



## A Review of Community Based Monitoring in the South Australian Murray-Darling Basin

### Logos

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## A Review of Community Based Monitoring in the South Australian Murray-Darling Basin

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## TABLE OF ABBREVIATIONS

AGDEH	Australian Government Department of the Environment and Heritage
DWLBC	South Australian Department of Water, Land and Biodiversity Conservation
EPBC	Environment Protection and Biodiversity Conservation
INRM	Integrated Natural Resource Management
JSC	Joint Steering Committee (Australian and South Australian Governments)
LAP	Local Action Planning
MDBC	Murray Darling Basin Commission
MECG	National NRM Monitoring and Evaluation Coordination Group
MERF	Monitoring and Evaluation Framework for the SAMDB INRM Group
MERSC	Monitoring, Evaluation and Reporting Steering Committee
MEWG	National NRM Monitoring and Evaluation Working Group
NCSSA	Nature Conservation Society of South Australia
NRM	Natural Resource Management
SAMDB	South Australian Murray Darling Basin Region

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# 1. Executive Summary

Community based monitoring of natural resources in the SA Murray Darling Basin Natural Resource Management Region contributes to awareness about the condition of the resource and impacts on resource condition. This type of monitoring underpins many decisions about natural resource management at the local level and has potential to influence decisions about management and investment at the regional level. This report examines the current and potential purpose, roles and responsibilities for community based monitoring programs. The report highlights where established monitoring programs can contribute to evaluation of progress towards the goals and targets for natural resource management in the SAMDB, and where current gaps and barriers constrain community based monitoring from achieving the full range of desired outcomes. The report provides background for the development of a Community Based Monitoring Framework for NRM in the SAMDB.

The review of community based monitoring examined the range of existing programs for the parameters monitored; level of integration with regional level planning processes; levels, motivation, priorities and satisfaction of community participants, and; outcomes or potential outcomes for community capacity building, local and regional planning and management, and regional monitoring, evaluation and reporting. The review utilised a written survey of community based monitoring programs to collate information on the operations and focus of each program. Key community members and project officers attached to community based monitoring programs were consulted about the background, scope, level of activity and level of achievement of monitoring programs.

## Scope of Community Based Monitoring

The community based monitoring effort in the region is substantial and covers monitoring of wetlands, surface water quality, groundwater, aquatic and terrestrial biodiversity, and land condition. Current monitoring programs extend across much of the region with a large number of groups concentrated on the Murray River and National Parks.

## Contribution to Regional Monitoring and Evaluation

Community based monitoring has the potential to contribute to evaluation of progress towards a range of Resource Condition Targets in the INRM Plan for the SAMDB, with particular potential to contribute through

- Surveys of vegetation condition and extent
- Surveys of wetland condition, extent and connectivity
- Fish surveys

Other community based monitoring programs have potential to contribute to meeting the requirements of the regional Monitoring, Evaluation and Reporting Framework where they reliably meet acceptable standards of quality assurance and quality control (QA/QC). Even where QA/QC is assured there are continuing barriers to the use of community based monitoring data including, consistency of methods between different types of groups and programs, clarifications of responsibilities for data storage and management, and the extension of QA/QC procedures to the maintenance of a standard set of metadata.

## Community Participation in Monitoring Activities

Community participants in community based monitoring programs reported that they were motivated by the desire to make a contribution to maintaining the health of the environment (and natural resource management) and to increase their own knowledge and understanding of natural resources. Participants reported that they liked being involved in the monitoring programs because the information gathered assisted them in determining appropriate management actions and allowed them to detect the results of their management interventions. The level and importance of involvement in different components of a community based monitoring program was also examined and showed that current levels of involvement in analysis and interpretation of monitoring data is relatively low.

The biggest challenges facing community based monitoring programs were reported to be the difficulty of renewing the membership and enthusiasm of community groups and the risk of losing experienced and capable participants and project officers. Almost all programs reported that data analysis was limited to different forms of data display and little further analysis of the data is undertaken.

### Influence on Local and Regional Decisions

Participants and project officers were confident that community based monitoring programs can and do influence decisions about natural resource management at the local level. Confidence in community based monitoring influencing regional decisions about NRM was lower and depends on the type and quality of the monitoring. Key factors limiting the influence of community based monitoring are confidence of decision makers in the QA/QC of individual programs, limited recording of standard metadata on monitoring programs, difficulties accessing monitoring data held by community groups and limited or poorly focussed reporting and communication of the results of monitoring programs.

### Recommendations to Support and Enhance Community Based Monitoring

1. To ensure participants receive benefits from their involvement in monitoring, provide adequate support through the provision of technical advice, data analysis and interpretation support and require a communication strategy be developed by each group (See Framework)
2. Any extra effort sought from community participants in monitoring should be demonstrably relevant to improving management decisions at a local scale.
3. The Community Based Monitoring Framework include a guide to developing a communications plan for monitoring groups.
4. Community based monitoring be supported as a valuable end in itself because of its ability to generate a greater appreciation and interest in natural resource management by participants in the monitoring.

5. The steps required to improve the quality of data collected via community based monitoring are:
  - a. Widely publicise where high-quality data that is collected with the assistance of community participants is being used to influence investment and management decisions across the region. People will only be willing to spend the extra time and resources to improve data quality if it is clear that there is likely to be a positive outcome from their extra efforts;
  - b. Provide community groups with tools to identify appropriate standards (many of the Waterwatch groups are already using the EPA data standards) and record the process of collecting data as well as the data itself (eg through the EPA Logbook);
  - c. Provide community groups with technical assistance, advice and support if they are willing to improve their data quality standards. Half of the groups who were collecting data at an "Advanced level" were doing so the assistance of state agency or university staff. Working collaboratively with "experts" obviously ensures that advice on how to maintain high data
6. Restructure the role of the Monitoring and Evaluation Coordinators to include the role of providing assistance to community based monitoring groups and project officers on the analysis and interpretation of their data.
7. Establish the Resource Information Centre in the SAMDB Region to promote wider access and use of existing data by all users and improve spatial data and Metadata management.
8. Continue project officer support of community based monitoring groups to maintain the effectiveness of the groups to undertake monitoring activities
9. Continue to provide community based monitoring groups with necessary consumables for recognised monitoring programs conforming to the standards set out in the Community Based Monitoring Framework

## 2. Introduction

### 2.1 Purpose of this Report

This report has been written to enable the SAMDB INRM Group to:

1. Clarify the purpose, roles and responsibilities for current and future community based monitoring programs;
2. Identify where current monitoring programs can contribute to evaluation of progress towards the goals, objectives and targets of the INRM Plan and Investment Strategies
3. Extend the regional NRM Monitoring and Evaluation Framework to encompass community based monitoring
4. Delineate the value of community based monitoring programs for informing regional or local decisions, meeting community objectives and/or building the capacity of community participants
5. Identify gaps and barriers in current community based monitoring and outline the necessary requirements to support relevant and effective community based monitoring programs
6. Promote and support best practice community based monitoring in the SAMDB region

### 2.2 Community Based Monitoring

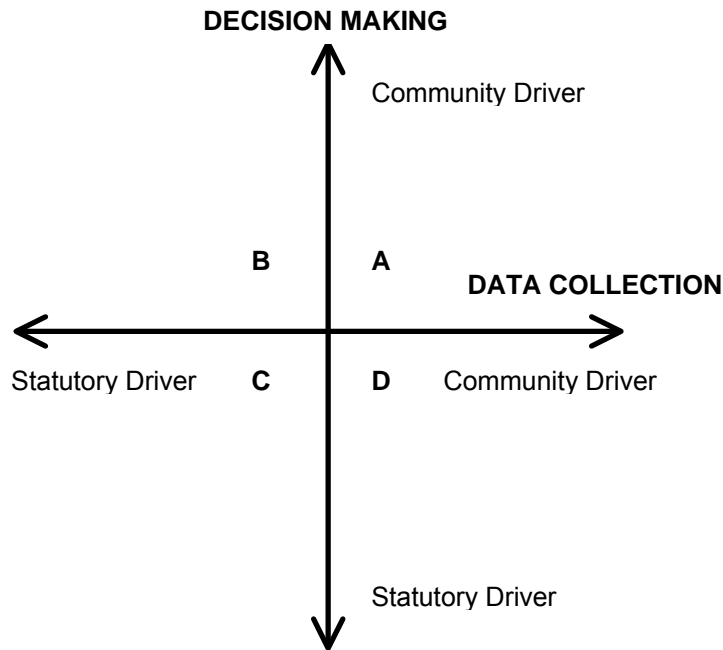
Community Based Monitoring is an emerging global trend to involve members of local communities in the evaluation of government programs designed for their benefit. The technique is being used to monitor and evaluate programs designed to improve the environment, health outcomes and outcomes of aid programs (Section 2.4).

