Change at the Irrigation Area Scale: An Exploration of Integrated Area Wide Management (IAWM) for Irrigation Communities

John Wolfenden and Michael Evans

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1. Executive Summary

This report presents the authors’ review of the Integrated Area Wide Management (IAWM) initiative in the Emerald region of central Queensland.

We provide some background information on the genesis of IAWM, observing that it has come about largely as a result of the actions of Ian Rankine and Bill Wilkinson in response to their observed need for improved data gathering and information management and use for farmers. This happened within the context of a community response to perceived existing and potential over-regulation and their wish to be involved in determining their own future.

IAWM is observed to build local skills and capacity for assessing and monitoring both production and environmental condition and trend, resulting in land managers feeling more in control and a true ‘learning environment’ being established that encourages appropriate change. Key features of IAWM include:

1. Focusing on how knowledge is managed and exchanged.
2. Participation of landowners in data collection, interpretation and review is essential.
3. A safe learning environment is essential for data sharing partnerships to emerge.
4. Shared data is used to build area-wide data sets that are ground-truthed at the farm level.
5. Area-wide data sets are in turn used to inform management decisions at the farm level.
6. Irrigators need access to government natural resource and water quality data, and can contribute their own data in partnership.
7. Private sector consultants are also involved in building data sets and as such require separate partnering arrangements.
8. IAWM is a practical, cost-effective means to monitor impact of land management on land and water.

We document the genesis of IAWM, and provide a synopsis of the key conceptual attributes of IAWM including its objectives (Section 4.2.1), enabling conditions (Section 4.2.2), drivers (Section 4.2.3) and barriers (Section 4.2.4).

It is noted that IAWM is necessarily “bottom-up” (implemented and owned at the farm level) rather than “top-down” (government or industry level). The need for this grassroots ownership is founded in extensive on-farm monitoring networks and the need for a safe learning environment that balances confidentiality with an effective means of peer-to-peer feedback on shared resource management issues.

The mission of IAWM is described as: To develop excellent local community capacity to participate in biophysical monitoring and landscape management...to be accomplished by engaging and skilling landholders and their service providers, and working collaboratively with scientists to implement practical yet rigorous monitoring programs.

The articulated vision of IAWM has a number of components including:

- To provide a safe learning and information exchange environment that allows growers and industries to pursue a continuous improvement learning cycle.
To build capacity and a process of involvement within the reform agenda.

To support rural industry groups to undertake some level of landscape information management within an agreed framework.

To provide an integrated data resource centre (e.g. data sets, knowledge, in-kind support, funding).

To integrate production and landscape issues and support better decision making.

To build partnerships that enable relevant change to occur more efficiently.

To develop more cost effective biophysical monitoring systems.

To implement better NRM outcomes based on looking at things at both the farm and landscape levels in an integrated manner.

To gain due recognition of industry Farm Management Systems, so that growers need not complete more than one planning process.

IAWM has many dimensions, and as such is difficult to represent in few words. This makes it difficult to communicate to others who might otherwise be interested in exploring it further. We propose that it might thus be useful to construe IAWM as one or more of the following:

- A model for sustainable collaborative data-sharing partnerships.
- A process-based model for capacity building in information supply and management.
- An action-learning model for participative action learning.
- A framework that encourages rural groups to participate in formal knowledge and information management.

We provide some consideration of theoretical underpinnings that can be applied to the IAWM model. In particular, we note that IAWM can be seen to transform the learning cycle under which innovation and adoption lead to business practice improvements, from a government-driven model to a more responsive stakeholder-driven model. Rather than circumventing government policy, IAWM creates new opportunities for partnership with government such that policy is informed by adaptive on-ground action.

Finally, we propose the development of an implementation model for IAWM. Our review of IAWM highlights its effectiveness as a tool of change towards more sustainable practices by farmers, and we thus recommend its consideration for use in other areas. Noting that IAWM can not be construed as a 'shrink-wrapped product' that can be neatly packaged up for others to use, we favour a process-based approach to implementing IAWM. Such an approach might be promulgated as a facilitation kit targeted at peak industry groups and agencies, setting out the stages of an IAWM implementation, including the identification of local issues, assessment of the local suitability of IAWM, templates for data sharing partnerships, and general timetables for key milestones.

In order to develop the necessary processes for implementing IAWM in other catchments, we recommend that a subsequent project should be undertaken with the twofold objectives of developing the details of a process-based implementation approach and actually establishing IAWM in another area. We also recommend that an interactive forum / workshop be undertaken to explore and exchange experience between those involved in area-wide styles of landscape management. The CRC Irrigation Futures is well placed to auspice and facilitate such endeavours.
2. Background

This Cooperative Research Centre for Irrigation Futures (CRCIF) project to review the IAWM approach, was undertaken with funding from the CRCIF and partner institutions Queensland Department of Natural Resources, Mines and Water and University of New England. It is part of a larger CRCIF project Supporting irrigation community and industry responses to change at a range of scales, and focuses on the irrigation area scale. Other parts of the project have dealt with catchment scale, remote irrigation community scale and property scale. Reports on these aspects of the project can be found elsewhere (see www.irrigationfutures.org.au). The overall project was undertaken to develop a range of tools and methods to assist irrigation communities at a range of scales to adjust to the contemporary policy and natural resource changes that they face. This research was and is needed so the pace and direction of change can be effectively managed through critical social and economic interventions.

The following text is adapted from the original project proposal for this review of IAWM as submitted to the CRCIF, and provides some context.

Integrated Area Wide Management (IAWM) has been successfully implemented in Central Queensland around Emerald (Rankine and Wilkinson, 2003; Wilkinson and Rankine, 2004; Wilkinson, 2005). Its intent has been to establish practical on-ground solutions to build landholder and local service provider capacity to become adept at managing both property and landscape scales in a manner that will make a difference. The model has a business focus that involves building an independent objective support system that connects growers, existing private and government service providers and land managers at a local level. It provides practical condition and trend monitoring tools and methodologies, and integrates whole systems information, both existing and new, in a way that encourages land managers to use the information. Most importantly, it builds local skills and capacity for assessing and monitoring both production and environmental condition and trend. The result is that land managers feel more in control and a true ‘learning environment’ is established that encourages change where appropriate.

From the commissioning documents for this project, the purpose of this report is to document the principles, processes and learnings from the IAWM model, including the design and description of the IAWM management support system. This would include description of the techniques and practices in use, identify support resources needed and relevant stakeholder processes.

The report is centred on a case study of Integrated Area Wide Management in the Fitzroy Basin, supported by a literature review. The literature review in Section 3 provides a theoretical and historical context for IAWM in the Fitzroy Basin and examines projects similar to IAWM at a national and international level. Section 4 sets out the case study and examines key implementation processes trialled in the Fitzroy that may be applicable in other regions. Section 5 provides some discussion of the findings of the case study and presents suggested next steps to be taken towards a wider implementation of IAWM style activities.
3. Literature Review

IAWM can be identified principally as a mode of regional capacity building through data sharing, hence the starting point for the following literature review.

