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Committee Secretary
Standing Committee on Regional Australia
PO Box 6021
Parliament House
CANBERRA ACT 2600
AUSTRALIA

Dear Secretary,

Re: House of Representatives Standing Committee on Regional Australia Inquiry into the impact of the Murray-Darling Basin Plan in Regional Australia

Thank you for the opportunity to make a submission to the Inquiry. Rubicon Water is an Australian company that has developed unique and cost-effective technology-based solutions to modernise the management of water infrastructure. The technology was developed in conjunction with the University of Melbourne School of Engineering and has been implemented in some of Australia's most important irrigation regions and increasingly adopted internationally.

Our submission to this Inquiry addresses the Terms of Reference collectively and provides specific information in support of the following Terms:

- Options for water-saving measures or water return on a region-by-region basis with consideration given to an analysis of actual usage versus licence entitlement over the preceding fifteen years
- The role of governments, the agricultural industry and the research sector in developing and delivering infrastructure and technologies aimed at supporting water efficiency within the Murray-Darling Basin
- Measures to increase water efficiency and reduces consumption and their relative cost effectiveness.

It is important, at the beginning of our submission, to make it clear that the Basin does have a sustainable future but it will need to be intelligently and comprehensively managed and it will need economic support to make the transition. Our submission outlines the most efficient and effective means of modernising the water management infrastructure and practices of the Basin. We believe the use of advanced information technology is essential for providing the data and infrastructure for correct decision-making that will be central to ensuring the maximum amount of water is recovered for environmental uses for the least cost, while also meeting social, economic and food security objectives.

Basin water management

Firstly, it is essential to acknowledge that the Basin is already a highly managed system – Australia's population and economic growth made this a necessity a long time ago. However, Australia will have to manage this unique area a lot more effectively if it is to continue to meet competing needs into the future.

Australia's response to the complex interdependencies of climate change, population growth and national development needs to be sophisticated. Changing water pricing, introducing new water policies, creating water markets, buying back irrigator entitlements and subsequently providing water for the environment may all be part of the answer. However, unless our water infrastructure enables users and suppliers to manage their requirements efficiently, no market or water reforms will work.

There is no doubt that climatically we are facing an uncertain future that will require resilient and intelligent infrastructure and management systems. Our responses to extreme droughts and floods will be optimised only with smart, automated infrastructure and decision-making systems. We are past the point where civil infrastructure (dams, weirs, levees etc) alone is sufficient to successfully manage the Basin's water resources. Measurement and information management systems that enable *all* water to be properly accounted for are necessary because without accurate information, it will simply be impossible to effectively manage water to meet these challenges.

Buying back irrigator entitlements is an alternative solution for achieving Basin environmental objectives. The proponents of this as the preferred solution have been loud in their claims that savings from investment in efficient infrastructure are not 'real' savings; arguing that saved water is essentially water that would otherwise be part of the greater water cycle. This is an erroneous and unsustainable argument reflecting a poor understanding of modern efficient water infrastructure.

To suggest that we should allow channels to continue to spill, leak and seep and that this water will eventually find its way into river systems for environmental benefit flies in the face of the extensive public policy and engineering responses to the 1980s and 90s salinity crises that devastated large regions of the Basin.

To better understand why *poor* management and control of irrigation systems is not an environmental good, it is useful to understand some basic hydrological concepts:

- Groundwater moves very slowly laterally. In the flat and shallow Murray Darling Basin, horizontal velocities in the order of only a few metres per year are not uncommon
- Unlike the deep, contiguous and pervious groundwater systems in other geologically younger parts of the world, excess irrigation water in the Murray-Darling Basin tends not to flow via the groundwater system to rivers and streams but to 'mound' locally and cause water-logging and salinity problems
- Most channel outfalls flow into surface drains. These slow moving drains often seep, they support unwanted transpiration via noxious weeds and they mobilise nutrients and pesticides in drainage water at the wrong time of the year.

