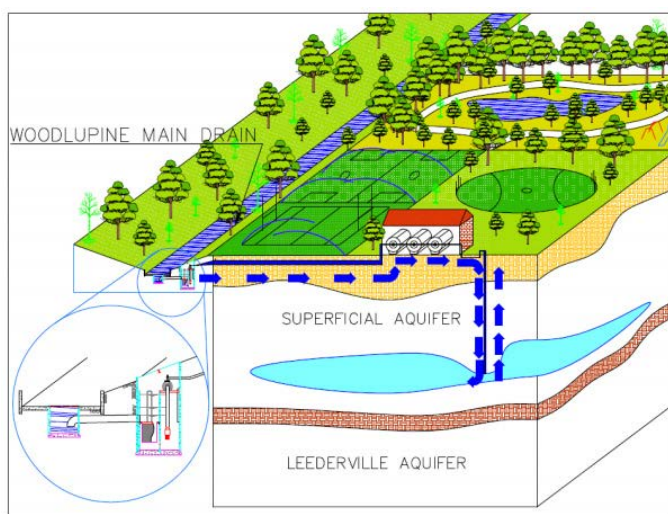
A concept was developed to extract water from the nearby Water Corporation Woodlupine main drain during winter, as these stormwater flows were destined for the urban water



runoff system with the Swan and Canning Rivers being the ultimate receiving bodies. It was proposed that following filtration, harvested stormwater could be used to recharge the Leederville Aquifer in winter and be extracted for irrigation in summer.

Although infiltration ponds were a lower-cost and simpler recharge option, this was not possible due to a layer of impermeable Guildford Clay between the Bassendean sands of the region and the superficial aquifer. Further investigations and on-site drilling indicated that MAR was feasible using an injection bore to recharge the Leederville Aquifer.

For the project to be viable and provide the city with an alternative water source, at least 50,000 kL annually was required. At full capacity, flows from the drain can reach 1.5 GL annually. Extracting 30 percent of the Woodlupine Main Drain flow (300,000 kL) would increase Hartfield Park's water allocation under the *Rights in Water and Irrigation Act 1914* by up to 100 percent for the Hartfield Park site and provide a sustainable water source into the future. Modelling and aquifer drilling calculations indicated the Leederville Aquifer could receive between 115,000 and 230,000 kL of water.



Stormwater is extracted from the Woodlupine Main Drain during winter, filtered and used to recharge the Leederville Aquifer, from which it is extracted for irrigation in summer.

TRIAL PROJECT

A trial project was undertaken to test the feasibility of the MAR scheme using the superficial aquifer. Water was extracted intermittently from the drain from late July to August 2015. An existing production bore at the park was retrofitted to inject filtered water into the aquifer. The water level response and water quality were monitored in the aquifer through the trial. The initial results showed less than expected flows (only 4,400 kL of filtered stormwater was recharged during the initial trial period), so the trial was extended.

KEY PROJECT FEATURES

- As the source water is very fresh (< 250 mg/L total dissolved solids), the harvested stormwater only requires filtration treatment.
- Water is delivered under dynamic pressure via a four-part filtration process: first filter to 70 micron; second filter to 50 micron; third filter to 2 micron; and finally the water is filtered using activated carbon prior to injection.
- The bore is approximately 50 m deep. The bore used to inject water into the aquifer in winter is also used to extract groundwater in summer.
- The injection to abstraction ratio is projected to be 1:1 and is subject to annual approval by DWER.
- The extraction point in the Woodlupine Main Drain is located 600 m from the injection point.
- A low-maintenance self-backwashing filter system was engineered to filter water to 2 micron with a 'slow opening' injection valve. This ensures air is not injected into the aquifer during backwash periods, mitigating the risk of entrained air clogging the long-term aquifer flow.
- Until more examples are established, MAR technology requires bespoke design, innovation and research to accommodate site-specific conditions.

Despite the small volume of water recharged, the trial showed the stormwater quality was of a high standard and that the aquifer storage was greater than previously estimated.

An activated carbon filtration unit was installed in 2016 to control biological fouling and the bore was pressurised to allow higher recharge rates to be achieved. The trial continued into 2017 and over the 2017 winter, 10,670 kL of stormwater was recharged to the Leederville aquifer at a flow rate of 5.75 L/s. There was limited biological fouling observed in this trial.

TRIAL EXPANSION

The trial has been running successfully since 2015, and apart from the initial fouling problems (which have not recurred since the addition of the carbon filters), the system has experienced only minor operational issues. The injection to abstraction ratio has proved to be close to 1:1 – apart from backwashing waste, almost all of water injected is abstracted.

The project was recently expanded with the drilling of a 300 mm dedicated bore. This bore has been used for the last two years of the trial and the system can currently harvest 12 L/s. With the addition of another carbon filter, particle separator and screen filter it would increase to maximum injection rate of 18 L/s.

ALTERNATIVE WATER SOURCES FEATU

Currently the city has a trial licence for 46,000 kL and it has achieved this in the last two years (a fourfold increase since 2017). The city is in the process of working with hydrologists and the DWER to increase to 76,000 kL per year.

LESSONS LEARNT

The approval process. The first step in the approval process involved obtaining a Department of Water and Environmental Regulation (DWER) 5C licence to take surface water, a section 11/17/21 permit to interfere with bed and banks and a 5C licence to extract the injected stormwater. This included demonstrating that any impacts of recharge and recovery on the groundwater system, the environment and existing groundwater uses (through changes in water quantity or quality) are acceptable. Once this was demonstrated, a licence was granted with conditions outlined in the WRMOS specific to the site. Approval from the Water Corporation to abstract water from the Water Corporation main drain was also required.

Factor in extreme climatic conditions. In the first year, record low winter rainfall and runoff affected the main drain and resulted in lower-than-expected available runoff. This highlighted the need to factor in extreme climatic conditions in the project's risk modelling.

Water quality treatment. The water abstracted from the Woodlupine Main Drain had high levels of suspended solids, particularly in the first flush runoff. This meant a custom-designed four-tier filtration process was needed before aquifer injection could take place.

It is highly recommended that future projects consider investing in a greater level of water quality treatment upstream of the harvesting location. This could involve the establishment of side entry pit catch basket inserts and upstream pollutant traps to reduce the flow of suspended solids into the drain and reduce the concentration of very small diameter particles that clog bore filters and cores. The Hartfield Park MAR used the AMIAD filtration process, which has been successful. However, an alternative system that has a smaller footprint and the ability to operate during backwash could be considered in future projects.

Allow enough time and resources. A key consideration was the need to allocate sufficient time for the commissioning of specialised equipment to ensure smooth installation and operation. There was also a stringent approvals process, which included discussion with DWER, Department of Health and the Water Corporation. Together with an extensive hydrological feasibility and viability assessment, the need for appropriate time and resource allocation was imperative to the success of the project.

Acknowledgments. Thank you to New Waterways for permitting us to publish an adapted version of their [case study](#) and to the City of Kalamunda for providing additional information.

Involving community in managing groundwater

Groundwater supplies half the world's drinking water and 43 percent of the water used to grow food. Across the vast majority of Australia, it is often the only water supply available – and its contribution to GDP is estimated at more than \$6.8 billion a year. However, overuse of groundwater during droughts and aquifer depletion has led to water crises, including in Australia's 'food bowl' the Murray–Darling Basin (MDB).

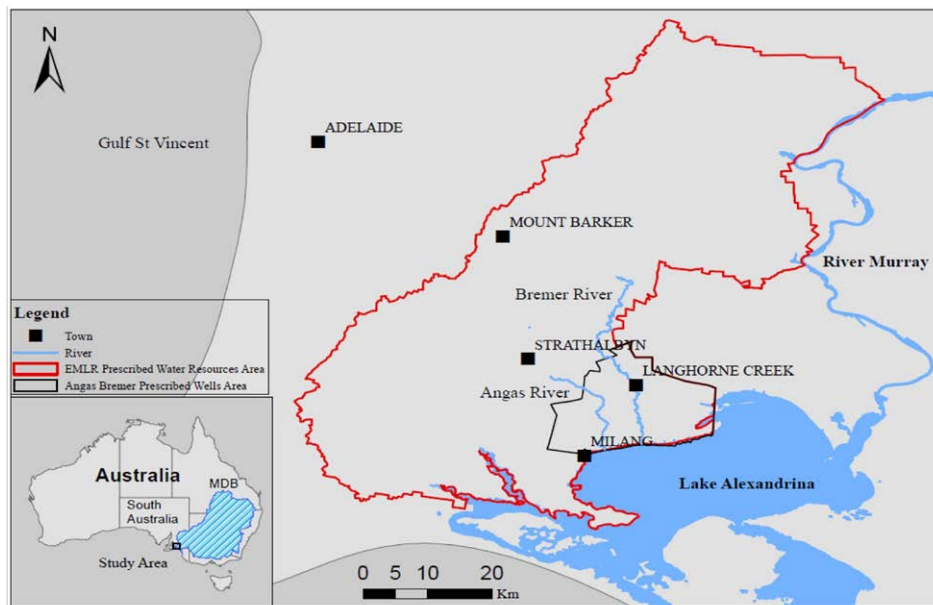
Flinders University Distinguished Professor of Hydrogeology Craig Simmons, a lead contributor to the recent UN World Water Development Report 2022, believes that to learn how to better manage groundwater, it is important to look to examples of successful collaboration between irrigators, local communities and government.

A rare and successful example of local collective action can be found in South Australia's Angas Bremer region. A recent [paper](#), co-authored by Craig and published in the Journal of Hydrology, describes how local irrigators, the community and government worked together to improve water management.

The Angus Bremer Water Management Committee's (ABWMC) [website](#) describes how more than 50 years ago it was evident that well-water levels in this region were falling and salinity of irrigation water was rising. This was because the volume of groundwater being extracted had increased to approximately four times the volume of water recharged to the aquifer each year.



Professor
Craig Simmons
of Flinders
University.
*Photo by Randy
Larcombe.*



Left: The Angas Bremer irrigation area in South Australia demonstrates how grassroots collective action can lead to successful groundwater co-management.

With the Angas Bremer district being at the lower end of the very complex and sensitive socio-ecological system, the area does not have control over upstream water-management decisions, but the community did commence work on co-management plans.

