INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE (ICID)

ICID WATSAVE AWARDS 2017

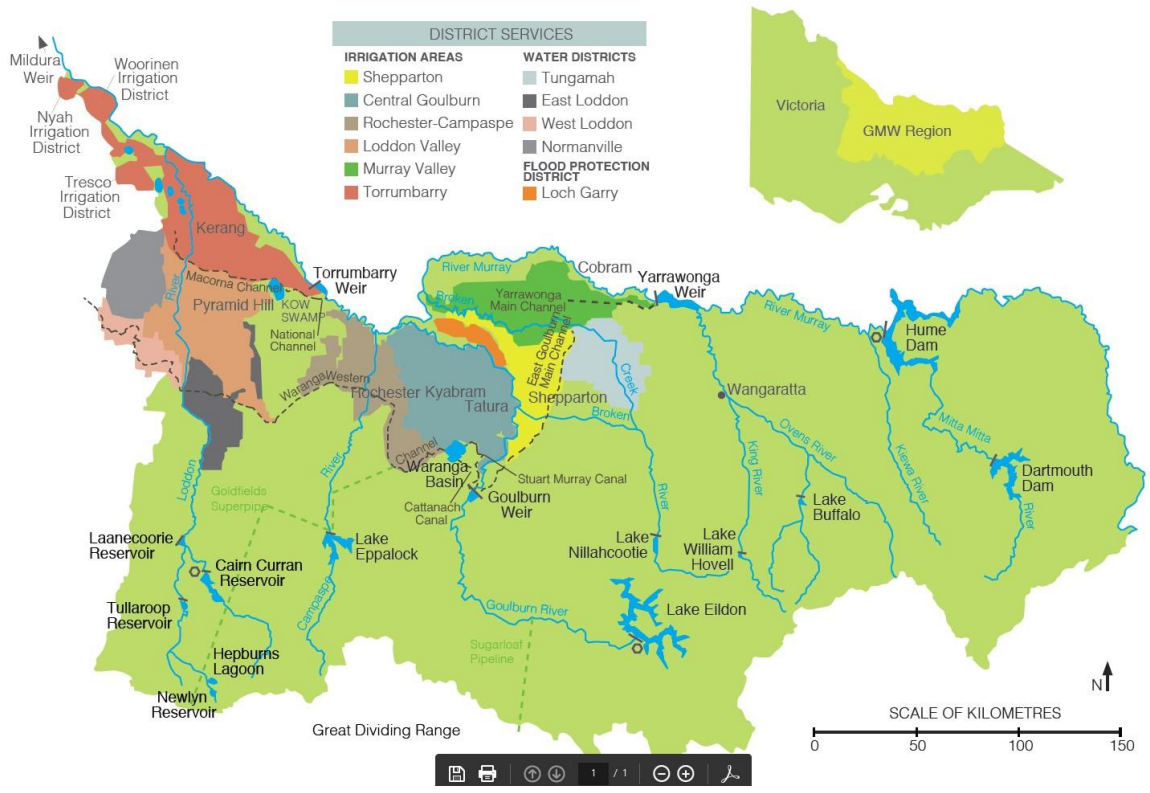
WatSave Technology Award

Farm Water Program, Water Savings Calculator

Describe the innovation.

The use of a water savings calculator to determine water savings generated through the Farm Water Program is the subject of this award nomination. The calculator builds on over 20 years of irrigated agricultural research and studies in the Goulburn Murray Irrigation District (GMID) of Northern Victoria in Australia and is an innovative way of using data to determine the water savings of each project proposed under this program. Extensive evaluation of post constructed projects have shown that the irrigators are experiencing the expected water savings giving new participant's in the program confidence to invest in new irrigation technologies.

The irrigation delivery systems of northern Victoria in Australia are being modernised to improve the delivery of irrigation water to properties across the GMID. The GMID is a significant irrigation region within the Murray Darling Basin and has a public irrigation delivery system of approximately 9000 kilometres of open earthen channels with gravity delivery of water to farming properties.