3.1. Natural Resources Data Management, Collaboration and Adoption

There is clear evidence in the natural resources management literature of a need for improved data management processes, and of the need for a more collaborative approach to data management. GHD (2000) argue that:

A basic imperative of good consultative processes is the availability of information...Generally good consultative processes include development of an information strategy which includes several mechanisms to provide information to stakeholders. These may or may not be developed with stakeholders depending on the timeframe and the purpose. That this [WAMP] process currently lacks an information strategy is a major weakness. (GHD, 2000:1)

Similarly, Letcher (2005) points out:

A key gap identified by many stakeholders involved in these negotiations was easy access to integrated, scientifically sound and generally agreed upon information on the socioeconomic tradeoffs likely to result from changes in access, allocation and pricing. (Letcher, 2005:1)

A number of recent developments in integrated natural resources management are designed to improve the accessibility of data and information for stakeholders in a collaborative setting. Hamilton (1997) argues that a participative learning approach can improve rates of adoption, but requires shifts in expertise such that scientists acquire facilitation skills and landholders develop research skills. Similarly Kingma et al. (2001) note that:

The capacity to learn and change requires a learning culture, extension, communication and a support environment and resources in the form of decision support systems, technology, data and information, R&D results, networks, IT and related systems. (Kingma et al. 2001:2)

Evans and Wolfenden (2005) explore this approach and provide evidence that decisions based on reasoned discussion of complex data, supported by management simulation of the outcomes of decisions, can lead to better resource management outcomes than a strict adherence to policy determined by analysis of data.

There is a large literature on the factors influencing rates of adoption of land management innovations in Australia (Pannell et al. 2005; Stanley et al. 2005; Richards et al. 2005; Guerin and Guerin 2004; Darbas 2004; Cary et al. 2002; McCartney 2002; Kingma et al. 2001; Pannell 2001; Marsh and Pannell 1998, 1997; Glyde and Vanclay 1996) The majority of these identify, *inter alia*, a need for improved access to information and data in forms that highlight production advantages as well as environmental benefits.
3.2. IAWM: Innovation in Natural Resources Data Sharing

Rankine and Wilkinson (2003) address the issue of collaborative data sharing in the form of a proposed information centre, to be established as part of the Integrated Area-Wide Management (IAWM) framework now operating in the Fitzroy Basin of Queensland. Such a resource centre would have the following general features:

- A rural industry information provider.
- Independent and objective information role and service provider to participants.
- In-house GIS capacity to integrate, analyse and add value to the individual data sets supplied under agreement from different stakeholders.
- Information management protocols that include: confidentiality; recognition of custodianship and rights of access; fitness for purpose; meta-data documentation; establishing a single ‘point of truth’ for datasets.
- Two-way integration with growers, consultants, agencies so that interchange of data and concepts facilitates constant improvement.
- Development of more comprehensive landscape and property level information and meshing of these two scales to improve decisions on an individual and area wide basis.
- Most cost effective method per participant.
- Good ‘transferability’
  (Rankine and Wilkinson 2003:4).

While the “bricks and mortar” proposed resource facility has not yet been realised in the Fitzroy, a number of elements of IAWM contribute to the presence of a “virtual” data resource centre in the Basin, which in many ways has been a considerable success (N. Morawitz and G. Kavanagh, Central Highlands Cotton Growers and Irrigators Association (CHCGI), pers. comm. 2006). A comprehensive GIS and natural resources management data store has been established and IAWM is providing mapping and facilitation / process support for a number of activities. These elements are explored in more detail in the Emerald Field Study that follows this literature review.

Wilkinson and Rankine (2004) provide a broad theoretical outline of IAWM as follows:

- IAWM is a practical, cost-effective means to monitor impact of land management on land and water.
- Participation of landowners in data collection, interpretation and review is essential.
- A safe learning environment is essential for data sharing partnerships to emerge.
- Shared data is used to build area-wide data sets that are ground-truthed at the farm level.
- Area-wide data sets are in turn used to inform management decisions at the farm level.
- Irrigators need access to government natural resource and water quality data, and can contribute their own data in partnership.
- Private sector consultants are also involved in building data sets and as such require separate partnering arrangements.
- Collectively, there is significantly more value when all these sectors share data, knowledge and skills within an agreed framework

‘IAWM is now recognised as a valued objective service provider that supports local landscape management.’ (Wilkinson and Rankine, 2004:8). It has established local commitment and ownership for the longer term.
Rankine and Wilkinson (pers. comm. 2006) identify the theoretical connection in terminology between IAWM and Area-Wide Pest Management (AWPM). These groups existed within the cotton industry, and had been implemented in the Fitzroy some time before IAWM first emerged there. They were established so that smaller geographically cohesive groups could exchange ideas and address issues that particularly related to pest management. There is however, no specific methodological link between AWPM and IAWM in the Fitzroy.

IAWM started as a direct result of joint discussions between private sector, industry support staff, state agency people, and landholders. The evolution of IAWM was grounded in finding a better information and process model that operated at a scale that would support effective decision making at an on-farm and landscape scale; and a mechanism that engendered rural industry becoming more formally involved in both the science and information collection, interpretation and management. The simple theory was that developing better knowledge management capacity in rural industry and its service provider network would enable these groups to contribute more effectively to decision making processes with government, catchment groups, industry and so forth. In other words, it set out to develop better information management and resource support processes that work for landholders and peak rural industry, and ones that industry see will suitably support their Farm Management System (FMS) and Best Management Practice (BMP) programs.

IAWM processes did make direct use of the existing AWPM groups as well as other existing social and business networks, and follow the concept of AWPM to the extent that natural resources management problems are regional in extent, requiring coordinated effort to integrate actions at the farm scale into outcomes at the regional scale. The methodological detail of data sharing under IAWM is not derived from AWPM but from locally-specific ideas about effective collection and integration of data from the farm scale to the regional scale. As such IAWM is less clearly defined in the professional literature (Starkey, 2004) than in the field documentation and tacit knowledge of the Fitzroy Basin project, which is explored further in the case study (Section 4).

3.3. Related IAWM Projects

A project referred to as Integrated Area-Wide Management has recently been trialled in the Condamine Catchment in Southern Queensland (Condamine Alliance, 2005). As with the Fitzroy Basin IAWM project, the Condamine Alliance acknowledges AWPM as a theoretical source and highlights among other things the role of community-based monitoring and evaluation, but makes no specific reference to IAWM in the Fitzroy Basin. While no specific links are articulated, Condamine Alliance staff, along with staff from other State Agency and Regional NRM catchment groups, did visit the Emerald Irrigation Area and discussed IAWM activities that were happening within the Fitzroy in its early formative stages when it was developing its first investment proposals to the State and Federal Governments. In 2003, the project leaders Rankine and Wilkinson, were invited to speak at Board meetings at both Condamine Alliance and QMDC.