A joint committee of irrigators and scientific officers from government departments was formed in 1979 to provide advice to the state government on how best to manage the Angas Bremer water resources. The committee (which has existed in different forms over the years, but is now the ABWMC) developed innovative water management policies and actions that have included:

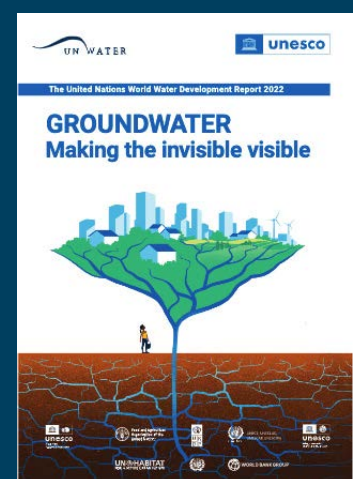
- stopping further expansion of the use of groundwater and management of the resource became controlled through legislation in 1980
- developing a water management plan and installation of meters on all bores by 1987
- encouraging growers to switch to low water-use crops, such as wine grapes
- many growers exchanged groundwater licences for River Murray licences
- in 1995, 42 growers joined forces to design, finance and build a state-of-the-art community pipeline scheme
- in 1997 the committee introduced annual reporting as a framework for self-education by irrigators
- establishing an irrigators' code of practice.
- working with government to develop water management plans.

The study concluded: "By working together with the government departments, the local committee has developed and implemented innovative water management policies which led to reduction of groundwater extractions by 80 percent, promoted artificial recharge from excess surface water, changed crops for increased profitability, and decreased water consumption, and constructed pipelines accessing surface-water sources."

While central government regulation and funding is important, it is also crucial to build trust between key stakeholders and for water users to have input into the rules.

Information. For more information contact Professor Craig Simmons, National Centre of Groundwater Research and Training, College of Science and Engineering, Flinders University, craig.simmons@flinders.edu.au.

The 2022 edition of the *United Nations World Water Development Report* entitled 'Groundwater: Making the invisible visible' describes the challenges and opportunities associated with the development, management and governance of groundwater across the world.



The report says groundwater withdrawal rates keep rising, with the agricultural sector using about 69 percent of the total volume, 22 percent for domestic uses and 9 percent for industrial purposes.

About 99 percent of the global volume of liquid freshwater consists of groundwater – and rising population, food production and irrigation has seen a strong increase in both groundwater and surface water has over the past century.

The report can be read [online](#).



CONFERENCE

COUNTING DOWN TO THE SOUTHERN HEMISPHERE'S BIGGEST-EVER IRRIGATION EVENT

With only four months to go, the countdown is on to the Irrigation Australia International Conference and Exhibition. Organisers are expecting a great turnout of delegates from Australia and the many International Commission on Irrigation and Drainage (ICID) member countries.

The theme of the conference, to be held at Adelaide Convention Centre from 3 to 10 October, is 'Irrigation for the future – challenges, innovations and opportunities'.

The organisers have received an impressive collection of abstracts and are in the process of finalising the program. Read on for a brief outline of two papers to give you an idea of the high-quality presentations that will be part of the program.

HAVE YOU REGISTERED?

Early bird registration rates are available until Friday 1 July 2022.

Special group offer for Irrigation Australia members: pay for five registrations and receive the sixth free.

Find out more and register [here](#).

A SNEAK PREVIEW

Hybrid drainage in the Shepparton Irrigation Region.



Carl Walters will describe a hybrid drainage system for the Shepparton Irrigation Region.

This presentation by Carl Walters from the Goulburn Broken Catchment Management Authority will look at how the Shepparton Irrigation Region can save money and improve sustainability with a new approach to removing excess rainfall runoff on irrigated land. Runoff is currently channeled through a network of constructed drains. But with lower runoff in recent times, constructing and maintaining earthen surface water drainage systems no longer makes economic sense.



The conference and exhibition provide an unprecedented opportunity to share ideas, knowledge and best practice between Australia and the world.

A hybrid drainage system connects natural drainage courses that have become fragmented or are obstructed by artificial barriers. Small connecting drains that outfall to the drainage course can improve drainage for farms and benefit the environment by reinstating more natural flows to wetlands, as well as making economic sense.

The next generation of IrriMATE. IrriMATE is an assortment of electronic tools to measure water on and off fields, and water advancement timing in furrow-irrigated cotton and sugarcane, and border-check irrigated pasture. The data collected enables an assessment of how much water has infiltrated the field. The process requires measuring inflow rate and water front advance during irrigation. Until recently, these measurements have been collected with electronic timers that are installed in the field just prior to irrigation and need to be collected and the data downloaded manually; this method has its drawbacks.



Malcolm Gillies and colleagues from the University of Southern Queensland will present an alternative simple low-cost system using soil moisture sensors and Taggle telemetry. This sensor system can be installed soon after planting and will detect water advance throughout the season with no user intervention.

A smartphone app allows users to locate and configure sensors and specify SMS alerts. A cloud-based software model analyses field data in real time and can determine the optimal cut-off time to ensure adequate infiltrated depths while maximising efficiency.

KARIN STARK TO FACILITATE RENEWABLE ENERGY WORKSHOP



Karin Stark, director of Farm Renewables Consulting, will be facilitating the half-day Renewable Energy Workshop.

One of the highlights of the conference program will be the half-day Renewable Energy Workshop to be held on 6 October. The workshop is sponsored by Grundfos and will be facilitated by Karin Stark.

Karin lives on a cotton and wheat farm in Narromine, NSW, and is director of Farm Renewables Consulting – a business that helps farmers reduce their costs and emissions by helping them adopt on-farm renewables. She is founder of the annual National Renewables in Agriculture Conference and Exhibition and was a finalist in the NSW/ACT AgriFutures Rural Women's Award in 2019.

Karin spoke to *Irrigation Australia Journal* to give us a run-down on what we can look forward to at the workshop, as well as her perspective on the future of renewables in agriculture in Australia.

JOIN LEADING GERMAN BUSINESSES AT THE EXHIBITION

We'll be welcoming organisations from far and wide at the exhibition – including some leading businesses from Germany. These companies will be showcasing their offerings in a large pavilion run by exhibition managers IFWexpo and DLG International. This is an exciting opportunity for our Australian visitors and ICID International delegates to see the best in German technology and products.

The exhibition will be an integral part of the activities and provides a unique opportunity for organisations to come face-to-face with attendees.

If you'd like to join leading Australian and international companies as an exhibitor, space is still available. Find out more [here](#).



IFWexpo
Heidelberg GmbH



CONFERENCE

IAL. People working in agriculture are facing the challenges of climate change, digitisation and other issues right now. What opportunities do you see among these challenges?

Karin. I think there are huge opportunities for farmers; farms are a major emitter of emissions but we can also sequester large amounts of carbon and be paid as carbon farmers. We farmers own about 60 percent of the landmass in Australia. That puts us in the perfect position to be strong advocates for combining renewables and the landscape; we can be at the forefront of adopting these new technologies. There are also increasing opportunities for farmers to reduce their high energy costs and start selling energy back to the grid for a secondary income.

IAL. What about the obstacles? Why isn't everyone doing this now?

Karin. There are few factors: First, the technology is not quite there yet. Farmers use energy differently to other users, and some do at a huge scale, and not many suppliers know how to construct these kinds of systems at the moment. Second, there are high capital costs associated with setting up a large-scale system and many farmers are reluctant to take on more debt. Third, the grid isn't up to the job; grid modernisation will change this.

But I think over the next five years we'll see dramatic changes in how farms use renewables. Already, in the last ten years, the cost of solar has come down about 87 percent. As we scale up and more money and research goes into developing technology, we'll see massive and rapid change.

IAL. What can we expect at the Renewables in Agriculture workshop?

Karin. It's going to be an interesting dive into the transition to clean, green energy, and how energy might be shared in the future. It'll give people an idea of what's on the horizon for agriculture and energy, what we should start considering, and some great examples of what people have done. To give you a brief run-down:

We'll start with a broad overview of Australia's energy transition and our opportunity to be energy exporters by keynote speaker Professor Ken Baldwin from the Australian National University.

Grundfos, the sponsor of the session, will talk about some of the interesting things happening around solar pumping solutions, illustrated with a case study.

We'll also hear from a farmer about how they've replaced electricity from the grid with solar and how that's reducing both emissions and costs on their property.

Dr Emma Lovell from the School of Chemical Engineering at the University of New South Wales will be talking about ammonia production on farms – how we can potentially

produce urea so we're not so dependent on buying it from overseas.

Dr Neil Thompson from ITM Power will talk about the potential for farms that have water and solar panels to produce hydrogen to replace some of the diesel in their tractors and run their pumps.

Our microgrids session will discuss how energy can be shared between farms. I've been involved with a study with Maddie Sturgess from Queensland Farmers Federation, in which we've been looking at the opportunities and challenges of sharing energy. Irrigators tend to be intermittent and seasonal energy users, so if you put a massive solar development on your farm to run your pumps, a lot of the time it's just sitting idle and you may not even be able to put it back into the grid because of grid constraints. We're looking at how that energy can be shared around the farm or with neighbours.

Then we've got agrivoltaics: we'll be taking a brief look at trials that AgVic are doing around putting solar over a pear orchard. We know from overseas studies that having solar panels over vineyards and orchards can actually benefit the crops – it reduces the need for irrigation because it keeps the soil moisture higher than if there were no panels over that crop. Plants only need to use a certain amount of solar irradiance anyway, so it could be win-win. As all our coal-fired power stations close down we'll need to look at better ways of using land – why not continue our grazing and cropping and combine this with solar panels?

Greg McGarvie from Australia Clean Energy, which is the only Australian electric vehicle manufacturer, will be talking about the electric vehicles that they are producing at a lower cost.

John O'Connor from NSW DPI will outline a study that he's involved in about the water energy nexus. John is part of an international working group initiated by Irrigation Australia.

And last but not least, Davey Water will be looking at how renewables can tie in with sustainable water use.

IAL. What are you most looking forward to at the conference, Karin?

Karin. I'm looking forward to hearing all the speakers' views on how our future might look in the agricultural sector, and how we can really start to decarbonise and address consumers' demands for cleaner, greener products.

One topic I'm particularly interested in is ammonia production on farms – the possibilities and challenges. This is a new area that I've never heard anyone speak about before. With the cost of urea skyrocketing over the last six months, the more self-sufficient we can be, the better. I feel like there's huge potential in the future for farms to be more self-sufficient through the type of work that Emma has done.



24th ICID INTERNATIONAL CONGRESS 73rd IEC MEETING

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Why attend?

- Visit the exhibition and meet with the industry leading suppliers of irrigation & water management technologies.
- Hear from the leading researchers and experts in the field of irrigated agriculture and drainage.
- Build strong relationships with industry suppliers and professionals.

Why exhibit?

The combined 2022 Irrigation Australia and International Commission on Irrigation & Drainage (ICID) conference and exhibition will bring people from up to 78 countries representing 90% of all irrigated land, to Adelaide in 2022 – can you afford not to be there?