The upgrades to the public delivery system include the renovation of sections of channels to minimise leakage and seepage with the use of clay or plastic lining together with the installation of remote controlled, automated channel regulators and delivery gates to properties. Some sections of channels are being replaced with pipelines while others are being removed where they are no longer required.

These changes have resulted in a higher level of delivery service for irrigation farmers with more consistent and larger flows of water available which allows for higher speed irrigations and improved

water use efficiency. Irrigators are now also able to utilize the internet to plan and order the delivery of water onto their properties to suit their needs.

In response to the improved water delivery standard, many irrigators are updating their farm irrigation systems to take advantage of the improved service. This includes works to enhance the performance of existing farm systems and changes in the type of irrigation system used on the property. These modifications are resulting in improved water use efficiency and the generation of water savings.

The Australian and Victorian Governments have developed programs to encourage irrigators to improve their irrigation systems. In return for the funding provided by the Governments, irrigators agree to return a portion of the water savings to the Australian Government to be used for environmental purposes. The remaining water savings are retained for productive use on the property.

In 2009, the Goulburn Broken Catchment Management Authority (GB CMA), together with other Victorian and regional groups, formed a consortium to develop the Farm Water Program (FWP). The consortium partners all have an interest in the management of the natural features in the environment, the agricultural productivity of the region and the prosperity of the community across the GMID.

The FWP has been successful in gaining over $200 million of Australian and State Government funds to date to improve irrigation systems on farms across the GMID, with 534 completed projects and a further 88 currently underway across 37,000 ha with over 82,000 Megalitres (ML) of water savings when all projects are completed.

The FWP has worked with irrigators across the GMID who have expressed an interest in preparing a package of works on their property and to gain access to funding to undertake the works. To be eligible properties need to be connected to the modernised regional delivery system and have a whole farm plan of the property detailing the proposed works.

FWP staff and Government agency extension officers work with irrigators to prepare a project for the property and this includes the use of the water savings calculator to determine the water savings expected to be achieved through making the changes.

Describe how the innovation saves water.

Essentially the water savings calculator used in the FWP gives an irrigator confidence to adopt a new more water efficient irrigation technology by estimating the expected annual water savings if that irrigation technology were to be adopted on a predetermined area of land. It does this by taking into account both the existing and future irrigation method, the soil type, and crop type.

Eligible irrigators work with FWP staff to develop a project using a previously prepared whole of property farm plan which provides details of the proposed changes to the farm irrigation system.

Irrigators in the GMID have been planning changes to their properties, particularly their irrigation systems, since the 1980s when financial incentives were first made available to encourage the development of whole farm plans. Initially whole farm planning was introduced in response to salinity management issues in the GMID and irrigators were encouraged to improve their irrigation systems to minimise accessions to groundwater. Now WFPs cover a range of issues including water quality, biodiversity and cultural heritage.

Whole farm planning has continued to be promoted in order to encourage irrigators to schedule proposed changes to farm irrigation systems in order to benefit from the improved delivery of irrigation water.

There is a considerable advantage in having the plan prepared prior to the development of a FWP project as planning requires time to consider the proposed changes. Irrigators employ a consultant irrigation designer to undertake a topographical survey of the property. The survey also includes the

existing infrastructure on the property together with the natural features of vegetation, soils and drainage.

The irrigator works with the irrigation designer and a Victorian Government irrigation specialist to prepare a plan containing the proposed changes. Irrigators are advised on the most appropriate irrigation system for the property, any changes to farm management systems, and how these changes can be best made.

Using the whole farm plan, irrigators are then able to nominate all or parts of their property to be improved through a FWP project with the plan providing the details of the changes.

FWP projects are able to contain technologies and works for three types of irrigation systems:

1. Surface irrigation with activities including:
    - Laser grading of irrigation bays to achieve a consistent grade down the bay to minimise water logging.
    - Drainage reuse systems to collect irrigation and rainfall runoff and store it in a constructed sump and pump the water for irrigation.
    - Improved gravity earthen channels and pumped pipe and riser systems that are able to accurately control the flow of water.