On the other hand, water saved through investment in infrastructure modernisation (*efficient* infrastructure) is quality water that is not used immediately and remains stored at the source. This water can then be released into the environment in a controlled manner, which can be timed to achieve maximum downstream environmental benefit. Given that the Murray-Darling Basin is already a managed system, we should manage *all* water efficiently so that it can achieve the greatest benefit for agricultural and environmental purposes.

The logical objective of Basin managers must be to manage the system to the maximum efficiency (lowest losses) and highest level of service to the water consumers (including the environment) that is economically feasible.

If this is not the case then the Basin managers need to be directed on what efficiency and levels of service they should aim for in running the system. You could, for example, save substantial future maintenance costs and let the system efficiency degrade to 50% like many third world countries but this would come at a devastating cost to the already stressed Basin.

Managing the Basin as well as possible has to be the objective, and investment in efficient infrastructure will be necessary if this is to be achieved.

Basin water measurement

Effective management requires accurate measurement and control of all Basin water, whether it is ultimately used for irrigation or for environmental benefit. This applies equally to water which is managed by the Commonwealth Environmental Water Holder (CEWH). The CEWH is currently the largest single holder of water rights in the Basin and will increase its entitlement under the proposed Basin plan options. With a likely entitlement of between 30% and 40% of total watercourse diversions, the CEWH would surely be required to manage this resource as efficiently as possible.

The same smart measurement and control technology, which is currently achieving efficiencies in the distribution and application of irrigation water, can be applied to the management of environmental water reserves, and should be a central component of an integrated, end-to-end Basin management plan.

The roll-out of accurate metering of water supplied to farms is already well underway and yielding significant dividends by eliminating inequitable distribution and encouraging more efficient irrigation practices on-farm.

Pre-modernisation metering is highly variable, although this is probably preferable to the ‘estimating of water use’ by which many irrigators account for their water usage. The previous standard device, known as the Dethridge Meter Wheel has, through various audits, been shown to have an average error of between 5-7% in favour of the irrigator, but the spread of individual meters is large, with individual meter accuracies spread broadly across the range of -10 to +25%.

These inconsistencies and inaccuracies have always been a barrier to the efficient management and control of irrigation water and a source of considerable inequity between farmers and indeed between all water users – agricultural, urban, industrial and environmental. Smart measurement and control technology removes this barrier. It is important that the roll-out of accurate water measurement continues, not just for irrigation but for all water.

Rubicon's solution

Rubicon has developed a unique technology which improves the efficiency of delivery of irrigation water to farms, which in turn results in large scale water savings with consequent economic and environmental benefits.

Most irrigation water in Australia – and globally – is conveyed to farms from storages using open channels. Rubicon's solution, called Total Channel Control, automates the operation of these channel delivery systems, enabling more efficient operation of the delivery network and resulting in less water wastage and improved service to irrigators, which facilitates further efficiencies on-farm.

It is an end-to-end solution that integrates a number of components to increase the efficiency of channel supply systems, including:

- water control gates that manage the flow of water in open channel networks with integrated meters and instrumentation to measure water level and flow;
- communications technology to remotely monitor and control gates and meters;
- management software designed to improve the utilisation of irrigation supply infrastructure; and
- unique modelling and control of channel dynamics.

The Rubicon solution is a much cheaper alternative to pipelining, improving delivery efficiency for a fraction of the cost.

It is unique in that it automates the entire supply process, from processing customer water orders right through to the automated operation of the outlets that supply water to the farm. All indications are that no other system in the world provides this level of automation and efficiency.

The result is a supply system that reduces wasted water by closely matching supply with demand. Additionally, by accurately measuring water throughout the system, leakage and seepage losses can be easily identified and high-loss sections of channel can be targeted for remediation (usually by lining the channel with HDPE plastic).

This unique technology was developed here in Australia, the result of a longstanding collaboration between Rubicon and the University of Melbourne's School of Engineering, headed by Professor Iven Mareels (co-author of this submission). The uniqueness of Total Channel Control has been recently recognised by the Australian scientific community with Professor Mareels being awarded The Australian Academy of Technological Sciences and Engineering (ATSE) Clunies Ross Award for his work on the IT-based management system underlying Total Channel Control in 2008. The Clunies Ross Award is one of the pre-eminent awards for scientists, technologists and innovators in Australia.

