
**Land and Water Australia Project
DAW 39**

**Developing the concept of
satellite links in on-farm
irrigation R&D for
improved R&D integration
across Australia**

**Final Report
December 2003**





Department of Agriculture
Government of Western Australia

LWA project reference no:	DAW 39 (formerly SOU 1)
Project title:	Developing the concept of satellite links in on-farm irrigation R&D for improved R&D integration across Australia.
Principal investigator:	Mark Rivers Research Officer Department of Agriculture Western Australia.
Principal project collaborators:	Geoff Calder General Manager Harvey Water.
Report prepared:	December, 2003.
Project objectives:	<p>Overall:</p> <p>To improve the development, the adoption and the effectiveness of irrigation research by:</p> <ol style="list-style-type: none"> 1. developing, trialing and evaluating a model for integration of broad-based R&D results into regions not previously involved in same – South West Irrigation (SWI) in this case; 2. establishing links between WA R&D, researchers and irrigators across other States for the purpose of correlating on-farm irrigation technical information and research in managing problems in irrigation areas; 3. adopting a network database of personnel who will provide an assessment of current research within Australia to develop project links, and; 4. developing local extension material on best management practices identified during the research where applicable. <p>Final Milestones:</p> <ul style="list-style-type: none"> • Integrate the sourced information into the development of a program of best management practices for the SWIA; • Document a plan for on-going networking and information sharing, taking into consideration the outcomes of CL25 in addition to the results of investigations from this project; • Document a plan for future technology audits to monitor progress of implementation of BMP's, and; • Undertake an evaluation of the methodology chosen for this project including recommendations to LWRRDC on how best to develop the "satellite mode" in future (if considered worthwhile).

The South West Irrigation Area and Harvey Water

The South West Irrigation Area (SWIA) is situated just over 100 kilometres south of Perth to the west of the Darling Scarp in the south west of Western Australia. The area is approximately 75km long and up to 15km wide, covering over 44,000 hectares of land in the shires of Waroona, Harvey and Dardanup. The SWIA contains some of the best soils in the south west for agricultural production and has historically been targeted for agricultural development. Today over 90% of land in the SWIA has been cleared for agriculture, mainly for dairy and beef cattle grazing, however a growing area is undergoing development for horticultural production of citrus, grapes and vegetables. Land use in the area has historically been dominated by dairy farming, and continues to be the predominant enterprise on irrigated properties. Recently however, land uses have started to change to a wider variety of enterprises, due in part to recent pressures on the WA dairy industry through deregulation of the national dairy industry, and also due to significant improvements in the irrigation infrastructure in the SWIA. Horticultural developments are now occurring, and land managers remaining in the dairy industry are actively seeking to make better use of their irrigation entitlements through utilisation of the new pressurised, piped distribution system.

The total value of agricultural production in the SWIA is estimated to be over \$100 million per annum, 80% of which comes from dairy production. The area has access to a large quantity of good quality irrigation water all year round, making it strategically important for the supply of milk during summer (supplying about 50% of Western Australia's total annual milk production).

The region does experience some soil salinity problems common to other irrigation areas and in some districts is subject to irrigation with saline supply waters. Irrigation drainage waters also run to environmentally sensitive estuarine receiving bodies including RAMSAR-listed wetlands.

In 1996 South West Irrigation (now known as Harvey Water) was established as a privately operated, irrigator-owned cooperative to oversee the supply and distribution of irrigation water to irrigators in the SWIA.

Since 2001, Harvey Water has invested approximately \$18 million in the upgrading of the original, gravity-fed channel water distribution system into a fully piped and pressurised system. Water pressures are maintained at pressures ranging from 300 – 600 KPa which allows irrigators to operate certain types and sizes of pressurised irrigation systems (such as Centre Pivots) directly from the water supply pipes with a requirement for only back-up or moderately sized ancillary pumps.

As well as investing considerable financial resources in improvements to the water distribution system, Harvey Water has also invested considerable resources in irrigation research and development in the region. Their role in securing access to additional research funds and coordinating research activities has been extremely important in terms of advancing the debate on the regional "sustainability" of irrigated agriculture.

