

Improving productivity and sustainability in irrigation

CASE STUDIES OF SUCCESS



PRACTICAL OUTCOMES FOR AUSTRALIAN COMMUNITIES

National Program for Sustainable Irrigation



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THE NATIONAL PROGRAM FOR SUSTAINABLE IRRIGATION

The National Program for Sustainable Irrigation focuses research on the development and adoption of sustainable irrigation practices in Australian agriculture.

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Research to improve irrigation sustainability

The National Program for Sustainable Irrigation invests in research to improve the sustainability of irrigation in Australia. The Program is a coalition of investment partners spanning industry and governments, with Land & Water Australia acting as Managing Partner. The Program provides a forum for debate and focusing effort on improving the sustainability of irrigated agriculture. Through it, issues impacting on sustainability now and into the future are identified and research is purchased, brokered and managed.

Attention is given to translating the information coming from research projects into applied knowledge.

Advances in knowledge through National Program for Sustainable Irrigation projects have led to improvements and water savings at the farm and landscape scales. Research has delivered new tools and information specific to water re-use, plant growth, water-use efficiency, precision irrigation, and

irrigation community-wide planning. While much has been achieved, much more research is required to achieve sustainable irrigation.

Irrigated agriculture accounts for around half of the profit generated from agriculture in Australia. It is the social and economic backbone of a number of substantial regions in rural Australia, contributing significantly to national development.

Better water management is required to address rising water tables, salinity and nutrient exports. Holistic catchment and landscape approaches are critical in optimising existing and future irrigation schemes. Increasing pressure from other water uses and declining water yield (in some regions) is forcing irrigated agriculture to improve its efficiency and sustainability.

The National Program for Sustainable Irrigation provides Australia with leadership in research and innovation to achieve sustainable irrigation.

Practical outcomes for sustainability and productivity

Through its partnerships with rural industries, the National Program for Sustainable Irrigation improves the productivity of irrigated agriculture, maximises community benefits, and minimises environmental impacts.

In its more than 20 research projects across Australia, the Program works at the property level with farmers, at catchment level with policy makers and planners, and at scales that cross state and territory borders.

Its projects identify and demonstrate practices and systems which:

- n offer higher productivity and improved quality while using less water and minimising environmental impact
- n improve security of water supply
- n assess and manage ecological risk, and
- n plan strategically to manage future uncertainty.

The projects featured in this booklet highlight the diversity of the research commissioned by the National Program for Sustainable Irrigation and the practical outcomes they offer for irrigation sustainability and productivity.

Case studies

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Less water | More pasture | Better pasture

1

WHAT	Two-year study comparing centre-pivot irrigation with traditional flood irrigation on a dairy farm
WHERE	Harvey Water Irrigation Area, Western Australia
RESULT	<ul style="list-style-type: none"> About 30 per cent less water used Up to 100 per cent increase in pasture production Improved quality of pasture No water run-off No nutrient run-off



A two-year study has found the use of centre-pivot irrigation on a dairy farm greatly improved water-use efficiency, pasture production and pasture quality compared with the flood irrigation used previously. Centre-pivot irrigation also brought wider environmental benefit through the absence of nutrient run-off.

Compared to the traditional flood irrigation operating beside it, the trial centre-pivot irrigator:

- n used 29 per cent less water in the first year and 31 per cent less in the second year
- n in the first year, 2003-2004, produced 54 per cent more pasture per hectare than the flood-irrigated bays, and in the second year produced 100 per cent more pasture per hectare than the flood-irrigated bays
- n produced higher quality; pasture from the centre-pivot site had a higher average percentage of crude protein and energy and lower average percentage of both fibre measurements.



While flood irrigation resulted in high levels of both water and nutrient run-off, there was no run-off from the centre-pivot site.

The project demonstrated on-farm innovation through:

- n adoption of centre-pivot irrigation for dairy pasture
- n adaptive water management through soil moisture monitoring, pasture sampling and management, and water and nutrient sampling, and
- n whole-farm planning to improve decision-making in investment in systems to improve water management.

The trial was the result of a partnership between the National Program for Sustainable Irrigation, Harvey Water, the Western Australian Department of Agriculture, private consultants Boorara Research & Management, irrigation specialists Kuzich & Co., and farmers the Hanks family. It won the Water Conservation and Management category of the 2005 Western Australian Environment Awards, a result that emphasises the win-win potential for profitability and sustainability in irrigation.



A 'learn and grow' approach

To underpin continuing agricultural prosperity, the Harvey Weir was built in 1916 for the first irrigation system in Western Australia. Since then, pastures in the region have been watered through flood irrigation of paddocks.

The Harvey Water Irrigation Area is now Western Australia's prime irrigated dairy area, supplying the south-west of Western Australia, including Perth, with more than 40 per cent of its milk.