ICID Conference Theme

Innovative Research in Agriculture Water Management
to Achieve Sustainable Development Goals

Irrigation Australia Conference Theme

Irrigation for the Future – Challenges, Innovations
and Opportunities

- Visit the event website at www.icid2022.com.au for further information.

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LONG-TIME MEMBER RECEIVES ORDER OF AUSTRALIA MEDAL

Well-known industry figure Simon Cowland-Cooper has been awarded a Medal of the Order of Australia (OAM) for service to the irrigation industry. The Order of Australia, announced on Australia Day each year, recognises Australians who have demonstrated outstanding service or exceptional achievement.

Simon's long career has included 30 years as a member of Irrigation Australia. He served as member of the National Board between 2010 and 2014 and chair of the Queensland Regional Committee from 1994 to 1996.

Simon retired from his consulting work last year, but at the age of 82 he is still actively engaged with the industry in a voluntary capacity. We caught up with Simon and he shared his reflections on his career, the irrigation industry and receiving the award.

"I've worked in irrigation for more than 58 years. I arrived in Australia in 1964 and within ten days I had a job working in cotton industry in Wee Waa, New South Wales. Life was very basic – people would laugh now if they saw the conditions we lived in. But I had free accommodation in a shed shared with two other guys, and I enjoyed the work, living in the bush. As well as driving tractors and doing other farm jobs, I learnt about irrigation of cotton crops," Simon said.

Simon's career has included design and construction of systems for agricultural and urban irrigation, as well as training young irrigation professionals. "For the first 15 years of my working life, I worked in agriculture, later transitioning into urban irrigation. In 1992, I created Broadwater Consultants, an irrigation design consultancy in Queensland, which I successfully managed until 2008."

Simon finds it hard to put his finger on one thing that he's most proud of in his career – but cites running his own business as one of the highlights of his professional life. "I enjoyed being in business, and particularly working with many different and unique people in the industry," he said.

"Being a member of Irrigation Australia has also been great from this perspective – to be successful in business, you need to develop professional relationships, and Irrigation Australia gives you that opportunity."

A few of Simon's notable business achievements include project management of irrigation design for Brisbane Airport, Christmas Island Refugee Centre, Gold Coast Convention and Exhibition Centre, Sunshine Coast University Hospital, Hope Island Resort and Hyatt Coolom Golf Club.

In his retirement, Simon continues to contribute to the industry as a member of the Resource Energy Environment Federation (REEF) Policy committee that is assessing the viability of the Mt Foxton Dam addition to the proposed Burdekin–Murray Scheme to transfer water from the Burdekin River in Queensland to the Murray–Darling River Basin.



Simon Cowland-Cooper was awarded an OAM for service to the irrigation industry.

Simon believes that water management, particularly in the Murray–Darling Basin, needs to be a high priority for Australia's irrigation industry in the near future. "At the moment the system is not performing as it should. We have enough water in Queensland not only for our state but also to send downstream. Water is key and we need to look after it," he said.

Simon said it's an honour to receive the OAM award. "It makes me very proud – and somewhat surprised that I have been chosen to receive such an esteemed award for service to the irrigation industry. I have received many terrific letters of congratulation from people I have dealt with during my working life."

Bryan Ward, CEO of Irrigation Australia, noted that Simon's Order of Australia is well-deserved. "He is an intellectual giant within the industry," Bryan said. "He has been around for a very long time and during this period he has made many friends and made a significant contribution to the irrigation industry. He has also been a stalwart supporter of Irrigation Australia."

Simon, together with close family members and Irrigation Australia's Bryan Ward, was presented with his award on 9 May at Government House, Brisbane – a venue that Simon knows well, since he once designed its irrigation system.

Eve White, Irrigation Australia

MACLEAN-IEDEMA AWARD NOMINATIONS

Do you know someone who has contributed above and beyond to the irrigation industry? Why not nominate them for the MacLean-Iedema Award.

Scott MacLean and Don Iedema were strong supporters and contributors to the Irrigation Association of Australia (IAA) during its early years. Both men were involved in the organisation at a regional and national level and Scott was a former chairman. Scott, Don and Roger Bell, an employee and talented irrigation designer, tragically lost their lives in a light aircraft accident in 1995.

The MacLean-Iedema Award was created by the then IAA to recognise their contribution to the irrigation industry and the association and to honour their memory. The award, which is presented biennially, recognises the outstanding contributions of individuals to the industry and includes a cash prize and commemorative plaque.

Nominations for 2022 close on 29 July and the award will be presented at the formal dinner of the Irrigation Australia Conference in October. Find out more about the award [here](#)

IRRIGATION REGULATIONS – 2ND EDITION NOW AVAILABLE

Irrigation Australia's important summary of the regulations and conditions that apply to the installation of irrigation systems connected to a mains or potable water supplies in Australian jurisdictions has been updated and is now available to members. This report details the qualifications and experience required by an individual and the scope of work that the individual is permitted to complete with respect to the installation. This detail has been collected for all states and territories in Australia.



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IRRIGATION AUSTRALIA NEWS

REGIONAL ROUNDUP



What's going on in the regions and with membership by Tracy Martin, Irrigation Australia's National Membership and Regions Manager.

Western Australia. The Perth Garden and Outdoor Festival, originally scheduled for May, is now being held in October. The WA Region is delivering a series of Waterwise Garden Workshops focussing on:

- the skills to evaluate their existing home irrigation system
- Waterwise tips and tricks
- an understanding of soil-plant relationships
- hands-on demonstrations of irrigation maintenance.



The WA committee has been continuing its Waterwise activities and, together with Water Corporation, is looking at improvements and initiatives for the coming year.

Melbourne. The Melbourne regional committee has provided a great service to the irrigation industry and Irrigation Australia over many years; however, they recognise that to remain active, the committee must evolve and grow. The committee recently encouraged Melbournians with an interest in the irrigation industry to consider joining. Several nominations were received from local Irrigation Australia members, and some from existing committee members who wish to continue their support as officeholders.

Congratulations to new officeholders:

Chair – Guy Nicholls

Vice chair – Andrew Rathjen

Secretary – Des Horton (continuing)

Treasurer – Anne Andersen (continuing)

Sponsorship and events coordinator – Gary Horton (continuing)

The Melbourne Regional Committee, together with Greater Western Water and Yarra Valley Water, will host a workshop on best practice for public open spaces, business cases, turf/plant/tree selections and technical information. This workshop has been deferred for 18 months due to COVID-19 restrictions but is now planned for August 2022.

If you are a member in Melbourne, make sure you check out the Waterwise Garden Irrigator and Waterwise Irrigation Design Shop programs. The programs, which are designed to optimise water-use efficiency and reduce water use in garden irrigation systems, can be completed as self-study.

NEW DATES ANNOUNCED WATERWISE GARDEN WORKSHOPS

28th - 29th - 30th
Oct 2022

to be held within the Perth Garden & Outdoor Living Festival

Garden enthusiasts will gain an understanding of waterwise lawn care, attractive lawn alternatives, efficient irrigation and how to improve Perth's soils. Come along to watch live demonstrations and the opportunity to ask an expert.

These Workshops will be held Friday, Saturday & Sunday only commencing 11.00am.

Visit the Waterwise Garden Workshop webpage on the Perth Garden & Outdoor Living Festival website to learn more & register.

[Click Here](#)



Underpinning the programs are best practice standards for irrigation system specifications, installation and design.

To learn how your business can become a Waterwise Professional, contact Irrigation Australia on (08) 6263 7774 or visit the Waterwise [website](#).

South Australia. In March, around 30 irrigation professionals in South Australia were treated to a tour of TK Shutter Reserve in Klemzig, which has a new irrigation system.

The reserve, home to the National Premier League South Australia team North Eastern MetroStars, has three turf playing surfaces surrounding a synthetic turf game surface. In 2019, the City of Port Adelaide Enfield (PAE) engaged Glenelg Irrigation to design an upgrade of the reserve's irrigation system. The work was undertaken by a cross-council team and included the installation of a new water meter for bore use, and diagnostic controls for the tank fill, along with Grundfos booster pumps and dosing pump for discharge to the irrigation system.

PAE put considerable effort into identifying a single irrigation control system to be standardised across more than 250 reserves. TK Shutter is the first of these reserves to be upgraded to the standardised system. The project took over 12 months from conception to completion, with construction taking place during the NPLSA off season in 2021, resulting in a flexible and low-maintenance system.



Around 30 irrigation professionals in South Australia attended an event at T.K. Shutter Reserve.

WATERWISE IRRIGATION PROGRAMS ON FACEBOOK

Have you checked out Irrigation Australia's Waterwise irrigation programs on Facebook?

Waterwise-endorsed members are fully trained in water efficient practices and can design, install, repair and maintain domestic irrigation systems.



There are two categories:

- **Waterwise Garden Irrigator** - for professional installation and maintenance services
- **Waterwise Irrigation Design Shop** - for expert advice and quality parts


The Facebook page aims to provide the wider community with #waterwise tips and advice and promote members.

Use the QR code and jump on Facebook to find out more and keep up to date.

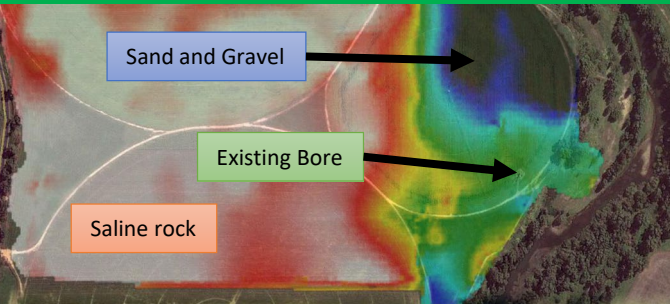


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PROFESSIONAL DEVELOPMENT

SNAPSHOT

- Geoff Harvey updates us on irrigation training plans and progress with training delivery.
- Shaun Purvis, who recently completed the Certificate III in Irrigation technology, gives his perspective on the course.
- Funding for metering governance has ceased.

IRRIGATION AUSTRALIA TRAINING



A training update by Geoff Harvey, Irrigation Australia's National Training, Certification and Marketing Manager.

The next step in your irrigation career: Certificate IV in Irrigation Management (AHC41119)

The demand for qualified irrigation professionals continues to grow, particularly for those roles in supervision and management. Often people in these roles don't possess formal qualifications but they do have many years of experience that should be formally recognised.

That's why you should consider completing a Certificate IV in Irrigation Management AHC41119.

Our Certificate IV in Irrigation Management is a nationally accredited course, tailored to deliver a multi-platform learning experience, reflecting the technical, supervisory, and operational skills of an irrigation specialist.

This qualification reflects the technical and supervisory skills and knowledge required to operate as supervisors and specialists within the irrigation industry. It applies to irrigation installation site managers and managers of irrigation systems in the irrigation servicing, horticulture, and agriculture industries.