DAW39 and associated projects

The work initiated and implemented through this project "The development of satellite links in on-farm irrigation R&D for improved R&D integration across Australia" now forms one component of a larger overall programme of work designed to develop and implement Best Management Practices (BMPs) for

sustainable irrigation farming in the SWIA. The relationship between these projects can be seen in figure 1.

The \$50,000 grant initially approved by Land and Water Australia (LWA) to assist with the South West WA BMP project comprised approximately 14% of the overall budget of this project over a three year period. However, the aspects of the project which are linked to the LWA funding are some of the most important components of the project overall. In particular, the development of robust, objective, repeatable and transportable processes for BMP development is an especially important area of effort. This is already being identified by interested parties external to the project who are attempting to determine the best process to follow in BMP development for various regions and agri-industries. Currently, approximately \$700,000 pa is being directed towards the development of agri-environmental BMPs for the SWIA and industries which are significantly represented in this region. These are summarised below.

Projects developed through and linked to DAW39

Coastal Catchments Initiative Projects:

- Identification and control of rural point sources in the coastal catchment of the Peel Inlet and Harvey Estuary
- Identification and evaluation of rural nutrient management practices in the coastal catchment of the Peel Inlet and Harvey Estuary

These two projects are part of a broader suite of seven WA CCI projects supported by the Natural Heritage Trust and administered by Environment Australia. In total, they are designed to provide a comprehensive approach to the identification and quantification of actual and potential risks to the health of the Peel-Harvey estuarine system through nutrient export from urban and rural environments, and to design, model and implement practices which reduce these impacts.

Links to projects being administered by the WA Department of Environment are particularly important as these links are facilitating the development of innovative approaches in linking regulation to demonstration of progress towards best practice.

SWIA Water Quality Monitoring Project

- A study commissioned by Harvey Water to obtain accurate, factual data regarding the quality of irrigation water from the headwaters of the SWIA through to outfall into the broader regional drainage systems.

During the early BMP-development stages of DAW39 it became apparent that only extremely limited objective data existed regarding regional water quality in the SWIA and the effects of various irrigation practices on this water quality. Harvey Water, in partnership with the Department of Agriculture, Western Australia (the Department) implemented this project in an attempt to fill this gap and to start to provide realistic data on which to build BMP development.

Irrigation BMPs Project:

- Improving the sustainability of irrigated farming in the SWIA through an industry-involved complete “best practice” program. A major emphasis is on surface (flood) irrigation systems for forage production for dairies, but the BMPs studied will also investigate alternative irrigation technologies and agricultural land uses.

This project (funded significantly by Harvey Water) provides on-ground verification through a robust scientific process of the BMPs being developed and proposed through DAW39. It is the direct link between the “paper” BMPs and the field sites which prove them to be “best.”

It also builds on the work undertaken through the SWIA Water Quality Monitoring Project (discussed above) which sought to objectively develop a more complete understanding of water quality issues within the SWIA.

DairyCatch

- Industry-led and funded development of Environmental BMPs for the WA dairy industry with an initial focus on effluent management, nutrient management and water use efficiency.

Harvey Irrigation Systems Project:

- Innovative irrigation and agronomic systems for the SWIA that will increase water use efficiency and farm productivity, and reduce ecological impacts.

This is the next phase of NPIRD / NPSI funding for the SWIA.