The key outcomes of the Condamine project, active from March 2004 to March 2005, include (Condamine Alliance, 2005):
• There must be a focus on multiple causes and multiple effects. The IAWM approach to achieving NRM outcomes provides an opportunity to address factors in multiples on a landscape scale to achieve measurable change.
• A focus on a single cause-effect relationship limits the impact of outcomes. The key lies in an integration of efforts to view an ecosystem on a sub-catchment and catchment level.
• Approaching NRM on an area-wide basis takes into consideration the farming system and its operation and impact within the wider subcatchment and catchment. This is an important step in providing clarity to land managers, regarding the cause and effect of operations. It demonstrates that the landscape scale approach is instrumental in achieving NRM outcomes.
• IAWM provides a catalyst for widening discussions on NRM and building on individual experiences.
• IAWM is a long-term process and cannot be fully implemented and tested within a 15 month timeframe. Implementation can require a two year period to show change and up to four years to show demonstrable outcomes.
• In the Warwick region, there has been a 200 percent increase in interest in NRM since the commencement of IAWM. (Condamine Alliance, 2005).

Condamine Alliance (2005) notes that monitoring of changes in natural resources is achievable at the local level, but requires support at the landscape level:

Protocols and indicators for monitoring biodiversity were not hyper-technical, although they require "commitment to understanding and application" if data is to be meaningful. Biodiversity monitoring can be "stand alone" or integrated within a framework to identify the benefits at the patch scale. Detectable benefits at the landscape and regional scale require significantly more effort and institutional support. Monitoring over time will provide key biophysical findings required to apply simulation modelling of the landscape under various land-use scenarios. (Condamine Alliance 2005:14)

Condamine Alliance (2005) reports partnerships as a significant component of the management process, including secondment of agency staff and development of partnerships between Landcare groups, state agencies, independent research units, local government, private consultants and landholders. However the precise nature of partnerships in relation to data sharing is not specified. Overall, the extent to which the Condamine IAWM project has been influenced by the Fitzroy Basin project is not clear.

3.4. The IAWM Facilitator Role
An often unrecognised aspect of the social challenges of natural resource management is the range of personality types of landholders and agency staff attempting to engage in change processes. Shrapnel (2001) argues that:

Extension has always played an important role in the dissemination of information. It is being increasingly recognised, however, that the success of the process of information exchange is influenced by the quality of the relationship between the extension worker and the landholder ... Some extension workers may not feel comfortable in groups as a legacy of their
underlying personality structure and may feel more relaxed with the traditional extension model involving one-on-one contact. (Shrapnel 2001:1)

Identifying IAWM facilitators with personality traits suited to a community leadership role may be quite difficult but is an essential component of successful IAWM implementation.

3.5. IAWM Nationally

There is evidence that the Fitzroy IAWM project, specifically, is beginning to reach a wider audience, and that data management in this form is being recognised as a key issue:

Meetings with farmers were held at Glengallan, Hermitage Research Station, Victoria Hill and Brookstead last week to identify two case study areas for the trialling of the Integrated Area Wide Management developed in the Emerald area in central Qld. The projects will help farmers undertake property based planning and to collect data in local catchments to monitor environmental conditions and inform them how their on farm practices can be improved to achieve sustainable and profitable results. (QFF, 2005)

There is also evidence that sharing of natural resources data is being recognised as a priority at a national level, however the emphasis tends to be on top-down rather than bottom-up initiatives. The National Land and Water Resources Audit (NLWRA 2006a) refers to an increasing demand for data and information to support planning and decision-making processes underpinning natural resource management across all levels of government, industry and the community. NLWRA (2006a) refer to their current project to provide national infrastructure for data access, but identifies no local users of this data other than “all government and regional organisations responsible for on-going natural resource data collection and resource condition and trend reporting”. This may not be compatible with the local-regional scale of IAWM partnerships. It also embodies the historical priorities whereby government and other research and planning groups focus on building data within government sectors as the primary focus. IAWM is focused on supporting rural industry and rural communities as the primary client and the interface that results in the conjunctive use and exchange of that information.

A joint initiative of NLWRA and ANZLIC (Australia’s national Spatial Information Council) has led to the development of a Natural Resources Information Management Toolkit (NLWRA 2006b). This has many ‘best practice elements’ in common with IAWM, in particular the goal of strengthening capacity of regional groups to access and manage data to address natural resources issues, and the practical need for partnerships between industry, government and others. It is noted however, that the toolkit emphasises the technical rather than the social challenges of data sharing, an area to which the IAWM project may contribute.

3.6. IAWM Internationally

International precedents for IAWM are difficult to judge, as the institutional frameworks upon which such partnerships might be based vary widely from country to country. Particularly in the United States, natural resources data sharing agreements between agencies and stakeholders can be identified (Ohio DNR, 1996; Land Information
Ontario 2002; USDA 2001), however these tend to be top-down rather than bottom up and in the main may reflect a legal safeguard rather than capacity-building agenda.

In the international development arena, forms of area-wide natural resource management are also reported, however once again the area-wide focus refers very generally to forms of Integrated Environmental Management (as a generic term) and not specifically to data sharing partnerships as envisaged by IAWM. The Global Environment Facility, an independent financial organization that provides grants to developing countries for projects that benefit the global environment and promote sustainable livelihoods in local communities, reports on projects for the management of trans-boundary water resources:

…projects in this [Operational Program, OP9] often involve determining what sectoral changes are needed to achieve the goals of sustainable development as well as what type nature of measures are needed to ensure that the ecological carrying capacity of the waterbody is not exceeded. Consequently, with these considerations and the area-wide [emphasis added] nature of interventions, community involvement and stakeholder participation become especially important (GEF, 2006).

4. Emerald Field Study

The authors conducted a field study of the Emerald IAWM project in March 2006, meeting the key project partners and some stakeholders as well as touring parts of the Fitzroy catchment and participating farms. The objectives of this study were:

- To obtain first person accounts from key participants of the project’s development and implementation.
- To obtain or identify sample documents such as partnering agreements and farm monitoring guides.
- To obtain first person stakeholder testimonials of the project’s benefits and drawbacks in terms of integrated farm and natural resource management.
- To begin to develop descriptive and theoretical frameworks for IAWM as an innovative and potentially significant contribution to the methodology of integrated management.

The following field report is based on transcripts of meetings with project partners and stakeholders. Transcripts were recorded by hand as chronological notes in conjunction with systematic construction of discussion on whiteboards. As a qualitative mode of reporting, the following interpretive summary refers to the meetings in which statements occurred, listed as M1 to M5 below, rather than to specific individual statements. This is intended to preserve a degree of anonymity as well as to provide a more effective form of testimonial provenance than the pers. comm. form, which would tend to become confusing over multiple meetings.
Table 1. Meetings conducted during Emerald IAWM study tour 1-3/3/06

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Date</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>1/3/06</td>
<td>Bill Wilkinson, Ian Rankine and authors, Emerald Department of Natural Resources, Mines and Water (NRMW) Offices</td>
</tr>
<tr>
<td>M2</td>
<td>2/3/06</td>
<td>Bill Wilkinson, Ian Rankine and authors, Central Highlands Development Corporation Offices</td>
</tr>
<tr>
<td>M3</td>
<td>3/3/06</td>
<td>Bill Wilkinson, Ian Rankine and authors, Emerald NRMW Offices</td>
</tr>
<tr>
<td>M4</td>
<td>3/3/06</td>
<td>Bill Wilkinson, Ian Rankine, Geoff Kavanagh and authors, Emerald CBD</td>
</tr>
<tr>
<td>M5</td>
<td>3/3/06</td>
<td>Bill Wilkinson, Ian Rankine, Neek Morawitz and authors, Morawitz property</td>
</tr>
</tbody>
</table>

The following discussion summarises these transcripts thematically as key points for evaluation. It is anticipated that existing evaluative frameworks for integrated management will be applicable, with some modification, to the evaluation of IAWM.