There were no centre pivots being used for dairy pasture in the Harvey Water Irrigation Area when this project was first envisaged in 2001, according to principal investigator Mr Ken Moore. "Rob Kuzich, the owner of a south-west agricultural water management company, approached Harvey dairy farmer Dale Hanks about trialing the centre pivot system on his property. Before the project started in 2003, a lot of time was spent planning and setting up the demonstration," Ken said.

Local farmers showed great interest in the project. The research team has found a "learn and grow" approach the most effective path to adoption of new practices. This is based on helping the farmer through critical learning steps that give measurable results.

The Harvey team worked with experts from Queensland and Victoria. "It's that combination of local knowledge and national expertise that can help create advances in learning," Ms Liz Chapman, Program Coordinator for the National Program for Sustainable Irrigation, said.

Efficiencies possible without major investment

Purchase of a centre-pivot irrigation system is a major investment. Even with positive returns through water-saving and higher production, some farmers are reluctant to make such an investment. Industry uncertainty, family commitments, stage of life, and business structures might impact on a farmer's investment decisions.

This project has shown the potential benefits of centre-pivot irrigation, but farmers need to do their sums properly, according to principal investigator Mr Ken Moore.

"Farmers need to examine returns from their existing irrigation system and what could be achieved from investing in a centre pivot," he said. Farmers also should be aware that differences in soils, management practices and skills mean the results achieved in this project may not be duplicated completely on other farms.

There are still potential benefits even for those who choose not to make the switch to centre-pivot irrigation. "There is potential

for farmers to improve their surface irrigation through better monitoring of water applied to irrigation bays to gain information about the flow of water across the bay and infiltration," Ken said.

"Depending on the observations, adjustments could be made to management which may produce improved results."

"Our research also found that in the second year, we were able to improve the performance of surface irrigation. The amount of water applied was reduced and more pasture was grown," Using 15 per cent less water on flood irrigation bays in the second year of the trial, production of dry matter increased 46 per cent. "It appeared that water logging from surface irrigation slowed down pasture growth and resulted in more unwanted weeds," he said.

"This project has generated a lot of interest from local farmers in centre-pivot irrigation and improving the performance of their existing surface irrigation."

Whole-of system resource management

A whole-of system approach to water resource management has led the Harvey Water Irrigation Area to pipe the Area fully. The project, which is now underway, will replace open channels with pipes, introduce significant energy efficiencies with the introduction of a gravity pressure pipe supply, and be funded through trading the water savings.

The Harvey region is a great demonstration of what can be achieved through research, development, collaboration and trade-offs.



Lessons for the future

It also highlighted some lessons for the future, according to National Program for Sustainable Irrigation coordinator Ms Liz Chapman. These include the need to know and do more in improving plant water-use efficiency, reducing adverse impacts from changes to soil structure, and to develop new approaches to extension to give farmers the knowledge they need to embrace change.

Less water | More fruit | Better fruit

- WHAT** Open hydroponics or advanced fertigation on 32 acres of citrus previously flood irrigated
- WHERE** New South Wales and South Australia
- RESULT**
- | Water use halved
 - | Fruit production up by 40 per cent
 - | Improved fruit quality and consistency



Citrus growers in both New South Wales and South Australia are finding that open hydroponics, also known as advanced fertigation, reduces water consumption, and improves fruit production, quality and consistency as well as plant health.

While Australian research into open hydroponics is continuing, some farmers have independently implemented the approach. Award-winning irrigator Mr Dean Morris is a strong advocate of open hydroponics. Dean and his neighbour Mr Wayne Protheroe grow citrus on 32 hectares just out of Leeton in NSW. Until 2002 they flood-irrigated their orchard, using up to 10 million litres each year, and the results were not ideal. Since introducing open hydroponics, water use has been reduced to between 4 million and 5 million litres a year.

Dean said that flood irrigation limited yield and tree health was sporadic. "In some years we got high yields of small fruit and in alternate years, small yields of large fruit," he said.

"In 2001 we heard about open hydroponics, and the concept really appealed to us." Dean went to considerable effort and expense to learn about the system, visiting a number of farms in South Africa.

"We started planning how to implement the system on the plane home," Dean says. Preparing the adjacent properties – which share the same irrigation

system – for open hydroponics also involved considerable expense, although Dean considers conversion costs would be less per hectare on a larger property.

"It cost us about \$4500 per hectare more than a conventional drip conversion," he said. "We couldn't have justified the expense without the partnership between myself and Wayne, and the shared cost of the pump house."

For their first year, Dean monitored the system very closely but he has since gained a lot of confidence in it. "Believing in it was the hardest part – it takes a total shift in thinking," he says.

Using irrigation "help lines" to monitor moisture levels, Dean and Wayne have halved their water use, but more importantly they have improved production substantially.