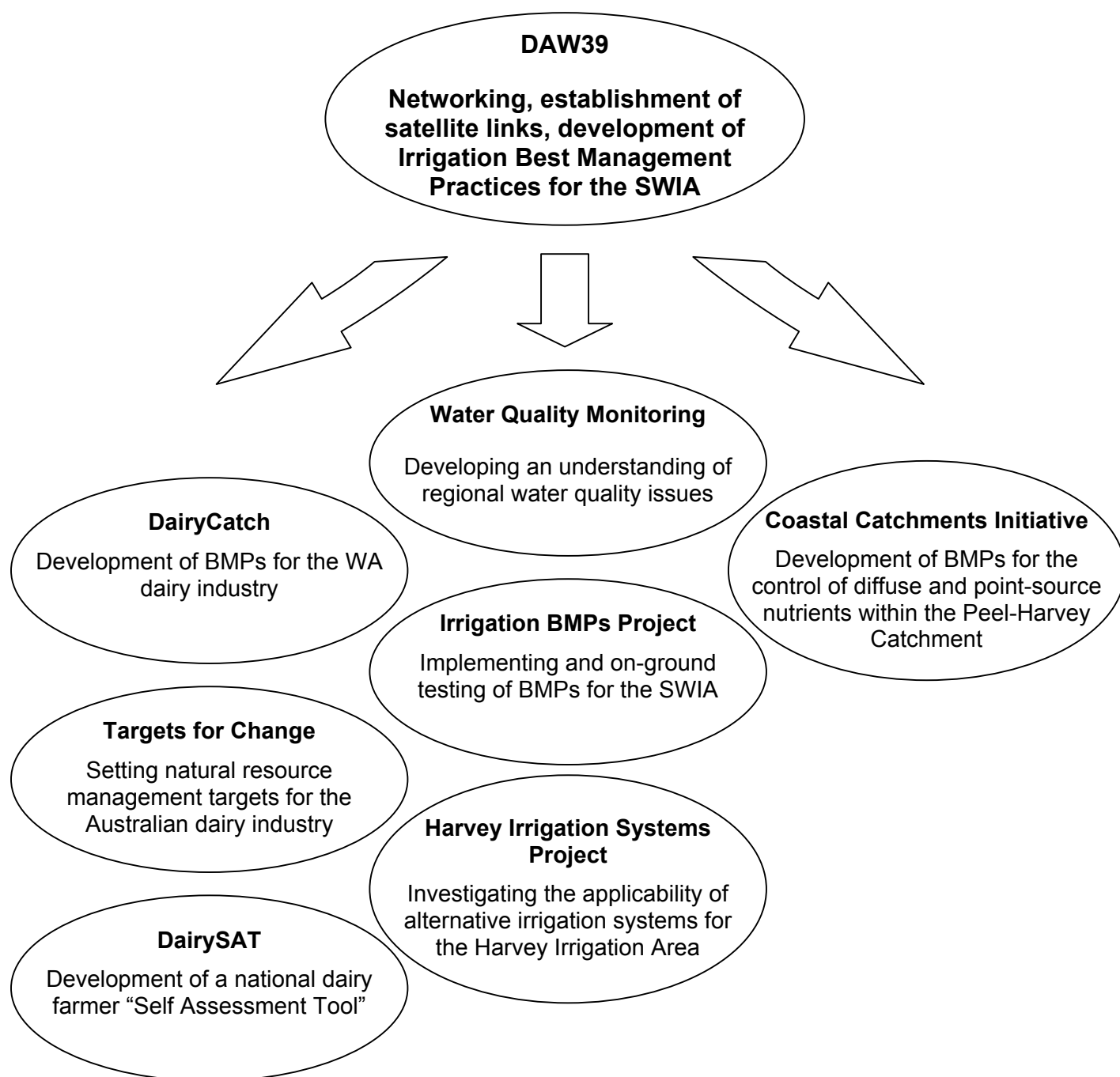


Figure 1: Projects developed through and linked to DAW39

Project Outcomes

Milestone

Integrate the sourced information into the development of a program of best management practices for the SWIA