4.1. Emergence and Development of IAWM in the Fitzroy Catchment

The term *Integrated Area Wide Management* emerged in the Fitzroy catchment in 1999, primarily in response to land and water reforms that were occurring at the time and a recognition by landholders and a range of other stakeholders that an integrated approach was required. This linked with Area Wide Management groups and Integrated Area-wide Pest Management (IAWPM) measures which were in implementation in the catchment at the time (M1, M2). Despite this convergence of terminology there appears to be little similarity between IAWM and IAWPM as distinct methodologies (M2). IAWPM is examined briefly in the literature review (Section 3).

IAWM was first suggested as a term by participants in a 1999 workshop coordinated and attended by the current IAWM project leaders¹ Bill Wilkinson and Ian Rankine along with other representatives of dryland and irrigated growers, local government, consultants and utility industries (M1, M2). This workshop is seen as a turning point in that it was convened extraordinarily to deal with the mounting complexity of the regulatory environment, and to a lesser extent to deal with specific farm and resource management problems recognised at that time (M2). Issues considered at the workshop included:

- Multiple government-driven changes occurring at that time: Land and Water Management process, Vegetation Management, Water Use Efficiency, Water Reforms.
- Voluntary industry driven BMP program.
- The difficulties that growers and industry groups were experiencing in trying to meet the multiple Government objectives, apparently without processes in place to do so (as though “being sent out to build the house without the tools and nails” (M2)).
- Tension and mistrust between growers, government and industry groups.

¹ Project leadership of the IAWM pilot project was undertaken by Bill Wilkinson Queensland Department of Natural Resources, Mines and Water and Ian Rankine of 4T Consultants. The IAWM pilot project work was funded by Cotton Research Development Corporation, NR&M, QDPIF and 4T. It has subsequently been funded under NAPSWQ through the Queensland Farmers’ Federation (Ian Johnson) which has engaged Ian Rankine and Bill Wilkinson as project leaders.
The community mood at this time was described as “frustration with legislation occurring without consultation, or as ‘facipulation’ – facilitated manipulation.” Change fatigue in terms of understanding and reconciling the degree of natural resources management change agenda was also identified. Also that:

In the middle of a drought farmers were getting massive reforms and costly things that threaten their businesses, imposed on them within ridiculous timeframes. They could do nothing about it. When they tried to engage their submissions/contributions were often dismissed as trivial and/or uninformed. People seemed to have reverted to the view of ‘bring it on’ – do whatever you want, and try and make us comply. This wasn’t leading to useful outcomes for any of the parties, farmers or agency people. (M2).

Discussion at the 1999 workshop turned to the need for “an integrated approach” with a combined focus on water, salinity and vegetation management across the entire area. The “community of interest” scale, combined with the regional scale of data collection requirements, suggested the term Integrated Area-Wide Management. Data collection requirements drove the formulation of the methodology, such that it can now be identified principally as a mode of regional capacity building through data sharing.

Identification of data types and availability was initiated by the project leaders, who established formal access to Agency data and undertook a range of processes to identify useful landholder and consultant data. Data collection by remote sensing and other high-end technologies is still developing, however the early data collection and exchange undertaken by the project leaders has produced extensive intercommunity connections with numerous benefits for the project: the project leaders can now go to grower groups, “throw down a map” and engage in constructive dialogue on local farm and regional scale issues (M3).

IAWM as originally proposed did not provide a clear link between data sharing and the social and institutional realities of the catchment, and required a number of additional elements before it came to be seen as a viable proposition. These additional elements emerged in a socially constructed manner as the idea was promulgated and discussed by stakeholders. The adoption rate was very fast. In the first year nearly every irrigator in the Emerald irrigation area contributed data to the process – only two stakeholders declined, both of whom have since joined the project. Subsequent demand for services and time of the key proponents continues to grow by a word of mouth diffusion model. When the project leaders visited the Darling Downs and Border Rivers areas, and Cane areas in the Burdekin many stakeholders there had already heard of IAWM (M2).

This rapid adoption and social construction of IAWM is seen as a key driver in the development of the methodology, which requires a high level of interaction between public, private and peak industry groups for successful implementation (M1). The project leaders also acknowledge the support provided by agency regional managers despite tensions over the changing service provision role of government agencies. They also acknowledge “championing” by industry groups such as the Queensland Farmers’ Federation (QFF) and Cotton Australia and other potential beneficiaries such as the Queensland Department of Primary Industries and Fisheries (DPIF) (M2).

Growth has since eased mainly due to there being no further time available from the project leaders to support sustained growth. This implies the need to engage new
people as facilitators, requiring training, facilities, and probably the easing of some institutional barriers between agencies (M2). Participating farmers recognise, however, the perceptual and management problems faced by the irrigation industry and see IAWM as an opportunity to simultaneously develop and demonstrate best practice improvements, specifically leading to an easing of wider community tensions and negative perceptions of the irrigation industry (M5).

While methodologies similar to IAWM appear in the literature, the Fitzroy case is of particular interest for its emergence from the overwhelming complexity of the regulatory environment, arguably a product of creative innovation triggered by near-chaos. IAWM is of theoretical interest for this reason, as well as practical interest for its success in establishing a progressive approach to the demands of regulation.

### 4.2. Key Methodological Attributes of IAWM in the Fitzroy

Integrated Area Wide Management is not intended to be a “shrink-wrapped” product linked commercially to its original proponents in the Fitzroy, but one that can be easily communicated as an idea with measurable “Triple Bottom Line” benefits and clear steps for implementation (M1). The following sections set out definable and measurable attributes of IAWM with the view to understanding how the successful implementation of IAWM in the Fitzroy can be repeated in other agricultural / bioregional areas.

#### 4.2.1 Objectives: Integrated Farm and Resource Management Goals of IAWM

The IAWM project leaders in the Fitzroy catchment point out that effective decision-making requires good information. The integration of farm management with natural resource management requires attention to data at a number of scales, from the paddock or farm scale to the catchment, basin or bio-regional scale. They argue that information across this range of scales can only be obtained by integrated monitoring systems maintained by stakeholders whose contributions are designed to combine at the larger scales (M1).

The project leaders also argue that, if this monitoring network is to be intrinsically sustainable, it must be both relevant and rewarding to participants. There must be opportunities, the capacity to use data for decision-making, and visible progress towards best practice improvement and recognition of farm and industry efforts in BMP achievement. This is descriptive of an action research cycle, a term frequently used by the project leaders (M1, M2, M3).