"Previously I couldn't find a drip system that would increase my production while also reducing water use, but the open hydroponics system has done both," Dean said. "In our second season using the system, we increased our navel orange production by 40 per cent. Every tree is getting the same amount of water and nutrients – their health is much improved and they're consistently producing good quality fruit."

"I believe that in the next 10 years, if citrus growers don't have this system or something like it then they won't survive."

What is open hydroponics?

Open hydroponics or advanced fertigation is an advanced method of horticultural production that may have considerable potential as a form of sustainable irrigation in Australia.

The system involves the continuous delivery of water and nutrients via a drip irrigation system to a reduced root zone to limit the influence of soil on the development of crops. The soil is used only as the medium by which the water/nutrient solution is delivered to the root zone.

Water and nutrients are delivered continuously throughout the day, keeping moisture levels near to

optimum levels (field capacity) at all times. This eliminates water and nutrient stress, two of the main factors that limit production.

In this way it has principles similar to conventional hydroponics, according to Mr Steve Falivene of the NSW Department of Primary Industries.

"The soil still has an influence, but it is reduced by a certain extent," Steve says. "The water/nutrient solution is usually confined to the 'onion ball' of roots that each tree develops, delivered by pulse irrigation through non-draining dripper technology or by

continuous low-output irrigation."

Steve Falivene is the principal investigator for a project investigating open hydroponics' suitability for Australia's perennial horticulture systems, and the possibility of its widespread adoption. The project was funded by the National Program for Sustainable Irrigation.

Open hydroponics has been used to a limited extent in countries such as South Africa, Israel and Spain for up to 30 years. Only a handful of Australian growers have so far adopted it.

Best practice a prerequisite

The main advantage of an open hydroponics or advanced fertigation system is that its adoption requires producers to implement best-practice irrigation, according to project principal investigator Mr Steve Falivene, of the NSW Department of Primary Industries. He considers best practice – particularly the accurate monitoring of soil-moisture and nutrient levels – critical to the success of an open hydroponics system.

"Open hydroponics has potential to substantially reduce water and fertiliser use where inefficient practices are currently implemented, even though Australia has already demonstrated considerable production improvements," he said. "However, because the system requires accurate and continuous application of water

and nutrients, best practice is a critical prerequisite.

"With open hydroponics, the potential risks of management failure – salinity and waterlogging, for example – are increased. There is a reduced margin of error for mistakes. A key factor in encouraging widespread adoption of open hydroponics will be providing training in best-practice skills.

"Offsetting this management risk factor are considerable potential productivity gains in both yield and quality through better tree health. Healthier trees are better able to withstand attacks by pests and disease, and produce more fruit that is larger and has a greater shelf life. This potential has important implications for Australian growers' export markets."



Can infrastructure cope?

Because open hydroponics requires growers to irrigate constantly, its wider adoption would place a high demand for secure delivery of supplies of water at the district level.

"Open hydroponics requires constant pressure in the lines," project principal investigator Mr Steve Falivene said. Large-scale adoption might give the opportunity to move to pressurised systems on a district level where, in some cases, only open channels are delivering water.

In some cases it will require a degree of on-farm water storage."

The National Program for Sustainable Irrigation project also involves assessing water supply infrastructure in irrigation districts for its ability to meet the irrigation demands of open hydroponics.

Security of water supply

- WHAT** Trial use of treated effluent for irrigation in horticulture
- WHERE** More than 350 vegetable growers in Victoria and South Australia
- RESULT**
- | Security of water supply
 - | Draft guidelines enabling easy transfer to use of recycled water
 - | Best-practice irrigation methods



The use of recycled water for horticulture (treated effluent) is a tantalising prospect for sustainable irrigation and security of water supply. The National Program for Sustainable Irrigation has funded research into the practicalities for growers in horticulture.

Vegetable growers using recycled water in South Australia and Victoria have been working with the research team to identify the potential and respond to the risks of using recycled water.

The Program's research has shown that while Australian consumers may support a concept that reduces irrigation's use of water from rivers, many may not be willing to accept the risk they perceive as coming with eating produce irrigated with recycled water.

Growers share these concerns for themselves as well as for their markets. The introduction of recycled water has drawn a mixed reaction among Werribee growers, but drought and the need for a more secure supply of

water has led to more than 100 of them joining the trial and using treated effluent in irrigation.

Thirty kilometres west of Melbourne, the district has more than 3,000 hectares of mostly market gardens, predominately growing broccoli, lettuce and cauliflower. For almost 100 years, growers in the district had unrestricted access to water from the Werribee River and groundwater resources. Up to 17,000 ML (17 billion litres) was being used to irrigate crops annually.

However, the drought of 2003 saw growers' water allocations cut to 40 per cent or less. An alternative source of water was needed, leading to a recycled-water scheme using treated effluent from Melbourne's Western Treatment Plant.