The opportunity for irrigation water savings

The agricultural irrigation industry is the dominant consumer of Australia's freshwater, accounting for approximately 70% of total use. Compared to other water users, irrigation uses its large share of water inefficiently. This situation is not unique to Australia and is replicated the world over.

Given the quantity of water used for irrigation, improving the efficiency of the systems that supply water to the farm and that apply water to crops presents a sizeable opportunity to save water.

The potential savings are in the order of 40% to 50% of the water currently diverted for irrigation. That is, through efficient supply and application of water, the same level of agricultural output can be achieved using 40% to 50% less water than is currently diverted from river systems.

These water savings are real and achievable. They would remain stored at the source and available for use in a controlled manner, timed to maximise improvements in the health of our river systems and the wider Murray-Darling Basin.

In order to achieve this level of water savings, the water supply system needs to be considered in its entirety – from its source to the plants that use it.

The Murray-Darling Basin Authority's goal of determining the volume of water required to maintain and restore environmental assets, using best available science and the principles of ecologically sustainable development requires a review of water use and water management at a Basin-wide level. This provides a once-in-a-lifetime opportunity to take an integrated approach to investment in irrigation infrastructure that manages the total supply from source to plant.

Breakdown of irrigation water savings opportunities

The potential for water savings occurs at three key stages as water moves from rivers through to productive use by plants:

Stage 1: Off-farm distribution

Off-farm distribution encompasses the transport of water from a river diversion to the farm meter outlet. Realistically, modernisation has the potential to improve efficiency by between 15% and 30%, taking water delivery efficiency from 60-70% to 85-90%.

The majority of these efficiency savings comes from addressing the three major loss components: outfalls (water spilt as a result of inefficient management), inaccurate metering and leakage through channels. Total Channel Control directly addresses these losses and identifies leaky sections of channel which can be addressed using targeted channel remediation.

Successful implementation of Total Channel Control within the Murray-Darling Basin has already proven that these efficiency gains are achievable.

Since implementing Total Channel Control the Shepparton Irrigation District (managed by Goulburn-Murray Water, Victoria) has achieved 84% efficiency and the Coleambally Irrigation District (managed by the Coleambally Irrigation Co-operative Limited, New South Wales) has achieved 90% efficiency, resulting in annual water savings of 60 gigalitres in the Coleambally District alone.

Importantly, an automated distribution system provides the on-demand supply and high flows are necessary for on-farm efficiency gains to be realised. Without high flows and on-demand supply, efficiency gains resulting from investment in on-farm infrastructure will be severely limited by the constraints of the supply system.

Stage 2: On-farm application

On-farm application relates to the supply of water from the farm meter outlet to the plant root. Here there are potential application efficiency gains of between 20% and 30% taking efficiency from 50-70% (traditional flood) to 85-90% (pressurised systems and precision surface irrigation).

With the majority of irrigated water in the Murray-Darling Basin currently applied using surface irrigation, it is not economically feasible to convert all irrigated areas to pressurised systems. Improving the efficiency of surface irrigation is the only viable option to achieve large-scale aggregate efficiency gains and water savings.

Efficient surface irrigation is known as precision surface irrigation, a technique involving the use of high flows (fast flow) and precise control over the application of water. A modernised off-farm distribution system as outlined in Stage 1 (above) is necessary in order to implement these techniques on-farm.

Stage 3: On-farm productive water use

On-farm productive water use relates to the timing and frequency of irrigation. Productive water use efficiency is a measure of the optimal water application for the maximum productive output. There are many examples that show farmers using up to half the amount of water for similar productive output.

The ability to accurately schedule irrigations is now part of the skill-set of the modern irrigation farmer. This encompasses providing farmers with the tools to help decide when to irrigate and creating an on-demand supply system.

Demand-driven water ordering allows the irrigation manager to respond directly to changing to plant water requirements, so that water supply is matched to crop water demand. On-demand supply is a key element of automated irrigation supply systems.