2. Micro and drip irrigation including:
    - Installation and upgrades of pumps, piping, and sprays and drippers.

3. Overhead sprinkler irrigation including:
    - Installation and upgrades of centre pivot, lateral move and fixed sprinkler systems.

Irrigation scheduling is also an eligible activity and includes soil moisture monitoring equipment linked to computer programs to record and forecast irrigation requirements.

Once the proposed changes are identified, the next step is to determine the expected water savings from the project. To do this the FWP has developed a water savings calculator using the results from a wide range of Australian and Victorian Government funded research projects in the GMID.

Over the last 20 years there have been many projects, field trials and soil investigations in the GMID, and the FWP has collated the results from 27 project reports to determine the expected water savings from the project activities. The calculator has values for water savings (ML/ha/yr) for each of the irrigation technologies and activities eligible for funding.

When the project activities have been identified, the irrigator is required to nominate the crop type that is proposed for the project area after the changes have been made.

The water savings calculator uses three crop types comprising;

1. Annual crops and pastures which have a crop evapotranspiration (ETo) of 3 ML/ha/yr.
2. Summer crops and horticulture with an ETo of 6 ML/ha/yr.
3. Perennial pastures, citrus and almonds with an ETo of 8 ML/ha/yr.

The crop type has an impact on potential water savings as the crops with an ETo of 3 ML/ha/yr are likely to be irrigated for short periods in autumn and spring with four irrigations in most years. The perennial pastures are irrigated for a longer period from spring, through summer and into autumn with about 20 irrigations depending on seasonal conditions. Water savings are expected to be higher for the perennial crops due to the higher annual volume of water applied over a greater number of irrigation events.

The third component of the water savings calculation is the soil type as this has an impact on the amount of water saved by irrigating with an appropriate application of water, improving surface drainage and

reducing deep percolation. The lighter textured sandy soils generally have higher infiltration rates and are likely to have greater losses compared to the heavier textured clay soils.

The soils of the GMID have been classified into six groups and there are a series of maps showing the soil types and groupings. This soil classification was mostly undertaken in the 1950s and 1960s to assist in determining the areas suited for irrigation and to provide irrigators with a guide of crop suitability for the various soils.

For the purpose of calculating water savings, three groupings of soil types have been used with lightest textured soils, the sands and sandy loams grouped as Light Soils. The loam soil types grouped as Medium Soils and the clays grouped as Heavy Soils. A map of the soils across the property is included on the whole farm plan and the FWP staff member working with the irrigator examines the mix of the soil types across the project area and determines the areas of each of the soil groupings for the crop types in the project area.

The soil type and crop type areas are then assigned to each of the project activities to determine the water savings across the project area. The water savings calculator consists of a matrix of water savings values for 11 technologies/activities across three crop types and three soil types.

This method of calculating expected water savings from each FWP project is comprehensive and the water savings are science based. Using this process, the determination of water savings is transparent and consistent across all projects. Table 1 is an example of the water savings calculator.

Table 1. The Farm Water Program Water Savings Calculator.