For the purposes of this study, the 'community' includes:

"businesses, service providers, workers, visitors, farmers, community groups, students and residents who make use of natural resources and services provided by ecosystems, but

whose core business or activities are not normally conserving and managing natural resources”<sup>1</sup>.

### Spectrum of Community Involvement in Natural Resource Monitoring



Community involvement in natural resource monitoring can cover a broad spectrum of types of monitoring and levels of involvement. The diagram above and the table below illustrate this spectrum.

Quadrant	Monitoring type	Example from SAMDB
<b>A</b>	Community participants collect data for information and influence at the local scale	Regional Waterwatch Program
<b>B</b>	Statutory or professional bodies collect data to inform and influence community based management.	Floating-flag Test Well Program
<b>C</b>	Monitoring by statutory authorities and professional bodies to fulfil statutory requirements.	<i>This type of monitoring is not considered 'community-based'</i>
<b>D</b>	Community participants collect data to meet a statutory responsibility	Angus-Bremer Water Management Committee

<sup>1</sup> South Australian Murray Darling Basin Integrated Natural Resource Management Group Inc. (2003) *Integrated Natural Resource Management Plan for the South Australian Murray-Darling Basin*

## 2.3 The Role of Community Based Monitoring in NRM in the SA MDB Region

### Monitoring and evaluation

Effective sustainable management of natural resources requires a detailed understanding of fluctuations in the condition of resource assets and the potential threats that pose a risk to the long-term viability of these assets. Throughout the SAMDB there are a number of threats that pose a risk to current and long-term viability of the region's natural resources – which could ultimately impact social and economic development within the region. The INRM Group has prepared a Strategic Plan (2004) and Investment Strategies (2003-2004, 2004-2005 and 2005-2008: currently under consideration) to identify priority issues and implement actions to maintain and restore the condition of natural resources in the region.

These documents have been prepared to meet the requirements of the National NRM Standards and Targets Framework and the National NRM Monitoring and Evaluation Framework. These frameworks set out themes and levels for setting targets within regions that meet National requirements for investment in integrated and accountable natural resource management. To implement the monitoring and evaluation components of the Plan and Investment Strategies the INRM Group has developed the SAMDB Monitoring and Evaluation Framework (MERF) to assess and report progress towards Resource Condition Targets (RCTs) and is currently establishing a process for measuring and reporting on Management Action Targets (MATs) and program outputs. The objective of monitoring is to record changes in the resource asset over time; understand the key drivers that are causing the change; and, to measure the performance of management in meeting targets and broader strategic goals. Monitoring activities are most effective when they are clearly connected to management decisions in an adaptive management framework. Community based monitoring can make significant contribution to decisions about resource management when it is adequately supported.

The INRM Group's approach to monitoring and evaluation is based on a core set of principles that reflect best practice (see MERF). These principles state that the monitoring and evaluation system implemented by this INRM plan must:

- be practical and objectively verifiable;
- be complementary to existing systems;

- be developed and implemented in partnership with existing data managers and users;
- recognise the need for regular, long-term data collection to enable credible scientific investigation and assessment;
- enable the determination of baseline conditions (or benchmarks), important and emerging issues, and trends over time;
- provide data that can be aggregated for reporting at a property, local, regional, state or basin scale;
- inform a periodic review against objectives, targets and desired outcomes;
- adapt over time as new knowledge enables refinement of monitoring activities; and
- be cost effective to implement and maintain.

The INRM Group is committed to establishing monitoring systems at an early stage to collect baseline information to guide target setting, and condition and trend analysis, particularly where there are existing information gaps. Management must be based on the best available knowledge, and monitoring helps to improve that knowledge. Monitoring will provide a realistic link between individual projects, regional trends in catchment health, and the overall outcomes and objectives of the INRM Group's Strategic and Investment Plans.

Involving the community in managing natural resources is the *raison d'être* of the INRM Group to ensure broad scale community support for improvements in the management of natural resource management.

*"Without a high level of involvement and associated behavioural change, it is unlikely that the full range of benefits that could be achieved will be realised."*<sup>2</sup>

The community has been heavily involved in preparing the existing plans, having been written by community-based organisations like LAP Committees or Soil Conservation Boards, or prepared through extensive participatory processes such as that required under the Water Resources Act 1997. This has ensured that they have a high level of community ownership and support. Community views, knowledge and aspirations have helped to shape this and other existing plans and their methods of implementation.

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<sup>2</sup> Integrated Natural Resource Management Group for the South Australian Murray Darling Basin Inc. (2003) Integrated Natural Resource Management Plan for the South Australian Murray-Darling Basin



## Capacity Building

A significant proportion of the investment identified in the Investment Strategy is for:

- raising awareness in the community of the region about threats to natural resource condition across the area,
- skills development of interested community members to understand and manage these threats, and
- broader-scale education to create support from the broader community for actions to abate potential and real threats to the underlying natural resource base.

Individuals from the community are encouraged to take on leadership positions to lead groups of people from government, industry and the community to make the decisions and trade-offs that are required to reverse natural resource degradation. Community members are also encouraged to change their own management actions to improve the condition of natural resources on their land, and to be part of an ongoing dialogue with scientists, government officers and officials and independent companies and industry collectives about the best strategies for managing natural resources across the region. The collective term for this awareness, skills development, education and participatory activity is “capacity building”. Community capacity building is seen as being critical to the success of the planning and investment activities undertaken by the INRM group.

Discussion of capacity building of community members and groups begins with a realisation of current capacity and action, and recognises the approaches and successes of previous programs. The SAMDB INRM Group has supported a number of programs for building capacity in monitoring natural resource change as well as in monitoring project performance and outcomes of management actions. For example, the SAMDB INRM Group has been implementing a project to promote and support principles of active adaptive management of natural resources. This project has developed a set of guidelines<sup>3</sup> for monitoring the outcomes of experimental management trials and supported 10 trials across a broad range of resource management issues. Where this type of monitoring is community based it has the same requirements for successful implementation as community based resource condition monitoring.

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<sup>3</sup> Guidelines for Incorporating Trials and Experimentation into the Management of Natural Resources (in preparation) SAMDB Local Action Planning Group

## 2.4 Lessons Learned from Other Community Based Monitoring Programs

Community based monitoring is increasingly being used and recommended as a tool for monitoring a range of government programs in Australia<sup>4,5,6,7,8,9,10</sup> and overseas<sup>11,12,13,14,15,16,17</sup>.

While community based monitoring is generally seen as a useful tool for engaging communities in environmental restoration programs and useful for filling gaps in government monitoring, issues arise about the quality of the data collected by community groups.

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<sup>4</sup> Buxton Connections (1999) Mid Term Review of the Natural Heritage Trust: Waterwatch Program

<sup>5</sup> Brad Zeller, Andrew Petroeschovsky and Christina Dwyer (2003) Monitoring coastal marine habitats and waterways: Government and community partnerships in action.