Who is the course for?

Certificate IV in Irrigation is designed for experienced irrigation professionals who are looking at progressing their career into supervision and/or management of irrigation professionals.

The qualification is delivered over a 12-month program with a blended learning platform of virtual and face-to-face training. There are 12 competencies within this qualification, which include:

Core units

- AHCWHS401 Maintain work health and safety processes
- AHCIRG435 Determine hydraulic parameters for an irrigation system
- AHCIRG436 Implement an irrigation-related environmental protection program
- AHCIRG437 Schedule irrigations
- AHCIRG438 Select and manage pumping systems for irrigation
- AHCIRG439 Interpret and apply irrigation designs
- AHCIRG442 Supervise irrigation system installation
- AHCIRG443 Supervise irrigation system maintenance

Elective units

- AHCIRG444 Manage irrigation systems
- AHCIRG337 Measure irrigation delivery system performance
- AHCSOL406 Sample soils and interpret results
- AHCBUS407 Cost a project

Course program and duration

Block 1: 12 x 4-hour virtual classroom sessions*

Block 2: 5 days face-to-face training

Block 3: 2 x 4-hour virtual classroom sessions*

Mode Of Delivery: Virtual classroom | face-to-face | Online post-course assessments

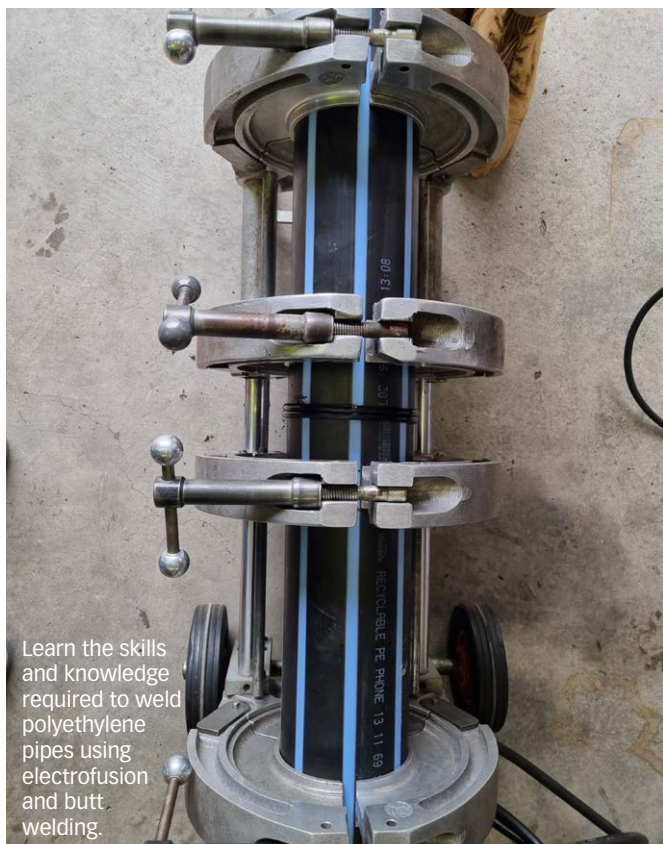
Irrigation Australia has at least four Certificate IV in Irrigation Management AHC41119 training courses scheduled for the next financial year, so get it quick to secure your spot.

Note: Funding options for this training course are also available in NSW, SA and WA (contact us for more information).

Certified poly welders in electrofusion and butt welding

Since Irrigation Australia has been delivering training and certification in electrofusion and butt welding of poly pipes, the demand for proper competency training has grown. Our offering is unique in the industry: participants not only receive a statement of attainment but are then able to become certified in these two disciplines within Irrigation Australia's certification program framework.

These training courses cover the skills and knowledge required to weld polyethylene (PE) plastic pipes using electrofusion and butt welding. It applies to welding of pipes and pipelines undertaken in the field and in factory conditions. Pipelines may be for the transmission of water, gas, or other liquids.



Learn the skills and knowledge required to weld polyethylene pipes using electrofusion and butt welding.

Learning outcomes

- A strong understanding of polyethylene pipe products and fitting relevant to butt and electrofusion welding requirements
- Ability to identify materials being used in the installation as compatible for welding using electrofusion welding methods
- Ability to calculate appropriate welding parameters to be used
- Experience with hands-on welding
- Ability to maintain and calibrate welding equipment
- A nationally recognised statement of attainment

Who is the course for?

This course is designed for any worker who uses an electrofusion or butt welder to form electrofusion or butt welds on polyethylene pipes and fittings. It is appropriate for people involved in the installation and maintenance of pipelines transmitting gas and liquids as well as personnel working in the mining sector.

Become a certified poly welder

A certified poly welder – CPW is an industry professional who can weld polyethylene pipelines safely, efficiently and effectively across a range of industry applications including plumbing, civil construction, oil and gas, and engineering.

How to become certified?

After successfully completing the one-day or two-day course and satisfying all the competency requirements, participants will become certified as a poly welder – CPW. Participants will be certified in one or both of the CPW streams: certified butt welder – BW or certified electrofusion welder – EF.

Units of competency

- PMBWELD301E Join polyethylene plastic pipelines using butt welding
- PMBWELD302E Join polyethylene plastic pipelines using electrofusion welding



This course is for any worker who uses an electrofusion or butt welder to form electrofusion or butt welds on polyethylene pipes and fittings.

RECERTIFICATION NOW AVAILABLE

Irrigation Australia now offers an efficient recertification process for poly welders after your certification expires, every two years. Participants can now complete the theory component online (self-paced) and can either provide evidence of welds successfully completed over the past two years (RPL), or they can do a face-to-face practical assessment with Irrigation Australia.

Information. For more information about training contact Geoff Harvey geoff.harvey@irrigation.org.au or 0418 888 876



PROFESSIONAL DEVELOPMENT

HORSES FOR COURSES – CERTIFICATE III TRAINING AT COOLMORE AUSTRALIA

Earlier this year, racehorse breeding stud Coolmore Australia made their New South Wales facilities available for Irrigation Australia to run a Certificate III in Irrigation Technology training course.

Shaun Purvis, who works on Coolmore's garden team, attended the course. Shaun spoke with Irrigation Australia about his reflections on the training and how he will apply it in his daily work at the stud.

IAL. Can you tell us a bit about your work?

Shaun. I work for Coolmore Australia as the garden team's irrigation technician. I manage the turf irrigation that consists of pop-ups, controller programming and troubleshooting, drip lines and solenoid maintenance/repairs in an ever-growing, dynamic work environment. I'm the only one in the garden crew who works on irrigation, but we all help each other with everything.

IAL. Why did you decide to do the Certificate III in Irrigation Technology?

Shaun. I really wanted to expand on my hands-on learning from the last few years and had heard Irrigation Australia was the way to go for further training.

IAL. What qualifications and experience did you have prior to completing this course?

Shaun. I've been at Coolmore going on six years, getting hands-on skills in irrigation from experienced people who have been here for decades. My mentor is from the farm team and has been at Coolmore for more than 20 years. I've been shown how to go about doing things professionally from a lot of different people over the years.

IAL. How did the course build on your existing experience and skills?

Shaun. I've learnt more from the course than from anywhere else. I already knew how to do the grunt work, so to speak, but Geoff, Andres, Luke and Peter gave me a much better understanding of the technical stuff like pressure differentials, readily available soil water and plant available water. And a new area for me was learning about pumps – basically everything I now know about pumps is from the course.



IAL. What knowledge from the course will you be applying in the workplace?

Shaun. Everything they taught us! The trainers were great, showing us the correct and professional standards from pumps all the way through to low-voltage wiring, polyethylene welding and soils and much, much more.

IAL. If you had to pick your favourite part of the course and one thing that you'd change about it, what would they be?

Shaun. The best thing was the like-minded people in the course as well as the trainers. It was a very comfortable learning environment; everyone had different levels of knowledge about different subjects and the trainers were a lot more laid back than I was expecting. They'd help anyone with anything – absolute legends.

The only thing I'd change was the first two blocks of training into practical face-to-face sessions like the last two blocks.

IAL. What advice would you give someone who's considering doing this training?

Shaun. I'd highly recommend it. I had a great time, made heaps of friends, expanded on my knowledge and the trainers were absolutely terrific. It was an awesome experience.

FUNDING CEASED FOR METERING GOVERNANCE

In 2019, the Murray–Darling Basin Authority (MDBA) started funding Irrigation Australia for a range of non-urban water metering governance activities, including auditing of validation certificates, assistance for CMIs/DQPs/meter manufacturers and liaison with state governments and departments such as WaterNSW. The funding also enabled the employment of a governance officer – metering.

This funding was discontinued in November 2021. Temporary funding was then provided by the NSW Government to enable metering governance activities to continue. The Department of Primary Industries has now confirmed that funding for metering governance duties has ceased. Consequently, we have reluctantly decided that metering governance activities by Irrigation Australia will cease in all Australian jurisdictions.

What does this mean for CMIs/DQPs? Enquiries about metering activities in NSW, other than those related to training and certification matters, should be made directly to the relevant departments as listed below:

NSW DPI. Email: water.enquiries@dpi.nsw.gov.au; website: [DPI Metering Website](#)

WaterNSW. Email: DQP.Enquiries@waternsw.com.au; website: [WaterNSW Metering Website](#)

We would like to record our thanks to Peter Smith for his service as metering governance officer since 2019 and request that CMIs/DQPs do not contact him on his mobile other than for matters relating to training and certification.

IRRIGATION TRAINING INFORMATION AT YOUR FINGERTIPS

Check out Irrigation Australia's [new training course booklet](#). This comprehensive publication provides essential details on training courses offered by Irrigation Australia.

- Certificate III in Irrigation Technology
- Certificate IV in Irrigation Management
- Centre Pivot and Lateral Move
- Meter Installation and Validation
- Introduction to Irrigation | Agriculture
- Introduction to Irrigation | Urban
- Irrigation Pumps and Systems
- Irrigation Efficiency
- Urban Irrigation Design
- Commercial Irrigation Design
- IRRICAD Design
- Irrigation Installer
- Storage Meter Installation and Validation



CERTIFICATES III AND IV – REGISTER YOUR INTEREST

Certificate III in Irrigation Technology AHC32419 (trade level). This qualification reflects the skills and knowledge required to become an irrigation installer, operator, retailer or technician for residential, commercial or agriculture industries. This is an in-depth irrigation training program which is assessed against nationally recognised Competencies towards Certificate III in Irrigation Technology AHC32419 (Trade Level). The program also uses subject matter experts for specialised topics such as hydraulics, troubleshooting and basic irrigation design.

Interested? Register [here](#).