In the Fitzroy catchment, the action research cycle is further described as requiring a “safe learning environment” in which partners to data sharing agreements can make use of other partners’ data without disincentives such as unequal commercial advantage or risk of litigation and/or penalties. The project leaders stress that the safe learning environment is critical and must be based on sustainable levels of trust between community members and partnerships. Trust would need to develop through progressive data exchanges – “you show us your data and we’ll show you ours” (M1).

Without this safe learning environment, it is argued that IAWM simply “won’t work” (M1). IAWM participants are accountable socially and legally, through formal data
sharing agreements and through their social relationship to peers in the community. The project leaders in particular are long-term stakeholders in the region and would be significantly impacted by a failure of IAWM through erosion of trust or loss of integrity. Encouragingly, participating farmers appear to have great confidence in the process and strong professional relationships with the project leaders; “they’re not reporting this to the EPA but we do now have some information reporting capacity for industry and regional natural resources management processes (M5).

Essentially, IAWM is a “farm management system” at an area wide scale (M1), that is inclusive of multiple stakeholders including landholders, government agencies and industry groups. The system depends upon developing data sharing partnerships that contribute to a safe learning environment, and the development of practical monitoring programs that involve existing social networks, farmers and the subsequent coordinated collation of this data. This supports continuous improvement through an action learning cycle. From our literature review, this combination of elements is highly innovative in the theory of Integrated Natural Resource Management.

In practical terms, it is anticipated that IAWM would eventually progress to the establishment of a data resource centre possibly managed along the lines of a co-operative (M1, M2, M5). This would most likely emerge as a virtual or online centre, but with sufficient funding it may be possible to secure premises for a community-owned resource centre, providing a valuable focus for service provision and common territory for partners in data sharing agreements.

Participating farmers in the Fitzroy catchment report their own objectives in IAWM as arising from the demand for sustainable agriculture in both the regulatory and market environments (M4, M5). This is perceived as being closely linked to high quality quantitative data on environmental and production input/output data.

4.2.2 Enabling Conditions: Institutional Settings and Other Conditions Identified as Critical for the Establishment of IAWM in the Fitzroy Catchment

Data sharing agreements between stakeholders, industry groups and government are essential to the establishment of IAWM. The project leaders point out that industries had not had much experience with this kind of institutional arrangement (M1). Early confidentiality and intellectual property agreements on data sharing with grower groups were quite simple, and possibly will need to be re-drafted as IAWM expands. The project leaders have tried a more comprehensive version of data sharing agreements, but growers appeared reluctant and this early improvement has been placed on hold as trust in the process develops among the regional community (M2).

The pilot IAWM project shaped the development of more extensive formalised data sharing with State Agencies under the current NAPSWQ funded IAWM project. The project leaders needed to develop data sharing agreements with agencies and industry groups such as the Department of Natural Resources, Mines and Water and the Queensland Farmers’ Federation. Similar agreements were developed with the NSW Department of Natural Resources for the Mungindi area.

In addition, there is a requirement for research and support roles in government agencies and peak industry groups. Key areas of expertise that these support roles
would need to cover would include:

- Regional crop mix
- Production technologies
- Water Resources
  - Management
  - Allocation
- Institutional settings
  - Government
  - Industry organisations
- Specific NRM issues
  - Salt
  - Water Quality
  - Etc…
- Any cultural / historical factors
- Economic / return of capital, level of debt (M1)

Data collection for these support roles would ideally be integrated with, if not largely serviced by, on-farm monitoring.

A critical enabling condition, of course, is the provision of funding and resources. Natural Heritage Trust funding was secured for irrigator land-use mapping. Funds were also provided by the Cotton Research and Development Corporation (CRDC), Queensland Department of Primary Industries and Fisheries, Queensland Department of Natural Resources, Mines and Water and 4T Consultants to do the 12 month pilot of IAWM in Emerald (2001 to 2002). CRDC put some additional funds in to lever off the original concept and to look at biodiversity. Private funding from 4T Consultants also occurred for the 2003/04 financial year (M2). Participating farmers also reported significant contributions of funds and labour towards the establishment of the project (M5). Funding is currently from the National Action Plan for Salinity and Water Quality, through the Queensland Government Agricultural State Investment Program (AgSIP) (from the start of 2005 until June 2007).

There is a need to look at the balance between public and private funding into the future (M2). Growers involved in a technical group within the project are considering how best to manage this sharing of the funding burden. If all the costs end up borne by growers, there will inevitably be a perception of cost shifting by government. There is a significant public benefit element of this, and thus a basis for supporting public investment. The project leaders observe that it is not about getting a grant every year, but rather about having a long-term commitment to the process (M3). Additionally, participating farmers argue that the success of the IAWM project can be partly attributed to contributions of funds and labour by growers to take up on shortfalls in government contributions (M4).

Those who have provided resources and data, in-kind time, and facilities, include NRMW, DPIF, EPA, Local Govt Association – Shire councils, Central Highlands Development Corporation, Regional Bodies – Fitzroy Basin Association, Condamine Alliance, SunWater, Local consultants, Landholders.
Other identified requirements were:

- Institutional support so that other driving individuals can communicate and communities can adopt/implement.
- Partnerships: public/private/peak industry groups at State level.
- Enabling individuals and data managers (such as the identified Key Proponants), though these roles and who plays them will evolve as capacity needs are met.
- A process document: “here’s the steps you go through that encourage IAWM to take place”.
- Data access agreements – legal documents.
- Enabling local individuals / independent champions to act as intermediaries in partnerships.
- Clear economic benefit for co-investment.
- Resourcing.

(M1)

### 4.2.3 Drivers: Prior Institutional Settings and Other Conditions Perceived as Motivating IAWM in the Fitzroy Catchment

A number of key drivers are seen as essential to the success of IAWM in the Fitzroy Catchment. Some of these factors are:

- The combination of an increasingly complex regulatory environment.
- Landscape management is complex and no one group can solve the issues and problems alone.
- Declining levels of trust between the farming community and government.
- Motivation by stakeholders to develop better processes to manage change in a realistic way and with due consideration for all components of the rural community.
- Demographic change (new community members, survivors after a decade of hardship and change).
- Legislation and policy changes (Water Allocation Management Plans and similar) and subsequent trust factors with State natural resources management agencies.
- Water Issues (COAG reforms, salinity etc).
- Motivation of enabling individuals such as Bill Wilkinson, Ian Rankine and Ian Johnson.
- Data monitoring networks, telecommunications infrastructure.

(M1)

A key driver combining both production and environmental objectives is the link between market forces and environmental change. However, farmers argue that the policy shift to an NRM focus has been at the expense of farming. Farming systems involve environmental, production and economic components. The project leaders and stakeholders recognised a risk that without their active involvement in changing this situation there would be more legislation, restrictions to farming activity, banning of chemicals and/or certain farming practices (M2, M4, M5).