Project Objective: 4

Practical, on-ground management options for irrigators in the Harvey Irrigation Area are now a significant way towards final development. The [BMP development process](#) detailed in previous Milestone reports and included as an attachment to this report has provided a robust and thorough framework on which to assess regional sustainability risks and to develop and prioritise BMP development. In recognition of this, the Department is now developing a significant new project which aims to use this process to systematically develop management options (BMPs) for each of the WA agri-industrial groups and agricultural regions. The format of the BMP documents has been developed with involvement of Harvey Water and the SWIA irrigators. Not surprisingly (but counter to some earlier trends in BMP / EMS development) the final BMP format has been designed to provide a great deal of detail to interested irrigators. Although an [introductory BMP package](#) has been developed which provides an overview of regional agri-environmental issues, highlights regional risks and provides general direction on the best ways to manage these risks, very specific, [detailed BMP specification sheets](#) are also being developed which provide detailed, practical instructions on practice modifications which would be required to move further towards “best”. It was initially thought that BMP documents would need to be brief and simplistic to meet the needs of the irrigator client group, but [the final package of BMP documents](#) is likely to total approximately 80 in number.

Importantly, nationally and internationally, Environmental Management Systems (EMS), sustainability indicators or other measures of environmental performance are being used as a means to access, or continue to access, commodity markets and to demonstrate sustainable use of natural resources. Australia is now starting to follow the lead of other developed nations in this regard, although on a national scale, Western Australia appears to lag the rest of Australia (van Beuren 2001). International research indicates that demonstration of environmental responsibility through some means is now becoming essential to maintain market access, and several associated means of assessment, audit and verification are being developed. Anecdotal evidence from representative enterprises in a variety of agri-industries supports this and there is now considerable resource commitment to the issue of EMS – in a strict EMS / ISO14001 sense, or in a more generic way. *However, it is also recognised that EMS implementation alone does not guarantee any improvement in environmental performance or necessarily result in improvements in the sustainability of enterprises or industries.* The development of on-ground, practical BMPs for the SWIA now positions Harvey Water and their irrigators extremely favourably if they choose to follow the path of EMS implementation to more sustainably manage their natural resources to: secure access to future commodity markets; to maintain ownership of their water entitlements, or; for more altruistic “clean and green” reasons. International commodity markets are becoming more astute in the way that they assess environmental performance. Mechanisms which have robust, objectively-developed practices as their basis are now being favoured over generic “systems” approaches which provide no real assurances other than simply demonstrating consideration of sustainability issues. Similarly, natural resource managers are looking towards clear demonstration of sustainable farming practices as a means to avoid potential

prosecution under environmental harm legislation. The development, adoption and promotion of BMPs as the means to demonstrate this is the preferred option of the WA Department of Environment. Again, this positions Harvey Water very well in this regard.

Key Findings

- **Grower groups (in this case Harvey Water) favour a two-part BMP design which provides (a) a broad overview of the regional sustainability issues and the practices which best address them, and (b) specific design criteria for particular BMPs which are relevant to their current action plans. (This view has also been verified by the DairyCatch project described earlier).**
- **A third part to the BMP design is also valuable to BMP developers. This section of the BMP documentation is a comparative assessment of the practice against the regional sustainability indicators. It provides a means to compare various practices, and to also assess the usefulness of practices developed through a particular industry or region for other industries and regions.**

Recommendations

- **That the BMP process developed and documented as part of DAW39 be advocated as the preferred method of BMP assessment and development for agri-industries generally.**
- **That progress towards BMP development and implementation via this route be assessed by natural resource management agencies as fulfilling the requirements to avoid regulation under “environmental harm” legislation.**

Milestones

Undertake an evaluation of the methodology chosen for this project including recommendations to LWRDC on how best to develop the "satellite mode" in future (if considered worthwhile)

Document a plan for on-going networking and information sharing, taking into consideration the outcomes of CLW25 in addition to the results of investigations from this project

Project Objectives: 1, 2, 3

The initial phases of the “networking” component of this project concentrated on the identification of research projects and staff throughout Australia who it was thought might be best placed to provide advice to their counterparts in Western Australia on various aspects of irrigation (particularly surface irrigation) research and development. Links were initially formed based on advice from (then) NPIRD staff and then particularly from Jeremy Cape as the Principal Investigator of NPIRD Project CLW25 and coordinator of the National Irrigation Science Network. It was in fact a formal requirement of this project that links be established with Jeremy Cape in recognition of his experience in the coordination of research activities and as the coordinator of an already-established formal research network. The end result of the initial assessment of related research activities was a Microsoft [Access](#)TM database which was submitted to NPIRD as part of the early milestone reporting requirements. This database has proven valuable to some degree to research staff in WA as it provides (albeit limited) summaries of national irrigation research activities, organisations and personnel. It provides a first-point-of-contact database for personnel either examining the possibility of initiating new research and,