Certificate IV in Irrigation Management AHC41119 This qualification reflects the technical and supervisory skills and knowledge required to operate as supervisors and specialists in the irrigation industry. It applies to irrigation installation site managers and managers of irrigation systems in the irrigation servicing, horticulture and agriculture industries.

Interested? Register [here](#).

TRAINING DIARY

DATE	COURSE	LOCATION
5 July	Certificate III in Irrigation Technology	Blended
6 July	Butt welding (1 day face to face)	Melbourne VIC
6 and 7 July	Electrofuson and butt Welding (2 days face to face)	Melbourne VIC
7 July	Electrofuson welding (1 day face to face)	Melbourne VIC
13 July	Butt welding (1 day face to face)	Adelaide SA
13 and 14 July	Electrofuson and butt Welding (2 days face to face)	Adelaide SA
14 July	Electrofuson welding (1 day face to face)	Adelaide SA
19 to 22 July	Meter installation and validation (4 half-day sessions)	Virtual classroom
19 to 22 July	Commercial Irrigation Design	Virtual classroom
2 to 5 August	Urban Irrigation Design	Virtual classroom
15 to 19 August	Certified Irrigation Auditor	
16 to 19 August	Irrigation Efficiency (4 days face to face)	Perth WA
23 to 25 August	Meter installation and validation (3 full-day sessions)	Dubbo NSW
23 to 28 August	Irrigation Efficiency (4 days face to face)	Perth WA
23 August	Basics in Drip Irrigation	Virtual classroom
24 to 25 August	Basics in Wiring and Electrical Troubleshoot-ing	Virtual classroom
6 September	Certificate III in Irrigation Technology	Blended
13 to 16 September	Meter installation and validation (4 half-day sessions)	Virtual classroom
27 September	Certificate IV in Irrigation Management	Blended
27 September	Irrigation Pumps & Systems	Virtual

INTRODUCING HUNTER'S PETER MADDEN

If you've completed a Certificate III in Irrigation Technology in the last few years, you'll likely have met Hunter Industries' Peter Madden, either virtually or in real life – and if you haven't met him yet, it's time for an introduction.

Peter, originally from the UK, moved to Australia 16 years ago and joined Hunter Industries four years ago as field service manager based in Sydney. Peter, who has more than 30 years' experience working in irrigation (predominantly in controller technology/decoder systems), provides technical support and training on advanced irrigation control systems.



Peter Madden from Hunter Industries is conducting training for Irrigation Australia's Cert III in Irrigation Technology.

In late 2019, Irrigation Australia approached Hunter about conducting electrical and controller trouble-shooting training for the trade-level Certificate III in Irrigation Technology AHC32419, and Peter was a perfect fit for the role. He developed a set of training manuals together with a suite of training tools, including wiring harnesses and control systems, for the students to get hands-on training. In addition, Peter now delivers a second module: 'Operating Irrigation Controllers and Sensor Technology'.

In 2020 and 2021, owing to COVID-19 restrictions, the training was delivered online. A box of training tools was sent out to each student, enabling them to get hands-on practical experience while studying virtually.

Finally, with people now moving around again, Irrigation Australia and Hunter have been able to take this training to the next level with the return of face-to-face training. Peter travels to wherever the courses are being run by Irrigation Australia – this has recently included Newcastle, Brisbane, Melbourne and Adelaide – to conduct his training component for the Certificate III.

IPLEX AUSTRALIA APPOINTS NEW GENERAL MANAGER

Iplex Pipelines, which provides pipeline products and solutions and is a sponsor of the Centre of Irrigation Excellence (COIE), has a new general manager, Paul Lavelle.

Paul was appointed general manager in January this year. He has served in leadership roles with Laminex and Fletcher Insulation (which, like Iplex, are both members of the Fletcher Building Group) since 2013.

Dean Fradgley, Fletcher Building Australia's Chief Executive, said, "His strong customer focus, drive for continuous improvement, and ability to influence positive outcomes, will ensure the strong momentum already achieved by the team at Iplex will continue to accelerate".

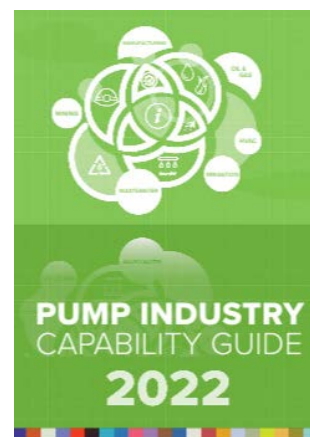
Paul is looking forward to leading Iplex. "I'm very excited to be joining the Iplex business at this stage of the business journey and look forward to working with the team and our customers to execute on the business vision of delivering innovative sustainable solutions trusted for generations", Paul said.



HAVE YOU SEEN THE NEW PUMP INDUSTRY CAPABILITY GUIDE?

The 2022 version of the Pump industry capability guide, produced by *Pump Industry Magazine*, is out now. The guide is the key reference tool for all pump users. The Australian pump industry has evolved from the days of a small number of large manufacturers to a much larger number of small to medium companies who often excel in their particular area and offer a range of very high-standard products and engineering expertise. This guide is a useful way for pump end-users to find the products and services they need.

The guide is easy to use by searching by keyword, industry category or product.



THE 24TH ICID INTERNATIONAL CONGRESS AND 73RD IEC MEETING

Irrigation Australia International Conference and Exhibition, 24th ICID International Congress and 73rd IEC meeting

Dates: 3 to 10 October 2022

Venue: Adelaide Convention Centre

Registration: www.icid2022.com.au/registration/

The 24th International Congress on Irrigation and Drainage and the 73rd International Executive Council meeting is being organised by Irrigation Australia's Committee on Irrigation and Drainage (IACID) from 3 October to 10 October 2022. The event will be held together with the Irrigation Australia International Conference and Exhibition at the Adelaide Convention Centre, South Australia.

Congress theme

The congress theme 'Innovation and research in agricultural water management to achieve sustainable development goals' will be addressed through two subthemes:

- What role can information and communication technology play in travelling the last mile?
- What role is played by multi-disciplinary dialogue to achieve sustainable development goals?

Information. You can find out more about the event [here](http://www.icid2022.com.au/).

WatSave Award nominations closing soon!

Do you know someone who's done some exceptional work in the area of water savings?

The International Commission on Irrigation and Drainage (ICID) is calling for nominations for the 2022 WatSave Awards. The WatSave Awards are presented every year to recognise outstanding contributions by to water conservation or water saving in agriculture across the world. The award celebrates actual realised savings and not promising research results, plans or good ideas to save water. The awards are given in four categories (i) Technology (ii) Innovative Water Management (iii) Young Professionals; and (iv) Farmer.

Nominations close 30 June 2022. For more information and to download a nomination form, visit the ICID website <https://icid-ciid.org/award/watsave/43>.

Completed nomination forms must go through the Australian ICID Committee (IACID) via chris.delphin@irrigation.org.au

EVENT SCHEDULE

DATE	EVENT	LOCATION	CONTACT/ INFORMATION
3-10 October 2022	73rd IEC Meeting and 24th ICID Congress	Adelaide, Australia	bryan.ward@irrigation.org.au http://www.icid2022.com.au
25-27 January 2023	10th International Micro Irrigation Conference	Dakhla, Morocco	http://10imic.ma/
16-22 April 2023	74th IEC Meeting and 4th World Irrigation Forum (WIF4)	Beijing, China	gaolh@iwhr.com
6-13 November 2023	75th IEC Meeting and 25th ICID Congress	Visakhapatnam (Vizag), India	rsdte@nic.in

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IRRIGATION IN INDIA AND AUSTRALIA: A LESSON IN SCALE

In February 2022, Irrigation Australian was contracted by the Australian Department of Agriculture, Water and the Environment to conduct a scoping study in India. While conducting background research, the Irrigation Australia team, which Jeremy Cape is leading, was struck by the contrast between irrigation in India and in Australia. While the scale and range of irrigation in India were very different, there are some striking similarities.

In this article, Jeremy details some of these differences and similarities.

Irrigation in India is on a huge scale compared with Australia; this scale becomes obvious when it is shown graphically (see Figure 1).

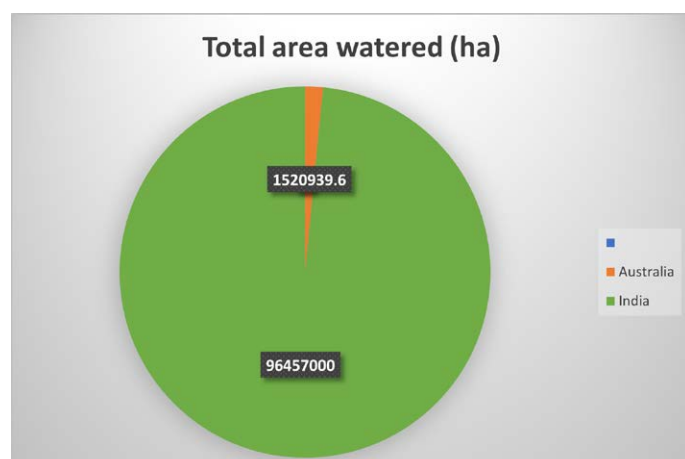


Figure 1. Irrigated area for India and Australia (Australian Bureau of Statistics, 2019-2020) (Central Water Commission, 2019).

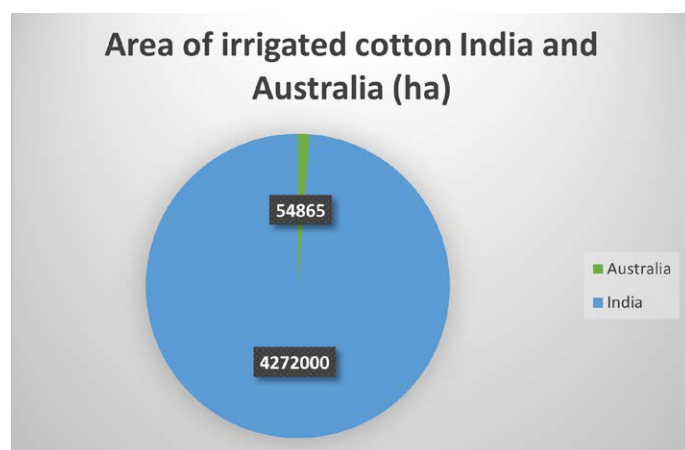


Figure 2. Area of irrigated cotton in India and Australia (Australian Bureau of Statistics, 2019-2020) (Central Water Commission, 2019).