<http://www.regional.org.au/au/apen/2001/r/ZellerB.htm>

<sup>6</sup> C. Chinn, R. Cawley & N. Johnston (2003) Regional Monitoring Pathways for Waterway Health. Queensland Department of Natural Resources and Mines.

<sup>7</sup> Centre for a Sustainable Built Environment (2003) Submission to the Discussion paper Sustainable Cities 2025 for the House of Representatives Standing Committee on Environment and Heritage.

<sup>8</sup> Environment Australia (1997) The Australian Coastal Monitoring Initiative Development Strategy <http://www.nht.gov.au/nht1/programs/cmp/monitor.html#Aboriginal>

<sup>9</sup> Reef Futures Monitoring Review <http://www.reeffutures.org/topics/monitoring.cfm>

<sup>10</sup> Barbara Musso, Graeme Inglis. Developing Reliable Coral Reef Monitoring Programs For Marine Tourism Operators And Community Volunteers. CRC REEF RESEARCH CENTRE TECHNICAL REPORT No. 24 <http://www.reef.crc.org.au/publications/techreport/TechRep24.html>

<sup>11</sup> Southern African Regional Poverty Network (SARPN) – Community Monitoring Programme <http://www.sarpn.org.za/index.php>

<sup>12</sup> C. M. Stepath (2000) Awareness and Community-based Monitoring. 9th International Coral Reef Symposium, Bali, Oct 2000. <http://www.saveourseas.org/CarlStepath/Awareness&CMJun20doc.pdf>

<sup>13</sup> Canada Community Monitoring Framework <http://www.ccmn.ca/english/library/whitelaw/introduction.html>

<sup>14</sup> Brian Craig, Graham Whitelaw, Jeff Robinson and Paula Jongerden. COMMUNITY-BASED ECOSYSTEM MONITORING: A TOOL FOR DEVELOPING AND PROMOTING ECOSYSTEM-BASED MANAGEMENT AND DECISION MAKING IN THE LONG POINT WORLD BIOSPHERE RESERVE. <http://www.sampaa.org/PDF/ch4/4.4.pdf>

<sup>15</sup> Andy Lyons (1998) A Profile of the Community-Based Monitoring Systems of Three Rural Development Projects in Zambia. <http://nature.berkeley.edu/~alyons/zm/usaidrpt.html>

<sup>16</sup> Paulo Neto, Irene Guijt. Community-based Monitoring of the Transition from Open Access to Restricted Use of Forest Area, Serra do Brigadeiro, Minas Gerais. <http://www.rimisp.org/webpage.php?webid=418>

<sup>17</sup> Grant Hunter, Claire Mulcock and Roger Gibson (2003) We mustn't lose the plot – community-based tussock grassland monitoring: A review of the REDIS initiative. <http://www.maf.govt.nz/sff/about-projects/pastoral-farming/redis-review-02-138.pdf>

Data confidence protocols for community based monitoring have been developed across Australia and have been successful in promoting the collection of data of appropriate standards (although not necessarily of the highest quality)<sup>18,19</sup>. For example, despite the variable expertise levels of volunteers, a report on the contribution of community volunteers to monitoring reef health showed that non-professional data collection can be accurate, reliable and a valuable contribution to the scientific understanding of the reef environment. However, a number of requirements must be met to ensure this including the incorporation of quality control procedures into the sampling methodology and the training and interpretive materials<sup>20</sup>. A review of quite sophisticated community based monitoring on grasslands in New Zealand recommended that a support officer, provision of a secure, centralised and standardised database for the monitoring data and access to expert scientific advice to help interpret data collected would dramatically improve the value of data collected through the program<sup>21</sup>. The consistent message from these studies is that community based monitoring inform decisions on how best to manage natural resources. A key factor for success is the development of data confidence protocols, and support in the form of data management tools and technical support.

The authors of this report strongly endorse the view that the incorporation of data confidence frameworks will increase the value of community based monitoring. Nevertheless, it is also clear that community based monitoring has intrinsic value from involving community participants in observing their natural environment.

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<sup>18</sup> C. Chinn, R. Cawley & N. Johnston (2003) REGIONAL MONITORING PARTNERSHIPS FOR WATERWAY HEALTH. Queensland Department of Natural Resources and Mines. <http://www.regional.org.au/au/apen/2001/r/ZellerB.htm>

<sup>19</sup> Brad Zeller, Andrew Petroeshevsky and Christina Dwyer (2003) Monitoring coastal marine habitats and waterways: Government and community partnerships in action.

<sup>20</sup> Barbara Musso, Graeme Inglis. Developing Reliable Coral Reef Monitoring Programs For Marine Tourism Operators And Community Volunteers. CRC REEF RESEARCH CENTRE TECHNICAL REPORT No. 24 <http://www.reef.crc.org.au/publications/techreport/TechRep24.html>

<sup>21</sup> Grant Hunter, Claire Mulcock and Roger Gibson (2003) We mustn't lose the plot – community-based tussock grassland monitoring: A review of the REDIS initiative. <http://www.maf.govt.nz/sff/about-projects/pastoral-farming/redis-review-02-138.pdf>

- It is often argued that participatory activities such as community based monitoring provide opportunities for communities to learn about the natural resources in their area and increase their commitment to maintaining and improving natural resource condition<sup>20</sup>. A Queensland review of community based monitoring of coastal marine habitats and water ways concluded that partnerships in coastal monitoring "*provide a mechanism for communities to learn about issues relating to sustainability of local habitats under threat from development*". They found that through monitoring, communities are able to take greater responsibility for stewardship of their local environment while increasing their capacity to contribute more effectively to management of coastal ecosystems<sup>22</sup>.
- In Canada, community based monitoring (CBM) is seen to be contributing invaluable information to the community on the status of the local environment. This can include changes in water quality and climate. The process involved in CBM are seen as increasing social capital, by involving and engaging all of the stakeholders or key members of the community in improving local policy<sup>23</sup>. Some examples of CBM in Canada are listed in Appendix 1.

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<sup>22</sup> Brad Zeller, Andrew Petroeshevsky and Christina Dwyer (2003) Monitoring coastal marine habitats and waterways: Government and community partnerships in action.

<http://www.regional.org.au/au/apen/2001/r/ZellerB.htm>

<sup>23</sup> <http://www.eman-rese.ca/eman/ecotools/common/intro.html>

- The Mid-Term Review of the Natural Heritage Trust found the Waterwatch Program<sup>24</sup> had been *“fundamentally an awareness and education tool in catchments providing education programs to schools and community groups”*. As well as raising awareness of water quality issues, it was evident that Waterwatch was playing an important role in monitoring water quality across catchments. The review highlighted a strong view in the Waterwatch network that Waterwatch could play a part in filling the gap that existed in statutory based data collection. In some catchments, community data was the only baseline information available. Increasing confidence in community data and better resourcing of Regional Coordinators was seen as enabling many Waterwatch groups to fill this much needed role. Waterwatch can provide agencies with a “Watch Dog” role that serves as an early warning system for pollution events. Waterwatchers have alerted councils to blocked drains, overflowing septic tanks and other point source pollution that has enabled a quick response and avoided negative publicity and costly repairs to storm water systems. School children educated by Waterwatch programs have alerted authorities to algal blooms resulting in harm minimisation by quick closure of swimming and recreational zones on lakes and rivers.
- Some Aboriginal and Torres Strait Islander communities in Australia are actively involved in monitoring coastal resources in areas that they manage. These programs are extensions of undocumented monitoring activities that have been ongoing for many thousands of years and are used by the indigenous communities to manage their local resources<sup>25</sup>.

Community based monitoring seems to work best when it is informing local decisions, where the decision makers themselves are participants in the monitoring.