therefore, wishing to assess previous work, or staff wishing simply to find the appropriate organisations from which to gather information. The value of maintaining this database with any real level of vigour, or of web-enabling the database to allow access to and maintenance of the database by a distributed network of personnel is, however, thought to be low. Research staff and organisations appear to be changing rapidly and continuously and, while periodic maintenance of the database may be worthwhile, any attempt to maintain it as an up-to-date, accurate reflection of the irrigation research industry at any given time would require significant investment of resources. The value of the database as an initial guide to Western Australian-based staff, organisations, activities and interests appears to be the best use of this resource. Discussions with Jeremy Cape in regard to this aspect of the project indicate that his findings through CLW25 and the NISN agree with this outcome.

Networking following the initial generation of the database tended much more to develop through personal contacts and references. Initial study tours to the Shepparton region of Victoria have produced the most robust and valued links between staff in WA and elsewhere.

Another issue which has become apparent through the course of the project has been a change from simply attempting to link generic “irrigation” research staff, to more of a self-driven network building mechanism through specific industry linkages. Ongoing network development now aligns closely with some of the additional projects which have evolved from DAW39 and which are beginning to be developed with an *industry* rather than *resource* focus. As examples, networks are now improving between: Viticulture research staff in WA and their Eastern-States counterparts through projects managed by the Wine and Grape RDC in Adelaide, and; dairy sustainability researchers around Australia through the “Dairying for Tomorrow” suite of projects including the Dairy Self Assessment Tool Project and DairyCatch (based in WA). Also, WA-based research staff working in irrigated *industries* are being approached to work on national steering committees or to provide feedback on national projects. This, although, not quite the network concept foreseen at the commencement of DAW39, is a key indicator of the success of DAW39 in initiating better and more robust networks of irrigation researchers. This also appears to be the most appropriate way in which to develop the concept of satellite links in R&D. Satellite trials are only useful if they are valued by both the initiator of the research and the host of the prospective trial site and if the research which they are designed to assess is relevant to both (or all) parties. Again, the common linkage which works best to ensure that these criteria are met is through an industry-driven approach.

This shift from resource (water) to industry linkages has a clear parallel in the evolving field of Environmental Management Systems in Australian Agriculture. Outcomes of the recent 3rd National Conference on EMS in Agriculture clearly illustrated the need (and natural tendency) for EMS (or other research activities) to be linked together through industry groups. This mode of linkage appears to have the broadest acceptance throughout the research and industry development communities. Regional, resource or enterprise-based approaches, while valuable in their way, do not receive the industry support necessary to drive their continued development, support and implementation as do activities linked through common agri-industries. This is becoming increasingly important as the research activities which have been previously funded by State Governments rely more and more on external support.

Key Findings

- Agri-industry-level involvement by research staff and organisations has the best chance of producing research findings that are accepted by growers and reach implementation. That is, resource or issue-based collectives are not the best means to ensure validity of results or of eventual improvement in resource condition.
- Similarly, the concept of satellite trials is limited as a general research approach as it relies on a close alignment of priorities among a geographically distributed group of researchers and/or land managers. It does have a role to play in nationally-coordinated research, however, research of this nature still tends to be driven more by the needs of large, well-established collectives than by issues of national significance per se.

Recommendations

- That NPIRD / NPSI form formal and ongoing links with representatives of the major irrigated industries and formally link NPIRD / NPSI strategic objectives to those of these partner groups.
- That the influence of industry collectives be used more by natural resource managers through not just the inclusion of these parties in the negotiation process, but by assigning the primary communication and strategic planning role to this relationship.
- To ensure ongoing development of the networks developed through this project, it is also recommended that future NPSI projects be either required to develop network analyses as part of the development of their communication plans, or be provided with network analyses by the NPSI reviewers who are generally already aware of relevant links.