Growers who have signed on to use the recycled water have done so mostly to ensure security of supply rather than for any quality benefits.

Best-practice irrigation management

Best-management-practice guidelines were developed through the project for growers to use and refine in the field.

The guidelines lead growers through the process of reviewing and adapting their management practices to enable an easy transfer to the safe use of recycled water.

Before using recycled water, growers must have an approved management plan and best-practice irrigation methods in place, and properties must be signposted. Through their quality assurance schemes or guidelines they must also have considered their customers' requirements.

Recycled water can be quite saline. In Werribee the recycled water is shandied with other water before it goes on the crops to reduce the impact of the salinity. Soil salinity levels must be monitored to avoid the build-up of salt around the root zone; growers must be prepared to flush the salt below the root zone if levels climb too high.

Concerns for salinity

Salinity has the potential to cause problems for growers using recycled water in Werribee. Because of the need to shandy the recycled water, grower Mr Anthony Agosta believes that using recycled water has merely supplemented existing supplies rather than secured his water supplies.

Shandying the recycled water has not entirely eliminated the salinity risk to crops, either.

Two 'daisy wheel' printed meters have been developed by the project for growers to identify easily the salt tolerance of their particular crop. The hand-held wheel tells growers of critical salinity levels that will affect crop yields, depending on soil type. The reverse side of each wheel is a salinity unit converter.

Anthony looks forward to the establishment of a strategy to reduce salinity levels of the recycled water to 1,000 uS/cm (1000 EC or 1.0 dS/m) by 2009, likely to occur through the treatment of recycled water with a desalination plant. This will enable growers to use more of the recycled water with less shandying.

Confidence in monitoring

The idea of using an environmentally-friendly recycled water resource for his crops has considerable appeal for Werribee vegetable grower Mr Anthony Agosta. However, his family's overriding concern when signing on for the scheme was to ensure a secure water supply.

The Agostas have farmed in Werribee for 50 years, currently producing iceberg lettuce, broccoli, cauliflower and brown onions on 45 hectares, using 270 to 300 million litres of water for irrigation each year.

Anthony has few concerns about using recycled water from an operational or safety perspective, because he has confidence in the quality monitoring processes in place. Nor does he see a risk from negative sentiment among consumers in the Melbourne and Sydney markets who buy his produce.



Balancing benefits and risks

Recycled water is generally higher in nutrients (nitrogen and phosphorus) than traditional sources of water, meaning growers might be able to reduce fertiliser inputs.

Growers need to account for the extra nutrients in their crop management strategies. Being aware of the extra nutrients is important also for their potential to increase algal blooms in farm storage dams, according to Victorian Department of Primary Industries research scientist Dr Rob Faggian.

"Irrigators with best practice in place will already be monitoring their soil and their water use,"

Rob said. "This kind of management is pretty much a prerequisite for using recycled water."

Other factors also need to be considered. Soil type is important, particularly in terms of clay content and the relative likelihood of soil sodicity problems developing.

"There are also potential environmental risks associated with using recycled water," Rob said. "For instance, native plants generally don't like too much phosphorus, so growers need to be mindful of their irrigation practices and avoid run-off where local biodiversity might be adversely affected. But again, best-practice irrigation accounts for a lot of these things anyway."

Other management issues may become apparent as the research continues. Particularly important, however, will be the outcomes of the Victorian Department of Primary Industries' latest trial, examining key factors such as the presence of pathogens and chemical contaminants (short-term impacts) and salinity (long-term impact).

"Assessing the use of recycled water for horticulture at both this and the regional level, using both traditional and best practice, is going to be very important," Rob said. "It will help improve the system, increase its use and thereby reduce pressure on natural water systems, and increase public confidence."

Assessing ecological risk

- WHAT Development of a formal and standardised method of assessing the environmental impact of irrigation activities
- WHERE National
- RESULT
 - | An Irrigation Ecological Risk Assessment Framework
 - | Management plans minimising ecological risk in the Murray irrigation region of NSW and the Lower Loddon River in northern Victoria



The future sustainability of Australia’s irrigated agricultural industries depends on effective ecological risk assessment and management.

An Irrigation Ecological Risk Assessment Framework has been developed to provide water catchment managers with a standardised method of assessing the effects of irrigation on aquatic eco-systems.

The framework, whose development was funded by the National Program for Sustainable Irrigation, sets out how to undertake a catchment-wide ecological risk assessment, with a focus on irrigation enterprises.

Environmental effects caused by irrigation can include waterlogging and deep drainage into the groundwater, salinisation, soil acidification, erosion, polluted run-off, diversion of water from wetlands, and change to river flow.

Some, such as a chemical spill into a waterway, have a low probability of occurring, but a large impact if they do. Others,

such as deep drainage below the root zone, happen more frequently, but the effect of an individual event is small.