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<sup>24</sup> Buxton Connections (1999) Mid Term Review of the Natural Heritage Trust: Waterwatch Program

<sup>25</sup> Environment Australia (1997) The Australian Coastal Monitoring Initiative Development Strategy <http://www.nht.gov.au/nht1/programs/cmp/monitor.html#Aboriginal>

### 3. Project Methodology

To achieve the project objectives and requirements, the project team undertook to review the literature related to community based monitoring, review the regional INRM Investment Strategy and MERF, review a previous survey and undertake a comprehensive survey of community participants in monitoring in the region.

The following table identifies which sections of the reports are relevant to each of the project requirements.

Table 1: Project requirements

Project requirement	Methodology	Results	Discussion
Identify the relationship and relevance of the current community based monitoring effort to the regional M & E Framework for reporting on the Management Action Targets (MAT's) and the Resource Condition Targets (RCT's) of the INRM Investment Strategy	3.1	4.3 & 4.4	
Identify the gaps and the barriers in the current community based monitoring effort with particular focus in relation to the Programs of the INRM Plan and Investment Strategy	3.1 & 3.5	4.5 & 4.6	CBMF*
Identify of the opportunities that exist to enhance the quality and relevance of the community based monitoring to: <ul style="list-style-type: none"> <li>• meet the regional M&amp;E obligations,</li> <li>• meet the community objectives, and</li> <li>• to achieve regional capacity building outcomes.</li> </ul> This may include recommendations for the adaptation of current monitoring programs or expansion of programs to other localities or to include other monitoring parameters.	3.2 & 3.5	4.5 & 4.6	5.1 CBMF
Develop a data confidence framework which identifies and documents monitoring standards, tools and approaches by which the community could achieve levels of quality assurance for the range of community based monitoring programs.	Literature review		5.2 CBMF
Identify support requirements to maximise the effectiveness and relevance of the community based monitoring effort	3.5 Literature review	Append. 12	5.3 CBMF
Identify community based monitoring training and development needs and development of recommendations regarding how these should be addressed.	3.5 Literature review		CBMF
Incorporate relevant information from other approaches to support Community based monitoring occurring in other regions in SA and interstate	Literature review	Append. 13	CBMF

\*CBMF = Community Based Monitoring Framework – separate document

### **3.1 Review of the SAMDB Plans and Monitoring and Evaluation Framework**

The Investment Strategy (Phase 2) for the SAMDB Region was reviewed to identify the Management Action Targets (MATs) that could generate data and information that may be useful for communities in the management of natural resources in the following ways:

- As baseline information to compare progress against;
- As a monitoring tool that can be used by community groups;
- As a process for identifying monitoring needs and priorities;
- Involves the use of community based monitoring as a methodology for collecting information.

The Monitoring and Evaluation Framework identifies Resource Condition Targets for which community based monitoring could have value. This information was summarised with other relevant information from the MERF into Table 6.

### **3.2 Stage 1 Survey of Community Based Monitoring Groups (Program Inventory)**

A survey of community-based monitoring programs was undertaken in February 2005 by the SAMDB Community Based Monitoring Reference Group.

This survey consisted of 20 questions identifying the monitoring parameters; data collection, storage and quality assurance techniques; location, duration and funding of the monitoring program and whether the monitoring program contributes to Management Action Targets or Resource Condition Targes determined by the INRM Group.

A list of potential community based monitoring programs was compiled from recommendations of INRM and SA DEH staff in the region. Organisations and key participants were contacted for the Stage 1 survey of monitoring programs. Through general inquiries it was established that several of the existing programs were not appropriate to include in the survey due to the absence of community involvement in the monitoring. The questionnaire for the Stage 1 survey was forwarded to the following organisations and key participants active in community based monitoring in the region. These organisations were asked to complete the questionnaires on behalf of the community groups that they were associated with:

1. Local Action Planning Group Officers
2. RMCWMB Wetland Support Officers
3. Waterwatch Coordinators
4. Soil Conservation Board support
5. Greening Australia Officers
6. Banrock Station
7. Calperum Station
8. RMCWMB Water Use Efficiency Officers
9. Friends of Parks
10. SA DEH Regional Officers
11. Conservation Council
12. Nature Conservation Society

Surveys were completed in writing by coordinators/facilitators or key participants in community based monitoring. Fifteen responses were received from 12 groups initially contacted. Some facilitators/coordinators completed a single survey as a combined (average) response for a number of similar community based monitoring programs. The data from the Stage 1 survey provides an inventory of the community based monitoring programs in the SAMDB.



### **3.3 Mapping of Community Based Monitoring Programs**

Coordinators and/or key participants of community based monitoring programs were contacted and asked to provide spatial data and metadata on each program. Some monitoring programs already supply spatial data to databases managed by government agencies (eg. most groundwater monitoring is managed by DWLCB and stored in the database Obswell). Other monitoring programs have very little spatial data or metadata and do not provide this data to any agency or external custodian.

Where spatial data was available community based monitoring program sites were mapped to display the extent and diversity of activities. The maps also highlight the location of community based monitoring programs and sites with respect to some agency monitoring programs.

### **3.4 Community Wetland Monitoring Questionnaire**

In order to gauge the ability of wetland community groups to independently monitor and manage their wetlands, in 2004 a wetland survey was sent to community members involved in monitoring programs by the Community Wetland Officers in the SAMDB region<sup>26</sup>. A total of 18 responses were received and the results are documented in section 4.1. A copy of the original questionnaire is included in Appendix 13.

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<sup>26</sup> Frears, A & Steggles, T. (2004) Community wetland monitoring questionnaire Unpublished.

### 3.5 Stage 2 Survey of Community Based Monitoring Groups (Program Evaluation)

The results of the preliminary survey were collated and examined to identify gaps and issues not yet addressed. Further clarification was also required from some programs to complete the inventory of monitoring programs. Based on this analysis and on the objectives for the Community Based Monitoring Framework, a further targeted survey was developed to consult with project officers and community participants engaged in community based monitoring to draw on their experience and knowledge to evaluate the programs and develop a regional framework.

The consultation approach used telephone surveys ( $n = 31$ ) to investigate the motivation and objectives, levels of involvement, current and required resources, data quality assurance and management arrangements, level of influence of monitoring findings and processes for communication of monitoring results and programs. The telephone surveys were based on 30 set questions with opportunity for respondents to provide further detail and comment throughout.

A cross-section of community based monitoring groups was contacted for input into the review and one key participant from each group was interviewed. Because the Wetland Monitoring (16 community groups) and Waterwatch (46 schools & 12 community groups) Programs represent a very large number of groups undertaking monitoring in the region, project officers for these programs were interviewed about one well established and resourced monitoring group and one less established or resourced group in the overarching programs. A minimum of two community participants from each of these programs was interviewed to provide a view of programs from both the project officer and community participant level of involvement. A copy of the questionnaire is attached in Appendix 4. Staff consulted during Stage 2 are listed in Appendix 5. The community based monitoring groups interviewed during Stage 2 are listed in Table 2 below.

Table 2: Groups surveyed in Stage 2 Survey (Program Evaluation)

<p><b>Waterwatch</b> Lower Murray Waterwatch network:  Jerois Primary School Signal Point (Community Participant)  Signal Point (Waterwatch Coordinator) Swan Reach Area School Finniss Catchment Group Cornerstone College Mt Barker Upper Murray Waterwatch network:  Renmark North Primary School Waikerie Primary School Unity College Murray Bridge</p>	<p><b>Biodiversity Monitoring (general)</b> Rodwell Creek / Wistow Landcare Group Inc. Doctors Creek Landcare Group Eastern Hills &amp; Murray Plains Catchment Group Friends of Gluepot Reserve Gluepot Reserve (Birds Australia) Friends of Riverland Parks Strathalbyn Naturalists Friends of Ferries McDonald &amp; Monarto Parks</p>
<p><b>Wetland Monitoring</b>  Upper Murray Wetlands Brenda Park/Scotts Creek Wetland Management Group Martin's Bend Wetland Management Group Ramco Wetland Management Group Overland Corner National Trust Wetland Management Group Lower Murray Wetlands Milang 2005 Progress Association Riverglades Community Wetland Inc Clayton (Dunn's Lagoon) Wetland Group Ukee Boat Club</p>	<p><b>Threatened Species Monitoring</b> Murray Mallee LAP Mantung-Maggea Land Management Group Black-eared Miners, Regent Parrots and Malleefowl</p>
	<p><b>Ground Water and Water Use Monitoring</b> Mallee Water Resources Committee  Currency Creek Wine Region Association Angus-Bremer Water Management Committee</p>

### Data Management

Microsoft Excel databases were developed to store results from both surveys.