FARM WATER PROGRAM
WATER SAVINGS CALCULATOR

Name:	An Example									**No:**		
FWP Officer:	0									**Date:**	29-Mar-17	
		Light Soils (Group 1&2)			Medium Soils (Group 3&4)			Heavy Soils (Group 5&6)			Water Savings (ML)	Total Area (ha)
Activity		Water Savings Factor	Area (ha)	Water Savings	Water Savings Factor	Area (ha)	Water Savings	Water Savings Factor	Area (ha)	Water Savings		
Crop Water Use = 3 M L/ ha/ yr. Annual Pasture, winter vegetables, winter cropping, cool climate or low yielding viticulture												
Improved Surface Irrigation	Laser grading	0.5	10.00	5.0	0.3	20.00	6.0	0.2	15.00	3.0	**14.0**	**45.00**
	Drainage reuse	0.4	10.00	4.0	0.3	20.00	6.0	0.4	15.00	6.0	**16.0**	**45.00**
	Gravity earthen channel	1.3	10.00	13.0	0.8	20.00	16.0	0.5	15.00	7.5	**36.5**	**45.00**
	Gravity piped/plastic lined channels	1.3		0.0	0.8		0.0	0.5		0.0	**0.0**	**0.00**
	Pressurised pipe/riser	1.3		0.0	0.8		0.0	0.5		0.0	**0.0**	**0.00**
Improved micro/drip Irrigation	Micro/drip irrigation (from sprinkler)	0.4		0.0	0.7		0.0	0.6		0.0	**0.0**	**0.00**
	Micro/drip irrigation (from lasered & reuse)	2.5		0.0	1.7		0.0	1.3		0.0	**0.0**	**0.00**
	Micro/drip irrigation Upgrade	0.1		0.0	0.1		0.0	0.1		0.0	**0.0**	**0.00**
Improved Sprinkler Irrigation	Sprinkler irrigation (from lasered & reuse)	2.0		0.0	1.0		0.0	0.6		0.0	**0.0**	**0.00**
	Sprinkler Upgrade	0.3		0.0	0.2		0.0	0.2		0.0	**0.0**	**0.00**
Irrigation Scheduling		0.2		0.0	0.1		0.0	0.1		0.0	**0.0**	**0.00**
Crop Water Use = 6 M L/ ha/ yr . Summer Cropping, summer vegetables, tomatoes, potatoes, stone fruit, pome fruit, warm climate viticulture												
Improved Surface Irrigation	Laser grading	0.8		0.0	0.5		0.0	0.4		0.0	**0.0**	**0.00**
	Drainage reuse	0.9		0.0	0.9		0.0	1.1		0.0	**0.0**	**0.00**
	Gravity earthen channel	2.0		0.0	1.3		0.0	0.9		0.0	**0.0**	**0.00**
	Gravity piped/plastic lined channels	2.1		0.0	1.4		0.0	0.9		0.0	**0.0**	**0.00**
	Pressurised pipe/riser	2.1		0.0	1.4		0.0	0.9		0.0	**0.0**	**0.00**
Improved micro/drip Irrigation	Micro/drip irrigation (from sprinklers)	0.8		0.0	1.3		0.0	1.3		0.0	**0.0**	**0.00**
	Micro/drip irrigation (from lasered & reuse)	3.9		0.0	3.1		0.0	2.6		0.0	**0.0**	**0.00**
	Micro/drip irrigation Upgrade	0.3		0.0	0.3		0.0	0.3		0.0	**0.0**	**0.00**
Improved Sprinkler Irrigation	Sprinkler irrigation (from lasered & reuse)	3.1		0.0	1.8		0.0	1.3		0.0	**0.0**	**0.00**
	Sprinkler Upgrade	0.6	35.00	21.0	0.5	15.00	7.5	0.3	10.00	3.0	**31.5**	**60.00**
Irrigation Scheduling		0.3		0.0	0.3		0.0	0.2		0.0	**0.0**	**0.00**
Crop Water Use = 8 M L/ ha/ yr. Perennial pastures, lucerne, double cropping, citrus, almonds												
Improved Surface Irrigation	Laser grading	1.1	25.00	27.5	0.7	10.00	7.0	0.5	15.00	7.5	**42.0**	**50.00**
	Drainage reuse	1.2	25.00	30.0	1.3	10.00	13.0	1.4	15.00	21.0	**64.0**	**50.00**
	Gravity earthen channel	2.7		0.0	1.8		0.0	1.2		0.0	**0.0**	**0.00**