The Ecological Risk Assessment Framework involves gathering information on the:

- n probability of an identified hazard occurring, and
- n size of the effect if it does occur.

Risks to the catchment can be described in a number of ways: words which indicate the size of potential problems; ranked subjectively by people who live or work in the catchment; or a computer model and/or real measurements can be used to quantify both the likelihood of a hazard and the size of its effect.

Irrigation enterprises generally co-exist with other agricultural activities such as dryland grazing and forestry, and with townships and tourism. All these activities can contribute to the degradation of ecosystems in the catchment. Recognising this, the framework has been designed to be adopted and implemented on a catchment-wide basis.

The Irrigation Ecological Risk Assessment Framework

Although the focus of the Irrigation Ecological Risk Assessment Framework is on aquatic ecosystems such as rivers, wetlands and estuaries, it can be used to assess the risks to other natural resources in a catchment. The steps involved in the Irrigation Risk Assessment Framework include:

- n formulating the problem
- n identifying the ecological values and assets possibly at risk
- n identifying the hazards that could impact adversely on these values and assets
- n analysing the likelihood and consequences
- n understanding how catchments work and how, when and why impacts occur
- n creating the ability to undertake scenario testing
- n characterising and ranking the risks
- n developing a risk-management plan to minimise the risks

Putting theory into practice

Partnerships were established to assess risks and develop and implement risk management plans in two irrigation areas in Australia by using the Irrigation Ecological Risk Assessment Framework .One focused on the Murray Irrigation region in southern New South Wales and the other on the Lower Loddon River in northern Victoria.

The aim of the Lower Loddon Catchment Ecological Risk Assessment (ERA) project was to provide information and decision-support tools to help relevant bodies identify management actions and monitoring programs to rehabilitate the Lower Loddon catchment.

The focus and scope of the risk assessment was developed during the problem formulation phase, in collaboration with stakeholders including natural resource managers, landholders, regulators, local government and water authorities.

Stakeholders identified two values at risk – the ecological health of the Lower Loddon River and farmland ecological values – to be the focus of a quantitative risk analysis.

The Lower Loddon risk assessment was a collaborative project involving staff from Environment Protection Authority Victoria, Monash University’s Water Studies Centre, the North Central Catchment Management Authority and Goulburn-Murray Water. The project was assisted by funding from the National Action Plan for Salinity and Water Quality and the National Program for Sustainable Irrigation.

The subsequent risk-analysis phase focused on developing quantitative Bayesian Decision Network models for these two environmental assets. These models summarise the causes and effects within the system, and describe the probabilities of various scenarios occurring.

The first model focused on predicting macroinvertebrate community diversity as an indicator of the ecological health of the Lower Loddon River. Habitat variables were found to have the greatest influence on the predicted macroinvertebrate community diversity and the model predicted that reducing stock access to the riparian zone and the channel would significantly improve the macro-invertebrate community diversity.

The second model focused on river farmland ecological values. The abundance of a common bird species, the grey-crowned babbler, was used as the measure of farmland ecological value; a model was developed to predict population abundance of the grey-crowned babbler.

The model predicted that reducing stock access to remnant forest area

significantly improved the probability of medium to high abundance of grey-crowned babbler populations

The results from both models support the current Loddon catchment management plan, where major fencing works are underway to reduce stock access to the riparian zone and river. Ms Anne-Maree Westbury, from Victoria’s Environment Protection Authority, described the Lower Loddon ERA process as worthwhile and well supported.

“We were very pleased when so many local people wanted to be involved in the Loddon ERA work,” she said. “It was invaluable to look at the river first-hand with local people and to involve local people because they notice changes in the river and the environment.”

Anne-Maree said it was important to spend time during the problem-formulation phase of the assessment to achieve a thorough understanding of what was required.

“In doing the Loddon assessment, we also realised that it was important to acknowledge upfront the work that had already been done in the catchment and to use that as a starting point.”

- n implementing the risk-management plan
- n monitoring the system to ensure the management plan is reducing the impact of the priority risks.

The framework stresses the need for stakeholder involvement throughout the assessment.

Confidence in monitoring

Information from the risk assessment must be combined with economic, social, political and cultural information to develop a full risk management plan for natural resources.

Risk assessment investigates the ecological values of the system; prioritising those values most at risk from a range of hazards. Risk management, on the other hand, is more focused on removal and minimisation of the impacts of the hazards.

Management plans should address the risks to the particular ecosystem with the most effective use of available resources, and

in a manner that is consistent, so far as possible, with the wishes of stakeholders. Relevant stakeholders for irrigation risk assessments and management include irrigators and irrigator groups, industry representatives, regional catchment management authorities, state resource management agencies, regulators, other government organisations, traditional owners, environmental groups, local government, scientists, non-government organisations, unions and consumer groups. Assessing ecological risk in a formal, broad approach is something many of these stakeholders are only just beginning to come to grips with.