Milestone

Document a plan for future technology audits to monitor progress of implementation of BMP's

Project Objectives: 4

Staff involved in DAW39 over the course of the project have also been actively involved in the development of the CCI Projects which have been described earlier. A significant proportion of the work of these projects is concerned specifically with the development of appropriate technology audits to track the progress of BMP implementation. The developments in this area being completed through CCI will also be used in tracking the implementation of the SWIA BMPs.

Essentially, the techniques used to track BMP implementation follow the recommendations of the [protocols](#) developed by the US EPA Office of Water (USEPA, 1997), which are recognised as a benchmark protocol in this area. The protocol, published in 1997, has a stated focus of “the design of monitoring programs to assess agricultural management measures and best management practice implementation, with particular emphasis on statistical considerations” and specifically covers the areas of: sampling design; methods for evaluating data; conducting the evaluation, and; self evaluation.

The CCI project has also critiqued this protocol in light of Western Australian needs and differences to the US situation ([Ecotones and Associates, 2003](#)) The outcomes of this review have been incorporated into the [BMP audits](#) currently occurring throughout the Peel-Harvey Catchment including the SWIA.

Specific issues which have now been addressed include: the calculation of the number of enterprises required to be surveyed to develop a statistically valid description of present BMP distribution throughout the catchment; the format and content of the questionnaire used as the primary data-gathering tool; the likely period of review required for significant enough BMP implementation to occur to allow the observation of significant changes, and; the required links between the questionnaire-based BMP information and relevant GIS data sets to allow spatial analyses of BMP distribution change and environmental effect.

Key Findings

- **Robust, repeatable processes and protocols are a requirement to allow meaningful assessments of BMP implementation on a local and regional scale.**
- **Protocols have been developed internationally and should be used to allow comparisons on temporal and spatial scales.**
- **The assessment of BMP implementation is likely to be the best guide as to the sustainability or otherwise in agri-industry terms. Assessment of the condition of the regional, physical resource base is likely to be difficult, costly and may not provide meaningful information until long-term datasets are available and analysed.**

Recommendations

- **Communicate currently available BMP audit protocols to research organisations aiming to implement BMPs and/or natural resource management tracking systems.**
- **Expand State of the Environment reporting processes to include BMP tracking as part of assessments of the progress of agricultural sustainability.**

Overall Project Summary

At the commencement of this project, DAW39 had essentially two simple objectives:

- To develop a suite of Best Management Practices for use by irrigators in the South West Irrigation Area in the south west of Western Australia, and
- as part of the development of these BMPs, to improve the two-way exchange of information between irrigation research staff in WA and their counterparts in the other states of Australia.

However, instead of equally simple outputs, the project has produced significantly larger outcomes for WA irrigation research.

BMP packages for SWIA irrigators are still in the developmental phase with draft packages now becoming available. However, the need for local, on-ground verification of these practices, which was recognised through project stakeholder consultation mechanisms, has driven the investment of more financial and human resources into the development of a local BMP-testing programme. Essentially, irrigators are happy to wait longer for BMPs which are locally meaningful.

The BMP development process which was designed in the early stages of DAW39 has drawn considerable national interest and is being assessed by the Victorian DPI, Queensland Primary Industries and Ag NSW as well as now being adopted by the Department of Agriculture, Western Australia as the primary mechanism for the

development of sustainable farming systems throughout the State's agricultural regions.

Much improved networks also now exist between certain elements of the irrigation research community although not yet this group of organisations and personnel as a whole. It has now been clearly shown that national research communities are more robust and more easily established using industry links than either natural resource or "area of interest" linkages. These industry groups tend to value the contributions of all parties within their industry, while irrigation research as an issue in itself tends to be driven by the large irrigation regions and States and their perceptions of national needs. For a relatively small irrigation area such as the SWIA, there is some work yet required in raising the profile of the work being completed in this region to the level where it sways national research directions. Notwithstanding this, the profile of work originating in the SWIA and the research networks developed through DAW39 are now significantly better developed than they were at project commencement. Also, through projects which have to varying degrees evolved from the work and networks of DAW39, the future of irrigation research in the SWIA, ongoing links with researchers nationally, and the development of sustainable irrigation management options appears bright.