### Data Analysis

Survey results have been tabulated and graphed and relevant summary statistics calculated for interpretation.

## 4. Results

### 4.1 Community Based Monitoring Activities in the SAMDB Region

#### 4.1.1 Community Wetland Monitoring Survey

It is clear from Table 3 that there are some monitoring activities where communities have an interest in monitoring and feel confident in their own capacity (such as groundwater and surface water monitoring and photopoints). For monitoring animal populations (fish, frogs, birds, macroinvertebrates) and vegetation, community groups are willing to get involved but are less confident in their own capacity and presumably would require external technical support to participate in monitoring activities. Fewer groups are interested in maintaining a management log or measuring tree health, and are not confident in their ability to measure either independently.

There is a strong correlation ( $r^2=0.82$ ) between the perception of community groups about their ability to monitor independently and their willingness to participate in monitoring. A similar correlation ( $r^2=0.78$ ) exists between the perception of capability and participation in current monitoring activities.

**Table 3: Community Wetland Monitoring Questionnaire Results**

Parameter	Currently Monitoring	Capable of Monitoring Independently	Willing to Monitor
Tree Health	1	2	5
Management Log	1	1	5
Macroinvertebrates	5	3	8
Birds	4	5	12
Vegetation	7	4	14
Frogs	8	6	12
Fish	9	3	9
Photopoints	12	14	14
Surface Water	12	10	13
Groundwater	14	12	15

Of the 18 groups that responded to the Community Wetland Monitoring Survey, 16 had been involved in community monitoring in the past and all 18 preferred to participate in monitoring in the future. The average number of days ranged from 4 days to 30 days per annum (average = 9.1). The majority of respondents preferred to participate in monitoring as part of a group.

The most common reason for participating in monitoring activities was to determine wetland condition and influence management decisions. Community wetland monitoring groups indicated that management decisions should be based mostly on professional advice and via wetland management committees and groups valued historical information, management plans and monitoring data much less on their own.

## 4.2 Inventory of Current Community Based Monitoring Programs

### 4.2.1 Location of Community Based Monitoring Programs

The locations of different categories of current community based monitoring programs are shown on Maps 1 – 5 below. The monitoring programs vary considerably in the standard of spatial data and Metadata on monitoring and monitoring locations. The datasets mapped are from those where spatial data on monitoring sites was provided (Table 4a) and where a dataset has been generated to allow display of the spatial extent of the monitoring program (Table 4b).

**Map 1** shows the spread of Waterwatch monitoring sites throughout the region and the water quality monitoring sites managed by SA Water. The location of many Waterwatch monitoring sites between water quality sites managed by SA Water highlights the potential for community based monitoring programs to benefit from easy access to agency monitoring programs. Map 1 also illustrates the extensive network of Waterwatch monitoring sites both along the Murray River and along tributaries in the South Western part of the SAMDB.

**Map 2** highlights the extent of the community-based wetland monitoring program. The monitoring on many of these wetlands is used to assist in management decisions.

**Map 3** shows an example of the intensive network of monitoring sites that are part of the Floating Flag Test Well monitoring program of the Riverland Irrigators. The network of floating flag test wells is established on irrigation properties transferring or buying water. More than 950 test wells have been established through this program, providing monitoring through direct visual awareness of emerging problems.

**Map 4** shows the approximate area of the Diviner 2000 Soil Moisture Monitoring Trial on the Fleurieu Peninsula. This program provided landholders with access to equipment for monitoring soil moisture for one year. Landholders receive assistance in using the monitoring results to schedule irrigation and benefit from improved water use efficiency. The program has also been available in the Riverland region and more than 200 growers (760 sites) have been involved in the program since 2001.

**Map 5** shows the locations or approximate areal extent of community based monitoring programs focussed on terrestrial biodiversity. Few of these programs were able to provide Metadata on the monitoring sites.

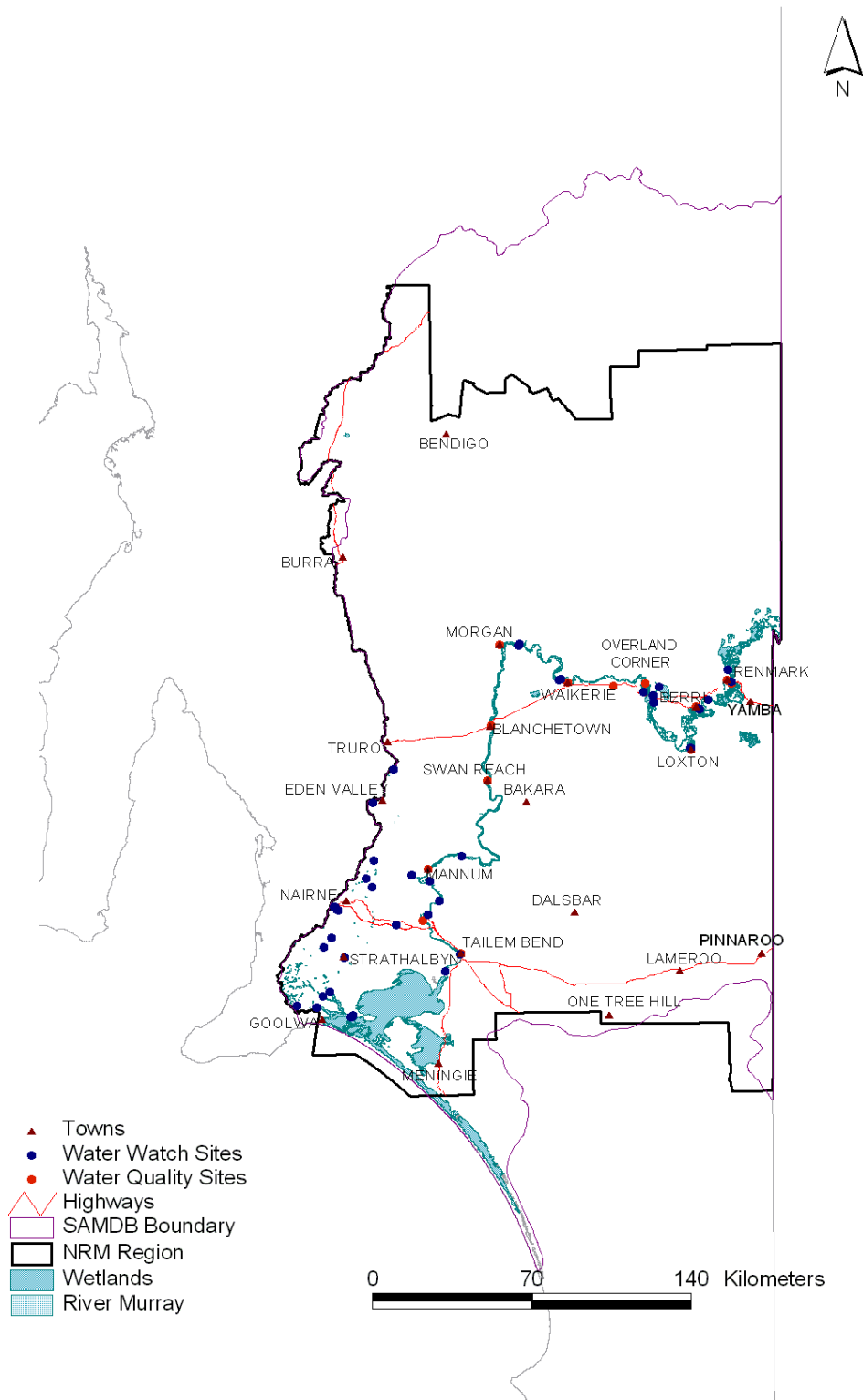
Examples of the metadata collected for monitoring under the Waterwatch and Community Based Wetland Monitoring Programs are shown in Appendix 2