Regional planning taking account of uncertainties

- WHAT** Strategic regional planning based on development and analysis of possible future scenarios
- WHERE** Goulburn-Broken catchment
- RESULT** Strategies identified to deal with future uncertainties and risks



One of Australia's major irrigation and food production areas is undertaking strategic regional planning based on scenario planning, a relatively new methodology in natural resource management.

The Goulburn-Broken Irrigation Futures project has been established to help the catchment community plan for the future. This planning is a considerable challenge, according to project leader Dr QJ Wang, principal scientist soil and water, Victorian Department of Primary Industries, Tatura.



"Regional planning needs to deal with complex issues, significant uncertainty and multiple stakeholders," QJ said. "This project has adopted a scenario planning approach, which to date has very little precedent in regional planning for natural resource management."

QJ said scenario planning was developed and applied by the Royal Dutch Shell Company to anticipate and plan successfully for the oil shocks of the 1970s.

"Scenario planning explicitly acknowledges ambiguity and uncertainty in the strategic question by creating a set of scenarios which are plausible alternative futures," he said. "These scenarios become a powerful tool for testing the robustness of various strategies and developing new ones."

The area that is the focus of the project is sometimes described as Australia's food bowl. The Goulburn-Broken catchment covers 2.4 million hectares, of which 280,000 hectares are irrigated agricultural land. Irrigated agriculture is a major component of the regional economy, producing \$1.35 billion in farm-gate gross value in 2000.

The Irrigation Futures project is crucial to planning in the region, evidenced by the funding support it has received from numerous regional and national bodies including the National Program for Sustainable Irrigation, the Victorian Department of Primary Industries, the Victorian Department of Sustainability and Environment, Goulburn-Murray Water, the Goulburn-Broken Catchment Management Authority, and the National Action Plan for Salinity and Water Quality.



Scenarios

The four external scenarios developed in the 24 workshops held around the region were:

- 1 The cost-price squeeze continuing to pressure farms to increase in size and invest in technology, growing numbers of lifestyle properties in the area, greater consumer expectations of “clean-green” produce and measurable climate change impacts on the region. Into this environment comes the discovery of fire blight in Australian horticultural areas and later, the introduction of genetically modified varieties resistant to the disease. Other genetically modified plants follow in what becomes a widespread adoption. In the meantime, water delivery systems are privatised and there is investment in infrastructure and services, free-trade agreements create both export opportunities and increased competition, and there is greater demand for high quality “bush” niche products.
- 2 Population shifts to rural areas, and there is a subsequent decline in agricultural production, changes in land use and technological innovations due to external pressures resulting in synthetic food products dominating consumption.
- 3 A decline in rural Australia resulting from the environmental movement briefly gaining ascendancy in national politics, followed by a revival under conservative forces strengthened by evidence that climate change is not caused by human activity.
- 4 A major world recession, drought, Chinese competition and reduced water allocations substantially impacting on Australia’s agricultural exports, partially offset by China’s demand for bulk agricultural commodities and Australia’s largely genetically-modified-free status.

With these future scenarios in mind, the workshops developed a series of 29 strategies to deal with the future.



Reconfiguring infrastructure ‘no small task’

Reconfiguring the infrastructure for a region that accounts for about 20 per cent of all irrigated water use in Australia is no small task, according to Goulburn-Murray Water’s Mr Derek Poulton.

“Planning alone will require three years and \$6 million, and we’re looking at implementation costs of at least \$200 million,” Derek said. “The need for flexibility in future systems has been highlighted by the scenario planning approach.”

Reconfiguration planning has also involved the compilation of region- and district-level atlases, documents containing base information on matters such as irrigation, drainage and land-use.

“We thought it was important to include in the atlases the outcomes from the Irrigation Futures project,” Derek said. The atlases will be used by water service committees to help them develop local plans.

“We’ve been particularly interested in the project as the future is uncertain and planning based on current land- and water-use is inappropriate. Water trading, climate change, changing land use and enhancement of the environment will clearly be major factors in shaping the future of our region. Scenario planning provides a means to consider a range of futures and develop strategic options that will be robust across several of the perceived futures.”



Identifying local and external challenges

The Goulburn-Broken region's irrigation industry faces substantial challenges in the future, according to Victorian Department of Primary Industries scientist Dr QJ Wang.

"It's one of the oldest gravity irrigation regions in Australia, and much of its aging infrastructure will need renewal over the next 50 years," he said. "However there are also external challenges and opportunities such as free trade agreements, climate change, water reform and technology developments that will significantly influence the industry's future."

What influence these developments might have on the Goulburn-Broken catchment's future was a key focus of workshops led by the Irrigation Futures project team at six regional centres – Benalla, Cobram, Echuca, Kyabram, Seymour and Shepparton – at the commencement of the project.