References

Ecotones and Associates. 2003. Department of Agriculture Peel-Harvey CCI Project Measures for BMP auditing and tracking - a review. Final project report.

United States Environmental Protection Agency. 1997. Techniques for Tracking, Evaluating and Reporting the Implementation of Nonpoint Source Control Measures - Agriculture. United States Environmental Protection Agency, Office of Water.

van Beuren, M. 2001. Emerging markets for environmental services – Implications and opportunities for resource management in Australia. Rural Industries Research and Development Corporation. Canberra.

Attachments, publications and information products

[A Proposed Process for the Development of Best Management Practices in Agriculture by the Department of Agriculture, Western Australia Discussion. Paper February 2002. Department of Agriculture, Western Australia. 2002.](#)

[South West Irrigation Area BMP assessment sheet proforma. Department of Agriculture, Western Australia. 2001.](#)

[South West Irrigation Area Sample BMP Cover and Assessment sheet. Department of Agriculture, Western Australia. 2001.](#)

[South West Irrigation Area BMP Cover Page Pro-forma. Department of Agriculture, Western Australia. 2001.](#)

[South West Irrigation Area Sample BMP Specification. Department of Agriculture, Western Australia. 2002.](#)

[Department of Agriculture, Peel-Harvey CCI Project. Measures for BMP auditing and tracking - a review. Ecotones and Associates. 2003.](#)

[Department of Agriculture, Peel-Harvey CCI Project. BMP tracking Survey. Department of Agriculture, Western Australia. 2003.](#)

[DAW 39 Communication Strategy. Department of Agriculture, Western Australia. July 2001.](#)

[DAW 39 July 02 additional Milestone Report information. Department of Agriculture, Western Australia. 2002.](#)

[DAW 39 Environmental Situation Audit July 2001. Department of Agriculture, Western Australia. 2001.](#)

[South West Irrigation Area Final Water Quality Monitoring Report. Department of Agriculture, Western Australia. 2002.](#)

[South West Irrigation Area BMPs Draft Introductory Booklet. Department of Agriculture, Western Australia. 2003.](#)

[DAW 39 Present Practices audit. Department of Agriculture, Western Australia. July 2001.](#)

[Techniques for tracking, evaluating and reporting the implementation of nonpoint source control measures – Agriculture. United States Environmental Protection Authority – Office of Water. 1997.](#)

[DAW 39 Irrigation research database. Department of Agriculture, Western Australia. 2001.](#)

[South West Irrigation Area BMPs Draft overall BMP document design. Department of Agriculture, Western Australia. 2003.](#)

[DAW 39 Poster presentation at ANCID. Department of Agriculture, Western Australia. 2001.](#)

[Presentation to International Sustainability Conference. Rivers, M. Department of Agriculture, Western Australia. 2003.](#)

[DAW 39 July 01 Milestone Report. Department of Agriculture, Western Australia. 2001.](#)

[DAW 39 July 02 Milestone Report. Department of Agriculture, Western Australia. 2002.](#)

[Abstract of paper presented to the International Sustainability Conference. McCrea, A. and Rivers, M.R. 2003.](#)

[DAW 39 Methods and Evaluation. Department of Agriculture, Western Australia. July 01.](#)

[DAW 39 R&D Report. Department of Agriculture, Western Australia. July 2001.](#)

[Field proven Best Management Practices are the only valid basis for EMS. Rivers, M.R. and Summers, R.N. Presented at National EMS in Agriculture Conference. Tanunda. South Australia. 2003.](#)

[Development of sustainable irrigated farming systems for Western Australia. McCrea, A. and Rivers, M.R. Presented to the International Sustainability Conference. Fremantle. Western Australia. 2003.](#)