**Table 4a: Community Based Monitoring Programs with Spatial Data**

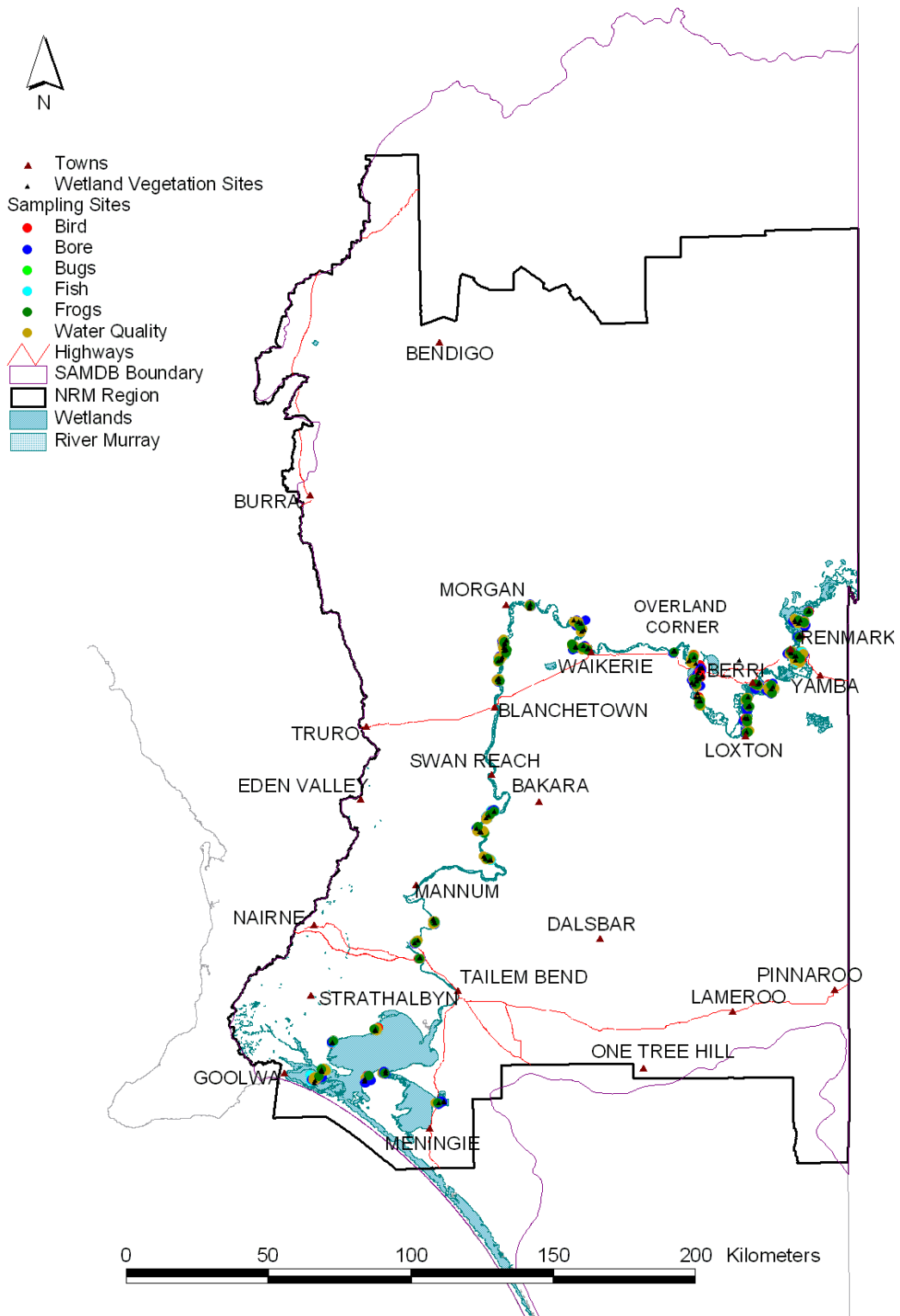
<b>Dataset Name</b>	<b>Custodian</b>	<b>Year of sampling</b>	<b># of Records</b>	<b>Metadata Provided</b>	<b>Description</b>
Waterwatch Sites	River Murray Catchment Board	2005	143 records	Yes	River Murray Catchment Board water watch sites containing group names, nitrates, EC, phosphates and turbidity (No Metadata)
Water Quality Sites	SA Water MDBC	1998-2005 (varies for different parameters)	14 records	Yes	Sites for water quality parameters (phosphorus, nitrogen, turbidity and EC)
Wetland Monitoring Sampling Sites	River Murray Catchment Board	2004	1789 records	Yes	Type of sampling sites includes birds, bore, bugs, fish, frogs and water quality
Wetland Vegetation Sites	River Murray Catchment Board	2004	137 records	Yes	The vegetation sites table contains wetland names
Wetland Vegetation Mapping	River Murray Catchment Board	2004	1482 records	Yes	The vegetation mapping contains wetland names, vegetation description and cover
Floating Flag Test Wells	Riverland Irrigators	NA	161 records	No	Water table levels
Eastern Hills and Murray Plains Catchment Group, Flora and Fauna Monitoring	Eastern Hills and Murray Plains Catchment Group	NA	8 records	No	Contains species information

**Table 4b: Community Based Monitoring Programs with Spatial Data Generated for the Report**

<b>Dataset Name</b>	<b>Areas covered</b>	<b>Generated From</b>	<b>Generated By</b>
Rodwell Creek/Wistow Landcare Group	Wistow area	Online Digitiser	University of Adelaide
Friends of Gluepot reserve and birds of Australia	Gluepot Reserve	NPWS spatial layer	University of Adelaide
Friends of the Riverland Parks	Cooltong Reserve, Murray River National Park, Pooginook Reserve	NPWS spatial layer	University of Adelaide
Strathalbyn Naturalists	Strathalbyn area	Online Digitiser	University of Adelaide
Friends of Ferries McDonald & Monarto Park	Ferries McDonald Reserve, Monarto Reserve	NPWS spatial layer	University of Adelaide
Mantung-Maggea Land Management Group	Bakara Reserve, Calperum Reserve	Heritage Agreement Areas spatial layer	University of Adelaide
Soil Moisture Monitoring Program	Finniss river/Currency Creek Area	Online Digitiser	University of Adelaide