Participation across organisations and interest groups is critical, and considerable effort went into targeting the right people to take part in the workshops, according to the project's operational manager, Mr Leon Soste.

"When we conceived the project in its first stage, we knew we needed as big a picture as possible," Leon said. "We cast the net widely, covering a range of interests and views and including producers, processors, social groups, environmental groups, businesses and government agencies.

"We had to put a lot of work into getting the participation we wanted, and despite some initial hesitation among the people we targeted we built trust and provided participants with a high degree of ownership of the process."

The project team conducted four workshops at each of the six regional centres. Workshop facilitator Mr Robert Chaffe said getting participants to think about the future was helped by focusing on the past.

"Participants were asked to think about the changes that had taken place in the Goulburn-Broken catchment area, as well as those that shaped the region, in the past 30 years," Robert said. "The exercise certainly helped in getting participants to think outside of their comfort zone in terms of longer time spans.

"Despite a disparity of backgrounds, there was a strong convergence in stakeholder aspirations. People generally wanted a balanced social, economic and environmental outcome and to have active community participation in future decision-making processes." About 120 people participated in the workshops (most going to each of the four workshops in their region), and with the project team they developed four external scenarios that might come to pass and impact on the future of the region.

"These weren't predictions of the future," says project systems analyst Mr David Robertson. "They were intended to reflect the future's uncertain nature."

'The best approach'

A keen participant in the forums was Shepparton farmer Mr John Pettigrew. An irrigator on the Goulburn River, John has been farming for 45 years and sits on the boards of Goulburn-Murray Water (the local rural water authority) and the Goulburn-Broken Catchment Management Authority. He is also chair of the Irrigation Futures project's governance committee.

"Scenario planning was really the best approach as it really allowed us to focus on the future," he said. "It was a very worthwhile exercise.

"The Goulburn-Broken Catchment Management Authority and Goulburn-Murray Water have already adopted some of the findings, one of which was the need to build on the region's adaptive capabilities so that it has the flexibility to meet a range of challenges.

"One of the important challenges for the area is the need to reconfigure our water infrastructure. Goulburn-Murray Water is now planning for this and will use findings from the Irrigation Futures project to ensure the region's irrigation infrastructure is flexible."





Researching the future

As the case studies in this booklet demonstrate, the National Program for Sustainable Irrigation has already achieved remarkable success in identifying the questions that need answers to make irrigation more sustainable and more productive. It has identified and demonstrated practices and systems that improve sustainability, boost productivity, and address ecological and other risks.

It has shaped and managed research of profound importance to horticulture, agriculture and rural communities, to Australian landscapes and Australian people.

The second phase of the National Program for Sustainable Irrigation is now being launched. This will provide a forum for irrigation stakeholders to be involved in developing research priorities and exchanging information. It will invest in research that will improve the sustainability of the irrigation industry, and will provide a mechanism for effective and efficient use of industry funds for sustainable irrigation research, innovation, and knowledge dissemination.

Research already underway will support future improvements in the sustainability and productivity of Australian irrigation.

Governments are working with around 250 stakeholder groups to develop a sustainability framework for application in northern Australia. The Northern Australia Irrigation Futures project, initiated by the National Program for Sustainable Irrigation, has an outlook of 50 years and more.

Project leader Dr Keith Bristow, from CSIRO in Townsville, said the project is attempting to develop a framework for decision-making about irrigation in northern Australia that communities and governments can aspire to.