	Gravity piped/plastic lined channels	2.8		0.0	1.8		0.0	1.2		0.0	**0.0**	**0.00**
	Pressurised pipe/riser	2.8	25.00	70.0	1.8	10.00	18.0	1.2	15.00	18.0	**106.0**	**50.00**
Improved micro/drip Irrigation	Micro/drip irrigation (from sprinklers)	1.1		0.0	1.7		0.0	1.3		0.0	**0.0**	**0.00**
	Micro/drip irrigation (from lasered & reuse)	5.3		0.0	4.1		0.0	3.4		0.0	**0.0**	**0.00**
	Micro/drip irrigation Upgrade	0.3		0.0	0.3		0.0	0.3		0.0	**0.0**	**0.00**
Improved Sprinkler Irrigation	Sprinkler irrigation (from lasered & reuse)	4.2		0.0	2.4		0.0	2.2		0.0	**0.0**	**0.00**
	Sprinkler Upgrade	0.8		0.0	0.6		0.0	0.4		0.0	**0.0**	**0.00**
Irrigation Scheduling		0.4		0.0	0.3		0.0	0.3		0.0	**0.0**	**0.00**
Linking Pipelines (no direct irrigation from pipeline)		Insert water savings from separate spreadsheet for converting earthern channels to pipelines										
										Project Totals	**310**	**345.0**

Describe how the innovation was introduced and spread.

The water savings calculator was first used in 2010 to determine water savings for the first projects prepared by the FWP. This followed the development of the calculator and some work with FWP consortium partners to ensure that the calculations were correct and accepted. Several irrigators and irrigation specialists reviewed some examples of water savings calculations and provided feedback on its accuracy and use.

The water savings calculator has now been used across 622 FWP projects, covering more than 37,000 ha with expected water savings of 82,000 ML. The FWP has prepared detailed case studies of 56 completed projects and this work has confirmed that the irrigators are experiencing the expected water savings.

There has been universal acceptance by irrigators of the water savings determined using the water savings calculator. Along with the detailed cases studies completed to date, at the completion of every project, irrigators prepare a final report of their project which includes an assessment of the water savings being observed.

With over 500 reports received, irrigators are reporting that the water savings are being achieved. While these reports are prepared mostly after the initial irrigations with their improved systems, it is clear that irrigators are observing water savings immediately after the changes have been made.

This work has also shown that while the changes to the irrigation system generate water savings, the changes do not automatically reduce a property's overall water use.

The improved irrigation systems are providing irrigators with additional benefits of reduced labour requirement and ease of operating a more flexible irrigation system. These changes are allowing irrigators more options in the way they run their enterprises and for many this includes the adoption of higher value crops that have higher water use.

Some of the changes include the introduction of producing two crops per year, rather than one; or growing longer season annual pastures, when previously only short season annuals were grown. In these cases, the water use per ha may have increased, but this is due to the change in crops. The farmers report that the new system has significantly lower water use (0.5 – 3.6 ML/ha and 0-1.1 t/ML) than the old system if it had been employed to grow the same crops.

There are other irrigators, who after upgrading have kept identical crops and with the new system they have generally experienced both a reduction in water use (ML/ha) and an increase in production (t/ha and t/ML) when compared with the old system.

Describe the scope for further expansion of the innovation.
Since the introduction of the water savings calculator, changes have been made with the inclusion of activities not funded in the first rounds of funding. Additional activities and crop types could be added into the calculator as required.

The calculator was prepared for conditions found across the GMID and care has been taken to discourage its direct use in other areas. While the principles are suited to be used elsewhere, the water savings factors are accurate only for GMID conditions, meaning that if the calculator were to be used elsewhere the actual water saving coefficients for that region would need to be determined to ensure the accuracy of the water savings.

The water savings calculator has been developed for use in determining water savings expected to be realised through the implementation of works contained in a FWP project. However, it has a wider use in providing water use efficiency information for irrigators as they plan changes to their farm irrigation systems. In the future it will continue to be used as a decision support tool for irrigators to use when comparing the water use efficiency merits of technologies and practices they may be considering adopting.

Describe the roles of the individual nominees.
The nominees represent the Goulburn Broken Catchment Management Authority (CMA). Goulburn Broken CMA is the lead agency in a regional consortium and has been implementing the Farm Water Program successfully since 2010. Chris Norman is the Chief Executive Officer and Carl Walters is the Sustainable Irrigation Program Manager for the Goulburn Broken CMA.