As discussed in Section 4.1, a key driver identified by the project leaders was the reform process itself. This was accompanied by a desire on the part of growers to play a greater role in the formulation and delivery of improved outcomes, plus a noticeable degree of fatigue after two or three years of reforms – “we need to stop shelling each...
other from the trenches”, “How can we move this forward?”; and also a lack of good NRM information at a scale suitable and readily accessible to landholders who have to implement the reforms (M2).

A third key driver was the need for more efficient ways of providing integrated resource management and production data to growers, with the objective of lowering the cost to each farmer of farm management planning (M2). Participating farmers argue that IAWM provides a means of obtaining data on the impacts of management practices at the regional scale (M4). From a theoretical perspective, this knowledge should support a learning process leading to best practice improvements and the ability to see potential problems at the farm level before they become regional in scale.

### 4.2.4 Barriers: Prior Institutional Settings and Other Conditions Perceived as Limiting IAWM in the Fitzroy Catchment

Key barriers to the implementation of IAWM in the Fitzroy were identified as:

- Stakeholders trying to deal with the level of change
- Knowledge and information management for rural industry in particular is very challenging given their resources.
- Public and private defensiveness to sharing of intellectual property – data sharing is seen as a threat to interests and may have unknown disincentives, such as giving others a market advantage or the opportunity to “use the data against us” (M5).
- Initiating and sustaining community activity is hard – people from all sectors give up – proponents need to keep working at it, and there needs to be significant visible progress. It is particularly an issue for farmers who often undertake input into change processes in a voluntary manner. Many disengage – it is draining; emotionally, time-wise and financially.
- IAWM requires ongoing strategic commitment – it cannot be regarded as a project in the usual sense, as the time frame is open (M1).
- Loss of extension staff within the regulatory state agencies
- A range of barriers arising from the deteriorating relationship between industry, agencies and individual growers over the reform process.

Data access agreements are seen as potentially controversial. Certain types of data in various locations cannot be integrated, but there is a wide range of potentially common data that can be shared. There are some negative perceptions of equity of access to information which need to be dealt with in high-quality data access agreements (M2).

There is a general reluctance to have true partnerships, possibly due to the defensiveness of particular organisational affiliations or threats to other NRM investors because the IAWM network has a degree of influence. Various regional organisations may react against the loss of control due to genuine bottom-up management and ownership. IAWM needs to emphasise the interdependencies between agencies, industry groups and stakeholders, in which some level of control needs to be re-distributed (M2).

A significant barrier was identified as the deteriorating relationship between regulators and growers, leading to a precedent of confrontation which needed to be overcome. Fixed mindsets were evident in some key players. The project leaders noted that predetermined positions were often based on limited information, and they proposed a solution: get better information to all the parties trying to find a common outcome. To
do this, a chasm between scientific knowledge (agency) and local system expertise (farmers) needed to be overcome.

Another barrier is that the project leaders – in their role as IAWM facilitators – are required to do the integrative work as an add-on to their normal role, rather than having it recognised as core business. The project leaders stress that natural resource management state agencies need to commit to a group of people whose core business is to support the IAWM model, and that State funds should be set aside to do this.

The nexus of public and private responsibilities is also problematic. The project leaders suffer from ambiguities about their mixed public and private roles. There appears to be a perception that “someone” will profit from partnership with government and access to data, leading to negative perceptions about the ethics of this partnership activity – for example does it favour some over others? There is also a perception that Governments will gain access to private information by “defacto” methods (M2).

Participating farmers suggest a significant potential barrier as the risk of attrition of participants, particularly the IAWM facilitators (i.e. the project leaders) (M4), however this can be managed by increasing grower involvement to run the process from the ground up. This key issue of grass-roots participation and peak industry ownership is discussed next.

4.2.5 Grass-roots Participation in Monitoring, Data Collection and Sharing

IAWM is described by its key proponents in the Fitzroy catchment as being necessarily “bottom-up” (implemented and owned at the farm level) rather than “top-down” (government or industry level) (M1, M2). IAWM has followed the path of working with farmers and peak rural industry groups – building / exploring information management capacity, resource condition monitoring approaches and linkages that will support or advance voluntary farm, management system program development. The need for this grass-roots ownership is founded in extensive on-farm monitoring networks and the need for a safe learning environment that balances confidentiality with an effective means of peer-to-peer feedback on shared resource management issues.

IAWM also projects into the hierarchically higher top-down domains through the development of industry-government partnerships, co-funding arrangements and the administration of data sharing agreements. Both the bottom-up and top-down elements are seen as essential to the success of IAWM, however the project leaders argue that the grass-roots level is potentially more important in the case of integrated data sharing through on-farm monitoring.

Data collection at the farm level, coupled with stakeholder interviews through door-knocking, appears to lend considerable local credibility to state-scale monitoring initiatives such as vegetation and biodiversity studies, quarterly bird studies, water quality monitoring, macroinvertebrates and aquatic fungi as bio-sensitive indicators. Vegetation in the study area has been mapped to the 1:5,000 scale, compared to typical NRMW data sets at around 1:100,000. IAWM has looked at remnant vegetation and corridors at the landscape level, indicative of overall landscape connectivity allowing the consideration of improvements at the landscape scale. Integration with
farm-scale monitoring creates influence on farmers to take collective action, contributing to overall targets for the Fitzroy Basin Association.

IAWM has developed water quality testing protocols on monthly and event-based time-scales, supported by a water quality field guide (Rankine et al. 2004). Water quality and condition data is recorded on GIS, including streams and irrigation systems (tailwater, storages, SunWater drains). The project leaders emphasise manual water quality testing rather than an automatic sampling instruments or sensors. This manual sampling provides an ideal forum for interaction with the landholders and stakeholders, ‘on their turf’ – the results became ‘theirs’. Samples are tested both in the field and in NRMW labs, using a combination of agency and project instruments and laboratory resources. This is supported with a formalised agreement with NRMW at the regional level. The IAWM project also provides training to farmers in data collection and result interpretation. Private infrastructure is also used, creating a three-way contribution of resources to data collection and analysis (M3).

A significant innovation adopted by a large proportion of participating farmers is the capacitance probe for soil moisture, allowing precise relative measurement of plant available water. This has greatly improved water application efficiencies (M5) and could potentially help with understanding deep drainage for purposes of secondary salinity management should that become a priority in the Fitzroy catchment (M3). Data from these probes can be linked directly into the area wide data that is being collected by the IAWM project.

Other aspects of collaborative monitoring and analysis are water volume measurements, which may be linked to NRMW’s formal water modelling (IQQM) in future. Local flows are measured during water quality observations, allowing estimates of sediment loads. Soil types and geology have also been used in IAWM monitoring (M3).

4.2.6 Data Quality Management

Given the high level of community involvement in data collecting and recording, the issue of data quality needs to be addressed. The following text is adapted from comments by Wilkinson (pers. comm. 2006), and has not been independently vetted by the present authors. We do however affirm the need for good quality control for IAWM created data to maximise its perceived value in the overall natural resources management framework.