By implementing on-demand supply and accurate scheduling, the potential productive water use efficiency gain ranges from between 20% and 30% as a result of reductions in the number of individual irrigations per season. These gains can be achieved while increasing yield and improving crop quality through reducing water stress or waterlogging periods and increasing the number of days of crop productivity.

Investment in pipeline infrastructure

Replacing open channel distribution systems with piped systems is an alternative to channel automation. However, in the majority of circumstances the pipelining of large irrigation districts is not economically feasible.

Pipes are capital intensive. This high initial capital investment is followed by high operational costs incurred as a result of the large amounts of energy required to move water through them. Whilst not all pipelines are pressurised, decreasing pipe pressure increases the required pipe diameter to provide equivalent flows, which increases capital costs.

Channel automation uses gravity to move water through the distribution system. With solar-powered control gates, meter outlets and communications networks channel automation requires no external energy inputs, providing a low-emission irrigation modernisation solution.

The case for pipelines can only be sustained the closer you are to the plant. Near the end of the supply system the volumes of water to be transported are lower which requires narrower pipes and less pumping. Pipelines do eliminate water lost through evaporation; however this is only a small component of the water lost transporting water in channel systems (around 3%). Eliminating this loss by pipelining provides only a small marginal benefit at a large cost.

Examples of channel automation

Rubicon has implemented several of its Total Channel Control systems in Australia and internationally. The systems have achieved substantial efficiency gains, the savings are real and water that was previously lost is now able to be managed and used for environmental releases or used for further irrigation.

<u>Coleambally Irrigation District, New South Wales</u>

The Coleambally Irrigation District's 500km of irrigation channels has been automated using Total Channel Control. The district's distribution efficiency has improved from around 75% prior to modernisation to 90% in 2005-06, resulting in water savings of approximately 60 gigalitres per year. Some of the savings have been returned to the environment while some have been used for further irrigation.

<u>Goulburn-Murray Irrigation District, Victoria</u>

The Goulburn-Murray Irrigation District is Australia's largest by capacity. It is currently being automated as part of the Northern Victoria Irrigation Renewal Project (NVIRP) using Total Channel Control and is one of the largest canal automation projects in the world. The project will increase irrigation water use efficiency to at least 85% and save approximately 425 gigalitres of water annually.

These savings are being distributed to irrigators, Melbourne city and returned to rivers as environmental flows. Already the region's Shepparton irrigation district has achieved 84% efficiency.

<u>Macalister Irrigation District, Victoria</u>

The Macalister Irrigation District has been partially automated since 2004 using Total Channel Control. With the project partially complete, 8.1 gigalitres of water is already being saved annually and released back into local river systems. The project is on track to save 15 gigalitres annually once completed in 2011.

Conclusion

New, smart infrastructure and operational systems, much of which is Australian designed, owned and built, are already operating within the Basin and saving water. The potential exists to extend the technology across the entire Basin to achieve environmental, social, economic and food security objectives.

The development of the Murray-Darling Basin Plan presents a once-in-a-generation opportunity to build an integrated end-to-end solution across the Basin. Management of water at a basin-wide level is the natural geographic scale on which it should be managed. We are fortunate to be able to do this in Australia without requiring transnational cooperation as in many countries, uniquely enabling us to implement an integrated solution.

With accurate measurement and control of all Basin water we can achieve a healthier system that benefits all users. Smart technology enables the implementation of cost effective solutions that can directly link environmental water demands and the real-time water requirements of crops to storages that can intelligently manage water releases through a connected network of rivers, channels and pipes.

Based on real-world savings that are being achieved by modernised irrigation systems, a comprehensive, integrated, Basin-wide approach to water infrastructure investment could save up to 40% to 50% of current water course diversion limits. This would equate to up to 4,000 to 5,000 gigalitres if implemented across the entire Basin.

Reform on this scale would be a world first and would require a significant commitment but it could be implemented incrementally, with large step-change improvements in Basin health followed by ongoing incremental improvements. The information and insight provided by such a system would provide for improvements for many decades following the initial implementation and provide the basis for ongoing research into the optimisation of Basin performance.

We would both value the opportunity to present our position to the Inquiry in person should we be given the honour of being invited to do so.

Yours sincerely,

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