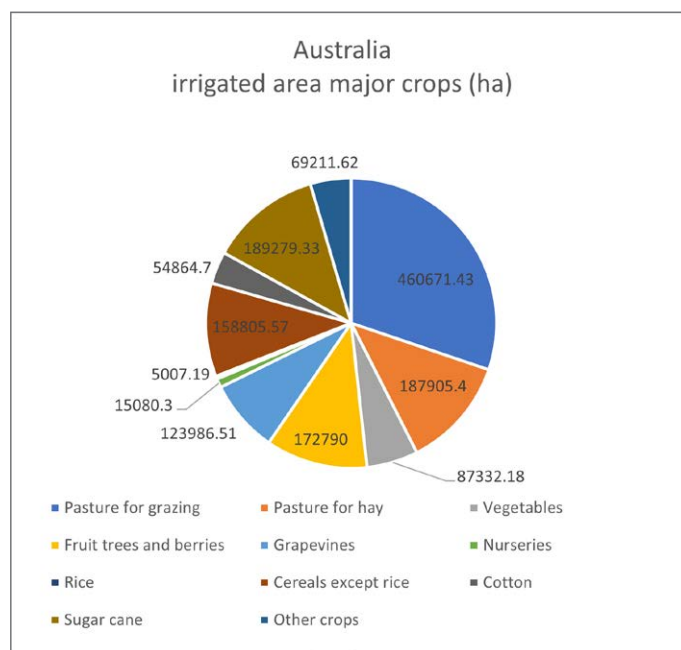


Figure 3. Area of major irrigated crops in Australia 2019-20 (Australian Bureau of Statistics, 2019-2020).

Australia irrigated 1.5 million ha in 2019–2020, compared to an irrigated area of 96.5 million ha reported by India in 2019. The relative sizes of the major crops grown reflect the same differences in scale. Figure 2 shows the area of cotton grown.

The pattern of irrigation in both countries is very different. Figure 3 shows the area of the major irrigated crops grown in Australia. The data is detailed in Table 1.

Table 1. Area of major irrigated crops Australia 2019-20 (Australian Bureau of Statistics, 2019-2020).

CROP	AREA (HA)
Pasture for grazing	460,671
Pasture for hay	187,905
Vegetables	87,332
Fruit trees and berries	172,790
Grapevines	123,987
Nurseries	15,080
Rice	5,007
Cereals except rice	158,806
Cotton	54,865
Sugar cane	189,279
Other crops	69,212
Total area	1,524,934

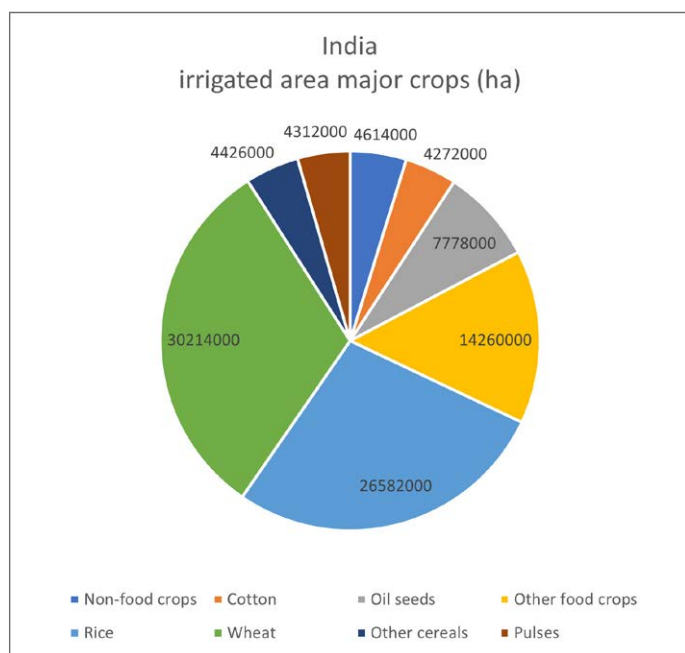


Figure 4. Area of major irrigated crops in India 2019 (Central Water Commission, 2019).

Table 2. Area sown to major irrigated crops in India (Central Water Commission, 2019).

CROP	AREA (HA)
Pasture for grazing	460,671
Pasture for hay	187,905
Vegetables	87,332
Fruit trees and berries	172,790
Grapevines	123,987
Nurseries	15,080
Rice	5,007
Cereals except rice	158,806
Cotton	54,865
Sugar cane	189,279
Other crops	69,212
Total area	1,524,934

The largest irrigated crop by area in Australia is pasture for feeding directly to livestock and pasture cut for hay. Sugar cane, fruit and nut trees, cereals (except rice) and grapevines are the next most widely grown crops. It is important to note that the area of irrigated crops was recorded in a drought year. As a result, annual crops that depend on irrigation were below their long-term average sown areas.

Figure 4 and Table 2 detail the area grown of the major irrigated crops in India. Apart from the difference in scale, the information shows the focus on food crops of different types when compared with the pattern of irrigation in Australia, which is dominated by pasture irrigation. In India the most extensively grown crops are wheat (30.2 million ha) and rice (26.6 million ha).

It is clear from all government literature in India that food production is critical. This helps to explain the different crop choices. It is interesting to note that while Australia only produces a fraction of the rice grown in India, it is one of the world's largest exporters of rice since most of the crop is exported. All of India's rice production is consumed domestically.



Another major difference is farm size. The ABS (Australian Bureau of Statistics, 2019-2020) reported 20,733 farms irrigating a total area of 1.5 million ha, an average of 73 ha per irrigator. Of course, farm size varies widely around this average with some extensive cotton and sugar farms measured in hundreds of hectares while some intensive vegetable properties may be less than 20 ha. In the area where the Irrigation Australia team is working in India, the major canal supplies water to nine separate commands with a total area of 3,577 ha. There are 8,638 farmers on this area with 80 percent of irrigators owning and managing farms of less than 1 ha.

Despite all these differences, irrigators in both countries must deal with the same basic irrigation challenges. When do I water? How much water do I apply? When is the best time to water? These are questions that every irrigator must answer. Regardless of the scale of the enterprise, the same tools, approaches and strategies are important and valid in both countries.

Jeremy Cape, Naturally Resourceful Pty Ltd, Ballina



WATER THEFT AND THE NEW ZERO-TOLERANCE APPROACH

SNAPSHOT

- Water theft as an offence is primarily enforced at a state and territory level. This article looks at Victoria's water management framework as an example.
- In Victoria, six water corporations are primarily responsible for ensuring compliance with the Water Act 1987 (Vic)
- This article outlines key offences related to water theft, strategies used by water corporations to ensure compliance, and recent developments in this area, including the shift towards a zero-tolerance approach

On the evening of 23 April 2020, Goulburn–Murray Water (GMW) received a tip-off about an illegal diversion of water from a channel in northern Victoria. Officers arrived on site at 11 pm and found a tractor pumping water into an on-farm channel. One and a half years later, Mark Anthony Ryan, the owner of a small farm, pleaded guilty for water theft. While Mr Ryan only stole \$508 worth of water, he was fined \$10,000 and ordered to pay approximately \$2,000 for GMW's legal costs.

This matter illustrates the 'zero-tolerance approach' taken in many jurisdictions to prevent, detect and enforce water theft laws by applying serious penalties to water users who exceed their legal entitlements. So what exactly constitutes water theft? And how is the zero-tolerance approach enforced?

What is water theft?

The law acknowledges that water is a vital communal resource to be shared. In Australia, the [National Water Initiative](#) recognised that "water is vested in governments that allow other parties to access and use water for a variety of purposes." A person commits water theft when they take water vested in governments without legal permission. This includes instances wherein water users exceed their authorised volumes by fractional amounts. Water theft is monitored and enforced strictly to enable all water users to access their share of water and to ensure sufficient water is left in waterways for other users and environmental purposes.

In Australia, water theft as an offence is primarily enforced at a state and territory level. In this article, we examine Victoria's water management framework which is broadly replicated in the other jurisdictions. In Victoria, six

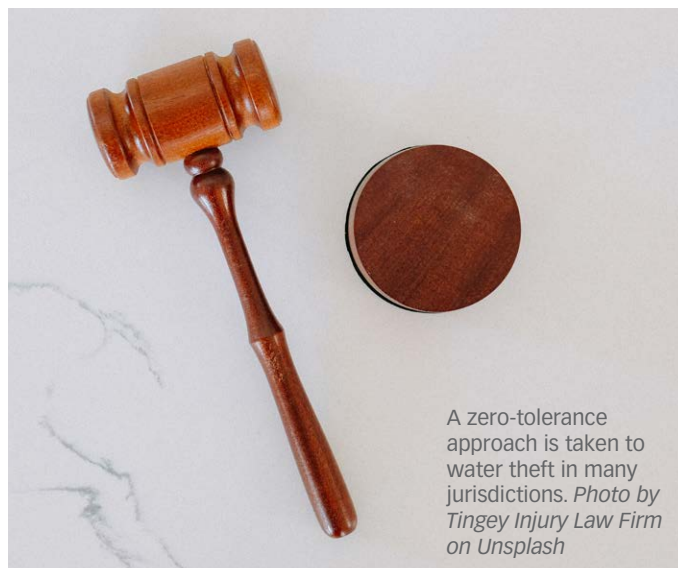
water corporations are primarily responsible for ensuring compliance with the *Water Act 1987* (Vic) (Act).

Water theft laws

Under the Act, there are a number of offences related to water theft. Two of the key offences are under sections 33E and 289.

Section 33E makes it an offence to take water from a declared water system without authorisation under a water share. Water shares can be issued under section 33F of the Act and authorise the taking of an allocated amount of water during a specified period. Taking water in excess of your water share constitutes an offence under section 33E. Penalties are increased where the taking is "knowing" or "reckless" and where the taking causes serious damage or economic loss. The maximum penalty for individuals is 10 years' imprisonment and a fine of approximately \$220,000 while corporations face a fine of approximately \$1 million.

Section 289 makes it an offence to take, use or divert an authority's water without consent. Water is "Authority's water" where it is under the control and management of a water corporation or a catchment management authority, or where it is supplied by any of these bodies for the use of another person. In practice, this is essentially all the water provided to users. Taking, using or diverting water in excess of the amount consented to would constitute a breach. It is also an offence to not comply with any conditions attached to consent – for example, taking water outside the relevant times or at a higher flow rate than prescribed. Taking, using or diverting water knowingly or recklessly, and where doing



A zero-tolerance approach is taken to water theft in many jurisdictions. Photo by Tingey Injury Law Firm on Unsplash

so results in serious damage, attracts increased penalties. The maximum penalties are the same as under section 33E.