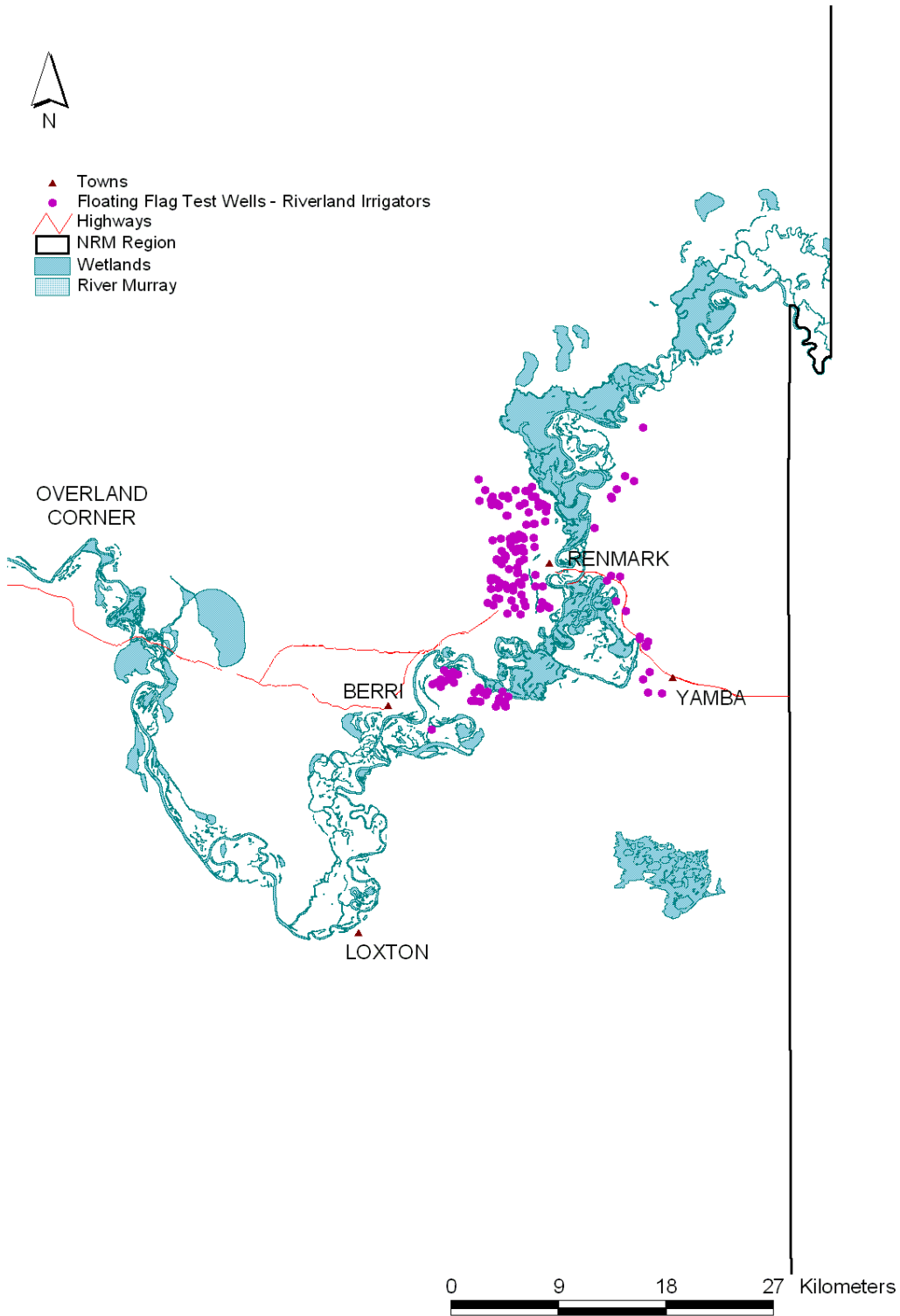


Map 1: Waterwatch and Agency Water Quality Monitoring Sites

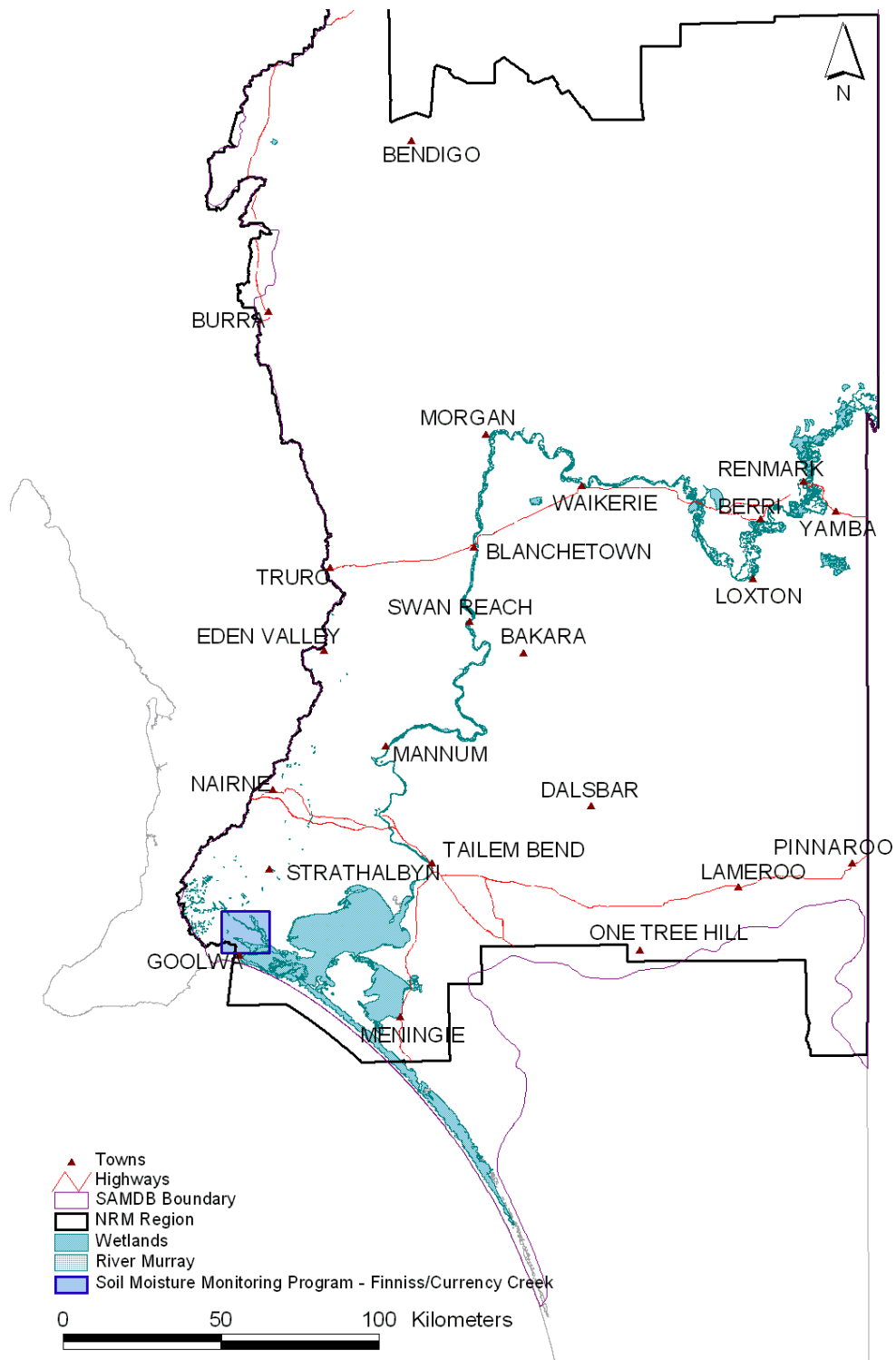


Map 2: Community-Based Wetland Monitoring Sites

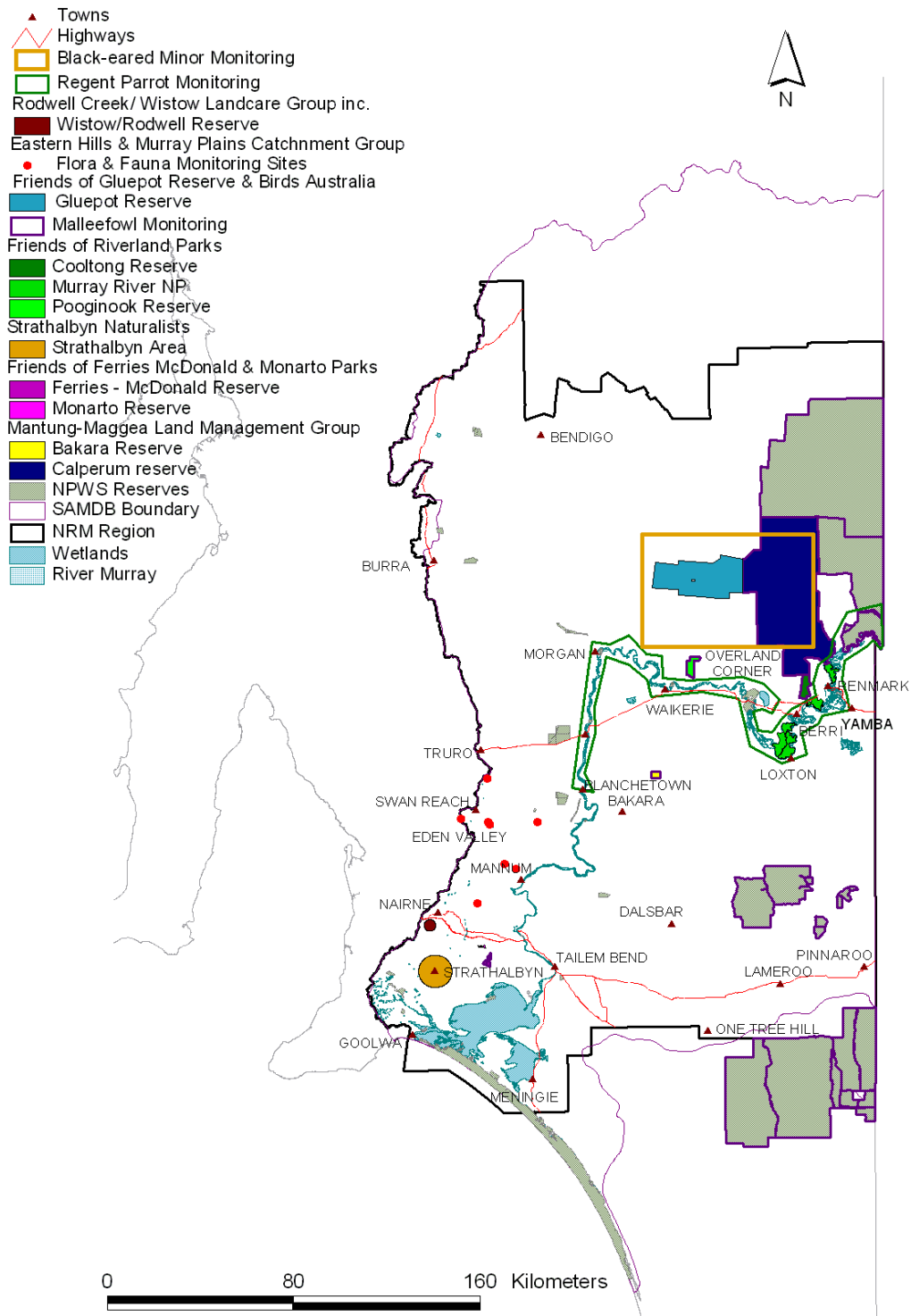




Map 3: Floating Flag Test Well Monitoring – Riverland Irrigators



Map 4: Soil Moisture/Wateruse Efficiency Monitoring (Fluerieu Peninsula)



Map 5: Community-Based Terrestrial Biodiversity Monitoring Sites/Areas

#### **4.2.2 Review of the Stage 1 Community Survey Responses (Program Inventory)**

The inventory of community based monitoring programs is provided as an electronic database (Microsoft Excel Spreadsheet) in Appendix 3.

#### **4.3 Institutional monitoring information**

The Investment Strategy (Phase 2) for the SAMDB Region identifies Management Action Targets (MATs) that will generate data and information that may be useful for communities in the management of natural resources in the following ways:

- As baseline information to compare progress against
- As a monitoring tool that can be used by community groups
- As a process for identifying monitoring needs and priorities
- Involves the use of community monitoring as a methodology for collecting information

This is summarised in Table 5. (Table 5 is expanded in Appendix 7 to show which MATs will deliver information useful for community based monitoring against each of the Resource Condition Targets (RCTs)).

**Table 5: Data generating MATs (as per Investment Strategy Phase 2)**

<b>Management Action Target</b>	<b>Useful for Community Monitoring?</b>
7: To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
10: To have assessed vegetation health and the potential future impacts of changes in the salt and water balance on vegetation health by 2006	Yes, to identify priorities for monitoring
21: To enable the baseline information required	Yes, as baseline information to compare progress against
22: To have implemented a system for cost effective consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by Dec 2005	Yes, as monitoring tool
24: By 2007, to have constructed and implemented a rigorously maintained accounting system for recording, monitoring and reporting on salinity impacts of water trade; supporting salinity policy through the provision of up to date, accurate information	Yes, as monitoring tool
31: To design and construct a web-based system for cost effective, consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by 2008	Yes, as monitoring tool
37: To increase irrigation efficiency throughout the Tintinara Coonalpyn irrigation area by 20% through improved irrigation management by 2006	No
42: To establish an inventory of assets currently or in the future likely to be affected by increasing dryland salinity by June 2005	Yes, to identify priorities for monitoring
53: High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
54: 45,00 ha perennial vegetation established in high priority areas by 2007	No
55: 9,000 ha perennial vegetation established through community engagement program by 2007	No
61: To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring
65: Identify monitoring objectives, appropriate trials and design native fish survey	Yes, to identify priorities for monitoring