Training
The whole monitoring program established in IAWM is about quality control standards so that the issue of community-captured data not being of acceptable standard is diminished. A training program has been developed that accredits growers participating in the area-wide monitoring network. This teaches participants about standards and clearly describes to each the need for rigour.
Sample collection and testing

- The IAWM technical staff regularly shadow-tests participants in sample collection. They also take and process samples from key ambient sites with quality field instruments (of the same or similar standard to those used by government).
- A random sample of field-assessed nutrient data is shadow-checked by sending samples to a NATA (National Association of Testing Authorities) accredited lab in NATA standard collection bottles.
- All pesticides are processed at a NATA accredited lab and are chilled and dispatched according to their standards.
- Rising stage samplers have recently been develop to supplement hand collected data.
- A state-wide comparison of the nutrient test kits that are used is being undertaken.
- All nutrient samples and pesticide samples are collected in lab approved sample bottles.

Data handling

- Data is recorded on standardised forms in triplicate so that the reorder keeps a copy and transcription errors are minimised when data is supplied centrally to the IAWM database.
- Data is checked as it is entered into the database for any obvious discrepancies.
- Birds are monitored and recorded using Birds Australia recording procedures.

Equipment

- There are calibration sheets for the equipment that are filled in each time the equipment is checked. The equipment is tested to laboratory supplied sealed sachets with recorded expiry date on them, and batch numbers are recorded on calibration sheet.
- There is a joint agreement for the team to use the local NRMW / DPIF government laboratory with scales, distilled water, ovens and other equipment.
- The GIS systems that have been established emulate government system standards in terms of data standards, consistency, metadata records and other key criteria.

4.2.7 The Vision: Long-term and Area-wide Objectives for IAWM

The project leaders articulated a Mission Statement for IAWM:

*To develop excellent local community capacity to participate in biophysical monitoring and landscape management.*

The overall Vision of IAWM can be broken into a number of components:

- To provide a safe learning environment that allows growers and industries to pursue a continuous improvement learning cycle.
- To build capacity and a process of involvement within the reform agenda.
- To provide an integrated data resource centre (e.g. data sets, knowledge, in-kind support, funding).
- To integrate production and landscape issues and find solutions on that basis.
- To build partnerships that enable relevant change to occur more efficiently.
- To develop more cost effective biophysical monitoring systems.
- To implement the intent of the Queensland Water Use Planning instrument without formally invoking it. IAWM demonstrates that people can become involved in sustainable NRM and risk management.
• To implement better NRM outcomes based on looking at things at both the farm and landscape levels in an integrated manner.
• To gain due recognition of industry Farm Management Systems, so that growers need not complete more than one planning process.

(M2)

The proposed community resource centre and safe learning environment can be seen as a virtual learning organisation in which adaptive management occurs through the practical interactions of landholders, governments, agribusiness and water managers. Adaptive learning cycles occur in both the biophysical landscape domain and the institutional policy domain, in that monitoring and data sharing lead to best practice improvements in natural resources and farm management and policy at a range of scales (M2).

This does not necessarily require community resource facilities to be built across Queensland or other states, but there is a challenge here to provide data/information at a high level of accessibility (M3) and an opportunity to benchmark farm and resource management practices at the regional scale (M4).

Participating farmers point out that IAWM can make a significant contribution to the wider vision of the irrigation industry, providing data in evidence of best practice improvements and eventually leading to reduced tensions with regulators and the wider community – affirming the “social licence to irrigate” (M5).
5. Discussion

The intent of this report was to document the principles, processes and learnings from the IAWM model, including the design and description of the IAWM management support system. This would include description of the techniques and practices in use, identify support resources needed and relevant stakeholder processes.

In this section we provide suggestions for descriptive models of IAWM, and some comments on the theoretical foundations for IAWM in Sections 5.1 and 5.2. respectively. In Section 5.3 we outline a model to support the implementation of IAWM in other areas. Comments about the ‘management support system’ and the ‘techniques and practices in use’ are provided in the final section.

5.1. Suggested Descriptive Models of IAWM

The IAWM project leaders have sought to communicate the ideas of IAWM to a wider audience through discussion papers, conference proceedings and refereed journal articles, with some success (M1). Following discussion with the present authors, it was agreed that a major impediment has been the difficulty of developing a simple, plain language descriptive model that would serve to make the objectives and approach of IAWM clear to stakeholders in other areas (M1).

IAWM has many dimensions, and as such is difficult to represent in few words. We propose that it might thus be useful to construe IAWM as one or more of the following:

IAWM is…
- A model for sustainable collaborative data-sharing partnerships.
- A process-based model for capacity building in information supply and management.
- An action-learning model for participative action learning.
- A framework that encourages rural groups to participate in formal knowledge and information management.

These ideas can be illustrated by before-after comparisons: For instance, compare a conventional “policy science” model of data collection and sharing: Data is collected by specialist teams and analysed by researchers who have no formal relationship to stakeholders, and the results are published to a specialist or government audience. Results are then used for the development of regulatory policy, largely without reference to what stakeholders may regard as relevant, realistic or viable. Result: growers are reluctant to share data that circumvents their decision-making process and subjects them to painful and apparently unrealistic reforms (M1).

In contrast, under IAWM data is collected by individual growers and dedicated IAWM and technical support staff, analysed by specialists who are also partners to data sharing agreements, and used directly by growers and industry to better manage their land and water, as well as by policy makers (M1). The data is managed in a central repository. There is an immediate feedback loop to inform growers and peak industry leaders of resource management conditions and trends, leading to adaptive management that is not dependent on an intervening policy development stage. Since partnerships include government agencies as partners, policy development would proceed in parallel with on-ground action and would be further informed by the
outcomes of action. Significant advantages over the conventional policy science model would include:

- continuous improvement through quick response to condition/trend data;
- benchmarking against more productive neighbours – “looking over the fence”, and
- accountability to peers, peak industry groups, and the market.

(M1)

In the above we do not imply a duality – i.e. either a policy science approach or an IAWM approach. We simply use the two to provide contrasting perspectives. There is a range of approaches presently being used for natural resources management around Australia, some with high levels of partnership and collaborative activity already embedded, and others that might more closely approximate the policy science model.

It was also suggested that IAWM could be explained through hypothetical examples, such as:

- Example: a farmer knows that community peers, peak industry body and government regulator can access his water quality data … leads to self-regulation on chemical use and control of runoff, resulting in ongoing improvement without regulatory action.
- Or: An industry group can access process and production data from private industry partners and vice versa…leads to benchmarking and best practice improvements.
- Or: Irrigation efficiencies (mainly decreased water use) result in unintended disincentives e.g. unit price of water goes up and government may resume unused water for other uses … Information sharing would place all irrigators on an equal footing for adoption of efficiency improvements so that these consequences do not unfairly disadvantage some.

(M1)

Lastly it was suggested that economic analogies such as the “Prisoners’ Dilemma” archetype could be used to explore the internal dynamics of trust and data sharing (M2). These ideas have the benefit of a “story-telling” approach to communicating ideas, but should be used with care as they will not necessarily appeal to all potential stakeholders.