Strategies used to ensure compliance

Water corporations employ a wide range of strategies to ensure compliance with water theft laws. Lower-level compliance actions involve water corporations encouraging and assisting compliance by educating the community about what constitutes water theft and alerting users when they are close to exceeding their allocated volumes. Medium-level compliance actions involve the use of enforcement tools to bring those who have engaged in water theft back into compliance such as warning letters and discontinuing water supply until payments are made. Last, high-level compliance actions involve prosecutions for breaches of sections 33E and 289, revocation of water rights and the issuance of on-the-spot infringement notices.

Recent developments

In 2017, the well-known *Four Corners* episode titled 'Pumped' made serious allegations of substantial water theft and poor regulation of the Murray–Darling Basin's resources. A 2018 review of Victoria's compliance and enforcement policies found that such policies could be used to greater effect, and that the approaches taken by water corporations to implement these policies were inconsistent and at times ineffective. In response to these findings, water corporations released compliance and enforcement strategies to establish consistency, transparency and more effective responses to water theft. In addition, the Act was amended to strengthen penalties and enforcement measures and to make it easier to prosecute offences. In 2020, an independent review found that significant progress had been made but there was room for further improvements. The review estimated that up to 3.6 percent of rural water volume was stolen and set a target of reducing this to 1 percent.

Zero-tolerance approach

To achieve the 1 percent target, the independent review recommended that water corporations clearly communicate to water users a 'zero-tolerance approach' to water theft. Water corporations have acted on this recommendation by increasing the use of numerous compliance strategies as outlined above, particularly prosecutions and the issuance of infringements. Water corporations have also increased monitoring of water use, such as by installing more water meters to better determine water take. In 2020/21, GMW undertook 25 successful water prosecutions and saw a halving of the number of customers who took water without authorisation from the previous year. Lower Murray Water, another water corporation, undertook one successful prosecution and issued numerous infringement notices and saw an 87 percent reduction in water theft.

How to avoid stealing water

To avoid inadvertently stealing water and being subjected to substantial financial penalties, it is crucial that water users regularly review their water entitlements and how much water they are currently taking. It is also important that users plan ahead month-to-month and seasonally and consider how much water they may need depending on their circumstances and projected rainfall. If users are unsure how much water they are entitled to, they should contact the relevant water corporation to enquire.

Dr Joseph Monaghan, partner at Holding Redlich, Christopher Watt, lawyer at Holding Redlich and Jacob Atkinson, graduate at Holding Redlich. Joseph practices in water law, having completed his doctorate on the Murray–Darling Basin Plan. Christopher and Jacob have degrees in law and environmental science. Joseph has experience in water theft law having acted on behalf of Victorian water corporations. Email: joseph.monaghan@holdingredlich.com.

IN THE NEXT ISSUE

The Spring 2022 issue of Irrigation Australia Journal will feature:

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CONTRACTORS' CORNER

A MODERN IRRIGATION SYSTEM FOR A MODERN RACECOURSE

SNAPSHOT

- The Sapphire Coast Turf Club, one of the newest and most modern country racecourses in New South Wales, recently upgraded its 20-year-old irrigation system.
- The upgrade included installing sprinklers and valves as well as three new pumps, which has resulted in improved efficiency and coverage.
- The irrigation water came from two sources: recycled water and a dam. A telemetry system was installed to supply the storage tanks from these two water sources.
- The new system is more reliable, efficient and user friendly than the previous system.

Sapphire Coast Turf Club is located on a 120 ha site at Kalaru not far from Bega in southeast NSW. There are two tracks at the club: a course proper (turf track) and a sand track.

The racecourse proper has a 2000 m circumference with banked turns, an all-round width of 30 m and a 400 m home

straight. This is one of the newest and most modern country racecourses in the state with great spectator facilities. The irrigation system is used to keep the turf on the course proper in good condition and to suppress dust and maintain density on the sand track.

Irrigation system upgrade

The wiring of the club's 20-year-old irrigation system was approaching the end of its life, and in recent seasons the racecourse managers have had to undertake regular and costly maintenance. In 2021, the club commissioned Waterland Irrigation to replace the ageing system.

Brett Amey, co-owner of Waterland Canberra, said, "The irrigation system was completely upgraded to a Toro Lynx Smart decoder system – only the 100 mm PVC mainline remained in place. We replaced the wiring of the whole system, updating the decoder system, solenoid valves, the sprinklers and the risers".

The irrigation pump station was also replaced with a custom booster pump constructed by Brown Brothers Engineers.



The Sapphire Coast Turf Club's irrigation system is used to keep the turf on the 'course proper' in good condition and to suppress dust and maintain density on the sand track.



Before (left) and after (right) shots of the pump set up. The pumps were installed on their sides to avoid obstructing the view across the course.

Some 480 Toro T5 sprinkler heads and 32 solenoid valves were installed on the sand track, 176 Toro Infinity Golf sprinklers on the turf track, with six large Perrot VP3 piston drive sprinklers at the track chutes to cover the larger distance of the chute opening. The new system is far more efficient than the previous system, with better irrigated coverage of the sprinklers.

The irrigation pump set draws water from two storage tanks. These tanks are supplied with treated recycled water from the local sewage treatment plant to supplement extraction from a local dam.

The system can also draw water from the nearby dam when available and if required.

The challenges

One of the biggest challenges with this job was the design and installation of the pump station. Unlike many racecourse pump stations, which are located to the side of the track, the existing storage tanks and pumping location was in the middle of the track. If the new pumps and pump shed were too high, they would obstruct the view across the course.

A Lowara eHM horizontal multistage pump, which has a lower profile than vertical pumps, was not suitable since it would not be big enough for the job. Instead, a custom booster system consisting of vertical multi-stage pumps and an Inca control panel was configured to offer a wide range of flows and flexibility based on the pumping requirements on site.

Two Lowara eSV 33SV05 pumps and one Lowara eSV 22SV07 pump were used. The hydraulics of these pumps, combined with a high-efficiency motor (IE2), mean that

they deliver maximum efficiency, lower lifecycle costs and increased energy savings compared with the previous ISO pump.

To avoid obstructing the view and to comply with the specification requirements, the pumps were installed on their sides, and the stainless-steel control panel was custom built at only 600 mm high. Custom-engineered bases were constructed by Brown Brothers to support the motors of these horizontally mounted pumps.

Another challenge that Brett had to tackle was to install the telemetry system to supply the storage tanks from two water sources, located on opposing sides of the course. "The design was a bit more complicated than some projects – the dam and the recycled water," Brett said. "We used a telemetry link to communicate between the three pumps. Once a tank is full to a specified level, the next pump takes over."

The final challenge was to ensure the track was operational for daily track work and race days throughout the entire project.

Outcome

Brett reported the turf club is very happy with the upgrade and outcome. The irrigation and pump system are now very reliable, more efficient and manageable in regard to time, labour saving and ease of use. With the addition of the Inca telemetry system, the whole system is now next level.

Acknowledgments. Thanks to Brown Brothers Engineers and Waterland Irrigation for providing content for this article.



SMART APPROVED WATERMARK REBRANDED AS THE WATER CONSERVANCY

Nearly 20 years ago, Smart Approved WaterMark was established to certify water-efficient products and services. The not-for-profit advisory hub is broadening its scope, and on World Water Day (22 March) it announced it has rebranded as The Water Conservancy.

CEO Chris Philpot said The Water Conservancy worked to support the water industry, local governments, households, and businesses to improve their understanding about where water comes from and how to conserve more and waste less. "Each year in Australia our reliance on water increases, yet the value we place on it declines. We need water to live and to keep our families healthy. But all too often we take it for granted."

He said The Water Conservancy made it its business to understand the attitude of Australians to water, improve water awareness and water literacy as well as water consumption and facilitate water efficiency.

Research is key to developing and implementing strategies and the creation of programs and resources. The most recent study commissioned by The Water Conservancy is the Billions of water-using minutes report, which determined how many minutes per day Australians think they run their taps for.

"Australians can be on auto-pilot using water at home so by becoming aware of how often they reach for their taps we inspire them to waste less," Chris said.

The Water Conservancy provides access to online tools and resources to support local government, the water industry and business. It also provides solutions to engage with everyday Australians and businesses through five separate programs: Smart Water Advice, Smart Water Solutions, Water Smart and Friends, Smart Approved WaterMark and Water Night.

"We are committed to changing people's behaviours and raising awareness about their water use. To do that, we continue to certify water efficient products and services, and provide advice about saving water at home, at work and in the garden.

"We enable businesses to identify water savings with water audits and recommendations, deliver performances and workshops in schools and run the annual water awareness initiative – 'Water Night' during National Water Week in October."

"Increasing everyone's perceived value of water is key to conserving more and wasting less," Chris said.

You can visit the new website [here](#) and download *Billions of water-using minutes* report [here](#).



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RECYCLED WATER ON THE BELLARINE PENINSULA

More wineries and other growers on Victoria's Bellarine Peninsula now have access to recycled water for irrigation with the \$2 million expansion of the recycled water pipeline in Portarlington now complete.

The expansion already has seven new customers connected to Barwon Water's recycled water system, with capacity for more to join. The increased use of recycled water for irrigation on the Peninsula will boost agricultural production, create climate resilient tourism offerings, and reduce reliance on drinking water for agriculture.

Planning for Stage 3 of the project – an upgrade of the Portarlington Water Reclamation Plant to provide 450 ML per year of higher quality, lower salinity, fit-for-purpose recycled water for high value agriculture and horticulture on the Bellarine – is under way. The Victorian Government will contribute \$2 million towards Stage 3, along with \$5.5 million from the Commonwealth and \$6.4 million from Barwon Water.

Source. Barwon Water [website](#).

CHANGES AT MDBA

Former Water Minister Keith Pitt selected Andrew McConville to head the Murray-Darling Basin Authority (MDBA). McConville will commence in the role of chief executive officer in June, replacing Mr Phillip Glyde, who retired in December 2021.

McConville has a Master of Science in Agricultural Economics from the University of Oxford and a Bachelor of Agricultural Economics from the University of New England. He has worked in senior corporate and management roles across agriculture, banking and natural resources.

The MDBA's governing body has also appointed a new member, Dr Jane Doolan, an eminent water specialist from Victoria who has extensive leadership experience in sustainable water resource and environmental management. She has previously held positions including Commissioner with the National Water Commission and the Productivity Commission, Professorial Fellow in Natural Resource Governance at the University of Canberra and Deputy Secretary for Water in the Victorian Department of Environment and Primary Industries.

Source. MDBA [website](#).

GREEN LIGHT FOR NORTH WEST TASMANIA WATER SALES

Irrigators in North West Tasmania have until 17 June to apply for water entitlements for Tasmanian Irrigation's \$100 million upgrade of the Sassafras Wesley Vale Irrigation Scheme.