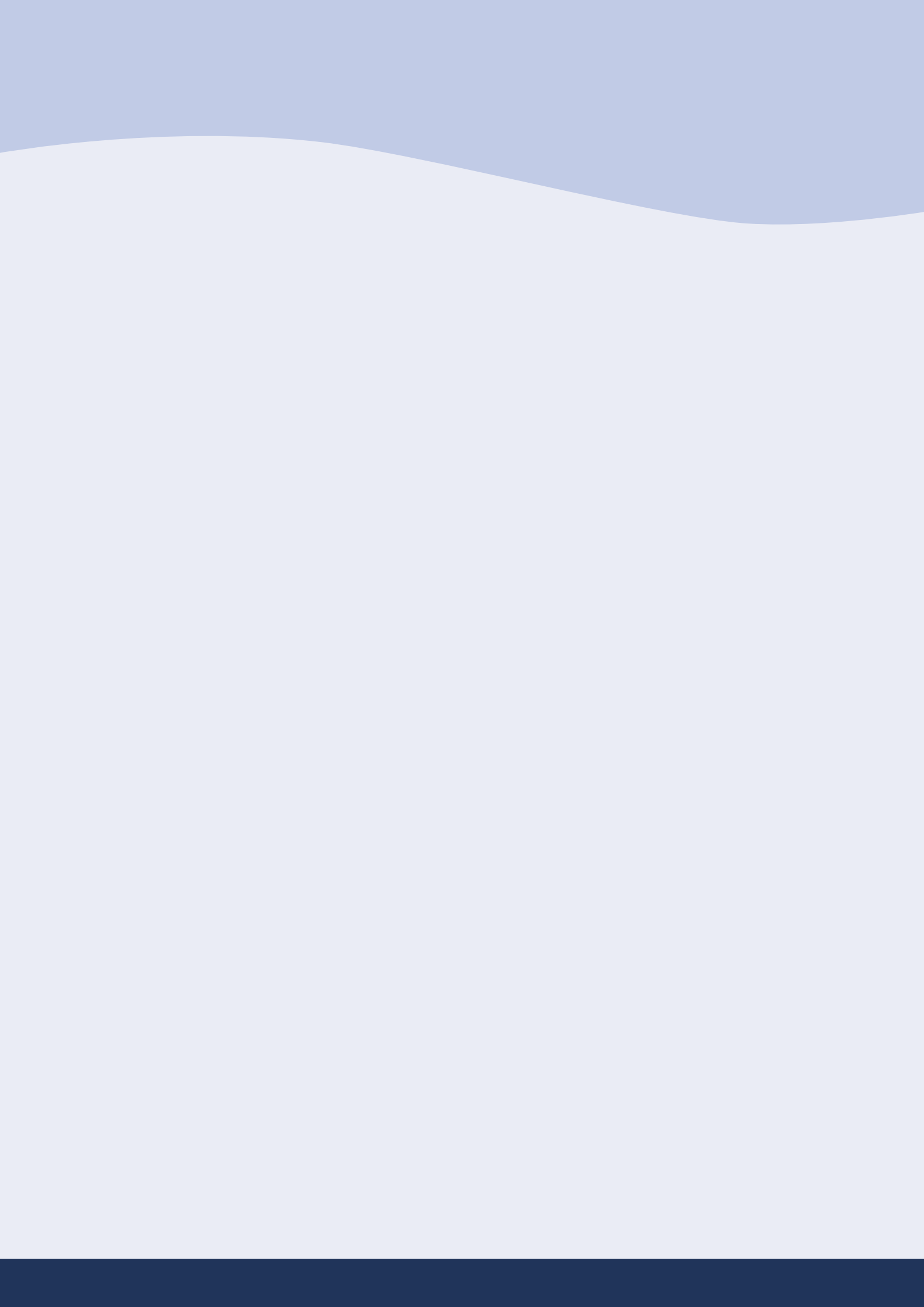
This is challenging research, but also often evokes passionate responses: for some, it is a much-needed opportunity to consider both the sort of future they would like for northern Australia and the key question of who gets to determine that future; for others, it raises concerns about the potential

for increased pressure for irrigation in northern Australia. The project is not to decide whether new irrigation developments should or should not occur in northern Australia, but to assist those who will need to make such decisions by improving the knowledge, tools and processes available to them.

While the northern Australia project is well underway, another research area is only beginning to take shape. In 2005 the National Program for Sustainable Irrigation resourced a scoping study to understand the potential gains from 'harmonising' water supply systems; whether substantial new efficiencies could be achieved if all the different components in a water supply system communicated with each other and were streamlined. The scoping study found that more efficiency is possible. Catchment organisations that have a role in water supply or landscape management will be able to improve their communications, and 'smart' systems will be implemented, to the advantage of both production and the environment. Some promising new technologies are at trial stage. The market will play a role in the technological harmonisation of water supply, delivery and on-farm systems.

Harmonising water systems, while important, will not determine irrigation futures. Realising the link between individual and community aspirations and business and environmental assets is crucial to our future. Total System Harmonisation is a term that the National Program for Sustainable Irrigation is using to describe systems that combine engineering or technological feats with social values, particularly as they relate to community views of catchment and environmental assets. Projects such as the Goulburn-Broken Irrigation Futures study (see Case study 5) are helping inform our linking of human systems with complex land and water systems.

Landscape values must be balanced with socio-economic perspectives and the reality of biophysical environmental needs if we are to achieve irrigation sustainability. The National Program for Sustainable Irrigation provides a mechanism for us to improve our understanding of each of these elements to underpin innovation and beneficial change.



CASE STUDIES OF SUCCESS

This booklet illustrates the diversity and practical outcomes of research projects undertaken by the National Program for Sustainable Irrigation to improve the productivity of irrigated agriculture, maximise community benefits, and minimise environmental impacts.

All research projects undertaken by the Program are detailed on its web site at www.npsi.gov.au

The National Program for Sustainable Irrigation has produced a review of more than 10 years of irrigation research, now available on CD and from the Knowledge Base on the web site.



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