5.2. A Theoretical Model for IAWM
The “Prisoners’ Dilemma” archetype mentioned above suggests that IAWM might be usefully explained using the systems science theoretical domain. IAWM can be described in systems terms as a network of information flows within a set of pre-existing production and natural systems. It uses an agreed information management framework, that growers and peak industry accept. It is a dynamic environment and requires an acceptance that information flows require confidence and competence. Each stakeholder becomes more comfortable with the notion of knowledge exchange and in time participates in sharing information that previously did not flow easily, and better decision making results. The information flows provide “feedback” on conditions within the system, leading to land and water management responses that work against negative environmental trends while promoting production capabilities. The regulatory environment is co-operative, since policy makers are partners in data sharing and action learning rather than over-riding command-control entities.
The emergence of IAWM as a stakeholder-driven movement against a background of increasing uncertainty, change and information overload bears some similarities to recent systems-theoretical models of organisational change at the “edge of chaos” (Flower 1993; Parker and Stacey 1995). In particular, IAWM can be seen to transform the learning cycle under which innovation and adoption lead to business practice improvements, from a government-driven model to a more responsive stakeholder-driven model. The causal loop learning cycle diagrams in Figure 2 represent an initial attempt to provide a sound theoretical basis for the emergence of IAWM in these circumstances.

**Figure 1. Learning Cycle Transformations of IAWM**

In the first generation learning cycle above, policy-making through agency and government is relatively slow and unresponsive to stakeholder preferences. Reforms implemented under this model have been associated with social and economic costs in farming communities.
The second-generation learning cycle reflects the experience of IAWM in the Fitzroy and suggests that at a crisis point, stakeholders can develop and adopt forms of adaptive management and self-regulation. Rather than circumventing government policy, IAWM creates new opportunities for partnership with government such that policy is informed by adaptive on-ground action.

Further, the self-regulation envisaged will be explicitly bounded within “… the existing regulation framework administered by government” (Wilkinson and Rankine 2004, p.1). This implies that high-level decisions such as water allocations to various extractive and non-extractive users would continue to be made by government agencies and/or statutory authorities.

5.3. Implementation Model for IAWM

The authors are of the view that IAWM represents a useful contribution to integrated natural resources management in general because it is so effective at engaging the local land managers in whole-of-system management. Moreover, IAWM demonstrates that it is feasible to move away from government-only approaches to planning and acting for sustainability – the private/public partnering inherent in IAWM is evidence of this.

The above factors combine to suggest that, at least in principle, the farmers and their service providers in any given area would be able to more effectively implement sustainable practices if IAWM were to be introduced. Of course, this presupposes that something similar is not already in place. Moreover, it assumes that IAWM would in fact be *suitable* in any given area, which might not in fact be the case.

In order to achieve this, there is a need for an implementation approach that can most effectively draw on the social and other resources of a region, in order to implement IAWM in a locally-appropriate form. Such an approach might be promulgated as a facilitation kit targeted at peak industry groups and agencies, setting out the stages of an IAWM implementation, including the identification of local issues, assessment of the local suitability of IAWM, templates for data sharing partnerships, and general timetables for key milestones.

We believe that the best way to develop such an implementation support package would be as a real-time exercise working with a community of farmers who would like to implement IAWM in their area. We suggest that this could be undertaken and facilitated under the auspices of the CRC Irrigation Futures, along with appropriate funding, and would explicitly draw on the hands-on knowledge and experience of the Emerald IAWM project leaders. This new project would have the triple objectives of facilitating the implementation of IAWM in the chosen area, developing IAWM leadership skills with local people, and developing and trialling a detailed implementation and training package to support subsequent roll-out.

As a guide, the implementation model would have the following key steps:

1. Identify an area or region that is likely to embrace IAWM. Consider the ‘enabling conditions’ described in Section 4.2.2 and the ‘drivers’ in Section 4.2.3, and assess the local suitability of IAWM.
2. Establish an IAWM working group with local farmers and key service providers...
(including selected peak industry representatives and agency personnel among others). Note the range of organisations involved in the Emerald IAWM project, and pursue a similarly broad-ranging involvement. Pay particular attention to the need for trust. It may be best in the first instance to ONLY have farmers and their advisors directly involved. A key finding from the Emerald experience is that it is critical to allow time for trust to develop.

3. With the working group review the IAWM experience in Emerald and consider how (and whether) it can be implemented in the new area.

4. Identify key resource provision issues. Decide on strategies to address these. In particular, determine how the IAWM facilitator role can be implemented. This might involve hands-on training in the Emerald area with the present IAWM facilitators. In subsequent applications, on-ground training could occur in other places that had implemented IAWM, supported by the implementation resource material to be developed.

5. Identify potential barriers to implementation (refer to Section 4.2.4 for examples for Emerald). Decide on strategies to address these.

6. Seek enlistment of farmers who wish to get involved to start the process. Perhaps replicate the ‘door knocking’ exercise undertaken within the Emerald project.

7. Establish an appropriate information management framework. The data resource centre concept outlined in this report could be a useful model. There are also other similar models now underway in Australia that should also be considered.

8. Assess data quality requirements - a range of relevant actions are reported in Section 4.2.6.

9. Commence on-ground activities. As part of the implementation design project, various written resources would be produced to help in subsequent applications. In addition the Water Quality Monitoring Field Guide (Rankine et al. 2004) and other material from the Emerald project could be accessed and formulated into an integrated training and support package.

10. Monitor, evaluate, modify as required.

5.4. Management Support System and Tools and Practices in Use

Among other things, this project set out to document the management support system and tools and practices employed by IAWM. A number of such things do exist, and these are noted below.

- The Water Quality Monitoring Field Guide is a substantive output from the IAWM project, and is generating significant interest from many practitioners outside of the immediate IAWM community (Rankine pers. comm. June 2006). (See Appendix 1).
- The field guide is coupled with an overall water quality program including a training and accreditation program; triplicate field book that enables growers and others to take measurements and to keep a copy for their later reference; shadow testing of results through labs, and the installation of rising stage samplers in some key places.
- An irrigation land use mapping data set and coding framework is another output. The coding system was developed because of limitations of the existing National Land and Water Audit system. It arguably provides a more appropriate approach with information better suited to the IAWM objectives.
- A water quality recording database has been developed to complement the monitoring activities.
- We note also the extensive usage of spatial information systems (GIS) to record
data and produce maps, although we have not attempted to reproduce the detail of this here.

- Data sharing agreements have been put in place in some instances. An example of one relevant to IAWM is included at Appendix 2.
- Irrigation land use mapping framework and coding has been developed.
- Template field recording forms and excel calculation sheets for the laboratory assessment of water quality.
- The joint acquisition of resources that are being used by multiple parties has been facilitated – e.g. satellite imagery and water quality monitoring equipment.

In essence then, we have observed an informal management support system and a variety of tools and practices. Clearly, an implementation model such as that outlined for development in Section 5.3 will require these to be more formally articulated and documented. We envisage that this would happen as part of that development project.
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Appendix 1: Water Quality Monitoring Field Guide

This is available as a pdf for download from the CRCIF website under Publications/Irrigation Matters or http://www.irrigationfutures.org.au/news.asp?catID=12
Appendix 2: Sample Data Sharing Agreement

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- NOTES -