The 9,200 ML project will increase the scheme's total summer capacity to 14,660 ML. If sufficient demand is

recorded, farmers across Sassafras, Harford, Thirlstane, Moriarty, Wesley Vale, Northdown, Pardoe and East Devonport will be able to access this additional high-surety irrigation water.

Tasmanian Irrigation has also been working to optimise the design for the project and has incorporated new parameters to increase water trading flexibility, boost pipeline flows and reduce operational risk into the latest design.

The next step will be to finalise the design based on actual demand determined during the water sales process, then submit the business case to the state and federal governments and seek approvals and permits prior to construction commencing in later 2023. Tasmanian Irrigation plans to deliver the additional water to farmers in time for the 2025–26 season.

Information. Application forms and further information can be downloaded from the Tasmanian Irrigation [website](#).

HIGHER TRADE OPPORTUNITY AT THE BARMAH CHOKE

The Barmah Choke water trade balance to start the 2022–23 irrigation year will be the highest since trade restrictions through the choke came into force in 2014.

The MDBA acting Executive Director of River Management, Dr Andrew Kremor, said the water available to trade downstream of the Barmah Choke on 1 July 2022 would be about 40.6 GL.

The Barmah Choke is a naturally narrow stretch of the River Murray that runs through the Barmah-Millewa Forest near Echuca. A restriction on the trade of water through the Choke has been active since 2014 to protect water delivery to existing entitlement holders and to maintain the river environment in the Choke.

Trading water from downstream to upstream of the Choke is always open, but trades from upstream to downstream can only happen if the same or greater amount has first gone the other way – this is the 'balance' of trade. River managers assess the balance of trade through the choke in planning for the year ahead, by considering factors like storage levels, expected demand, state allocations, and climate forecasts.

Information on trade opportunities and applications to trade are provided by the relevant Basin state trade approval authorities. Water market participants should consider the closing times and opening times of Basin state water registers for the 2021–22 and the 2022–23 water years respectively, when determining their trade activity.

There are no plans to relax the restriction on trade across the Choke in 2022–23.

Source. MDBA [website](#).



MANAGE YOUR ENVIRONMENTAL IMPACT

Why is it important for businesses to manage their environmental impact, and where should you start with environmental management? This article from the Australian Government Business website explains.

Benefits for business

Environmental management not only benefits the environment, it can also be good for business through:

- cost savings – by spending less on raw materials, energy, water and waste management
- business reputation – people may be more likely to support a business that cares about its impact on the environment
- resource recovery – reusing and recycling resources can be profitable
- work health and safety – reducing chemical use and waste materials can improve workplace health and safety
- legal compliance – your business must meet certain environmental protection laws.

Regardless of the size and type of business you run, there are ways to manage your impact on the environment. Follow our steps to plan ahead and prioritise your environmental management activities.

1. Get an environmental audit. An environmental audit can help to assess the nature and extent of your business's current impacts on the environment. This will enable you to:

- identify how you could reduce your impact
- prioritise environmental management activities
- demonstrate your accountability to government, customers and shareholders.
- You can use this initial audit as a benchmark to compare regular ongoing audits against.

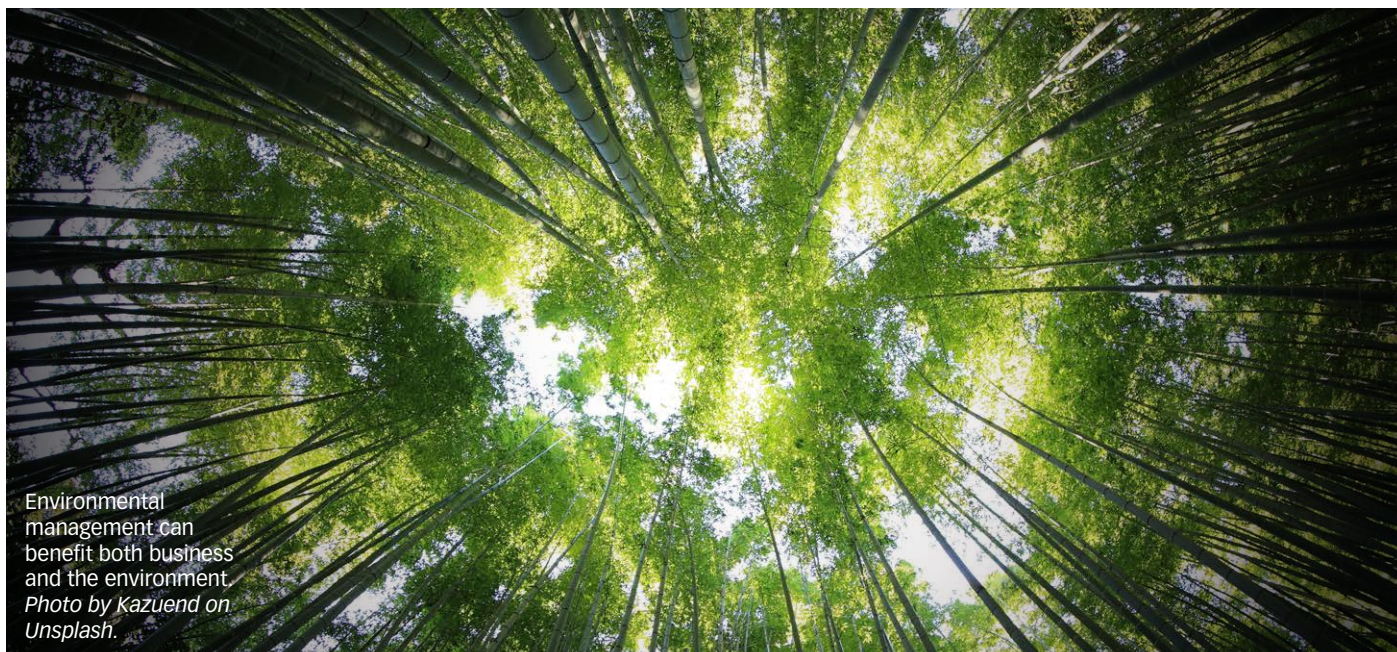
2. Set up an environmental management system. Once you have an understanding of your current impact, an environmental management system (EMS) can help you to plan ahead to manage future impacts on the environment. An EMS can also make it easier to get certain permits for business activities.

Your EMS should:

- identify the environmental impact of your business
- set your environmental objectives and targets
- provide your operational and emergency procedures for environmental issues
- outline responsibilities and your reporting structure
- identify areas for ongoing improvement.

Consider getting your EMS accredited – the ISO 14001 standard site URL <https://www.iso.org/iso-14001-environmental-management.html> sets out the requirements for a certified EMS.

3. Report on your impacts. It's a good idea to regularly monitor and report on your impacts on the environment. Common environmental reports made by businesses include:



Environmental management can benefit both business and the environment.
Photo by Kazuend on Unsplash.

- greenhouse gas and energy reporting
- corporate sustainability or triple bottom line reporting
- natural resource management monitoring.

For most businesses, environmental reporting is voluntary, but for some businesses mandatory industry reporting may apply. Find out about the:

- [National Greenhouse and Energy Reporting scheme](#) for certain large corporations
- [National Pollutant Inventory \(NPI\)](#) for businesses that exceed an emissions threshold
- [Australian Industrial Chemicals Introduction Scheme \(AICIS\)](#) for industrial chemicals.

4. Check government requirements. Australian, state and local governments jointly administer the environmental protection laws in Australia. Environmental laws that affect your business will depend on your business type. As a business owner, you need to understand which laws apply to your business and make sure you meet requirements.

Government agencies and industry groups also develop voluntary codes of practice to guide industry's impact on the environment.

You may also require environmental licences and permits for certain business activities. If an activity might affect areas of national environmental significance, you'll need to get licences or permits from the Australian Government. You can check for areas of national environmental significance with the [Protected Matters Search Tool](#).

If your activity is likely to impact on the local environment, such as parks, heritage sites, air and water, check for licence and permit requirements through your state, territory or local government. Links to all state and territory websites with information about legislation, approvals and guidance are listed on the [business.gov.au website](#).

5. Find environmental grants and awards. Consider getting recognised for your environmental initiatives. There are environmental awards available from Australian, state, territory and local governments including:

- [Banksia Foundation](#)
- [Climate Active certification](#) for carbon neutral businesses
- national, state and territory [Landcare Awards](#).
- Check your state, territory or local government website for other environmental awards.

Source. Australian Government Business [website](#) accessed 5 April 2022.



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To use the device, you hook it up to the pipeline with a clamp on either side of the section you're working on, earth it, and follow the prompts on the screen. An audible/visual alarm will go off if an electrical current is present.

Once you start work, the device continuously monitors the voltage, ground reference and bridging strap, which means it will uncover hidden intermittent electrical faults in the water infrastructure. If it detects a problem while you're working, an alarm will be triggered, and an event data logger logs the incident.

The device, which is based on microprocessor technology, measures and tests for stray voltage and pipework connection integrity while all connections are continuously monitored. Removal or poor connection of the monitoring cables will instantly raise an alarm. The data log can be downloaded on a USB and the device can communicate with your telecommunications systems in real time.

Cal Pacific, an Australian-owned business based in Newcastle, NSW, has developed the device in partnership with a water utilities company to ensure it can easily be integrated into existing management systems. The system has been rigorously tested under harsh field conditions.

Information. For information go to the PlumbSafe [website](#).



Above: PlumbSafe unit complete with universal clamps, leads and earth stakes.

Left: PlumbSafe unit test rig for pressure testing to 2 m of water.

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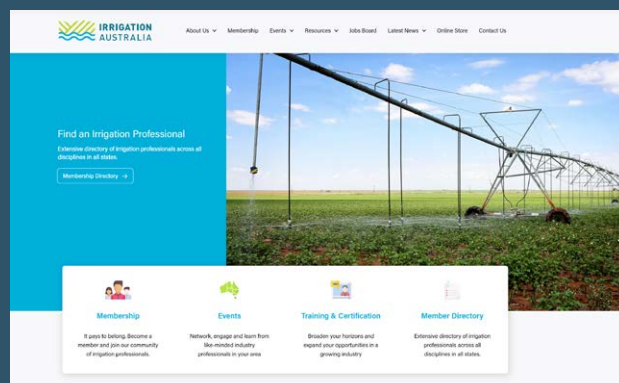
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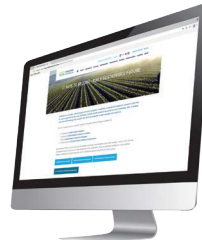
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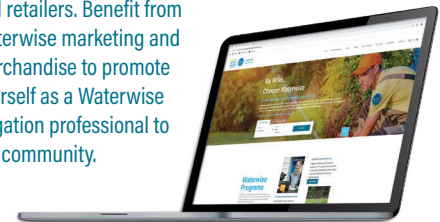
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