68: Identify areas that can be influenced by environmental flow enhancement and groundwater lowering	Yes, to identify priorities for monitoring
70: Commence baseline data collection and develop long-term monitoring program	Yes, as baseline information to compare progress against Perhaps also work together to collect data
71: Identify threatened species, communities or critical habitats within land system units across the Chowilla RR and GR	Yes, to identify priorities for monitoring
72: Identify priority areas or hot spots across the Chowilla RR and GR	Yes, to identify priorities for monitoring
74: regional wetland monitoring networks and data management mechanisms to fill wetland monitoring gaps	Yes, this involves community monitoring as a methodology

Management Action Target	Useful for Community Monitoring?
88: To have all water users metered by 30 June 2007	Yes, as monitoring tool
95: By 2006, to have increased the area of priority native vegetation retained and restored in HA and NPWSA reserves to over 2000ha	No
96: By 2006, 50% of regionally identified threatened communities are protected, conserved and managed in HA and DEH reserves	No
103: By 2006, an additional 85km of native vegetation protected and managed along 6 priority roadsides and a Bushcare site established in each area	Yes, this involves community monitoring as a methodology
104: by 2006, to have re-established 950 ha of native vegetation to provide viable habitat and links between vegetation and habitat fragments in priority areas	No
108: To have developed and be implementing coordinated control plans for introduced plants and animals for areas of threatened species and ecosystems by 2006	Yes, to identify priorities for monitoring
115: To have identified pests of significant impact by June 2005	Yes, to identify priorities for monitoring
116: To have identified priority pest plant and animal locations in areas of cultural and conservation significance and/or greatest need by June 2005	Yes, to identify priorities for monitoring
123: Identify baseline to establish on-going monitoring schedules by 2005	Yes, as baseline information to compare progress against
133: By 2006, an additional 10% of public land managed to maximise Ramsar values	No
134: By 2008, an additional 20% of currently eroding lakeshore is stabilised	No
137: By 2008, improved management of 100ha of existing riparian vegetation	No
138: By 2008, improved management of 100ha of existing riparian vegetation	No
140: By 2006, a description of the ecological character of the Ramsar site that can be used as the basis for future land, water, species and ecological community management	Yes, to identify priorities for monitoring
145: By 2006, a comprehensive ecosystem monitoring program that will enable evaluation of the impact of land, water, species and ecological community management actions	Yes, as monitoring tool
149: To restrict stock access to 25% of riparian zones in priority areas 2006	No
151: To have commenced a trial by 2004 of an alternative operating regime to enhance the ecological health of the lower Lakes, Coorong and Murray Mouth	No

#### 4.4 The Role of Community Monitoring in the MERF

Community based monitoring can play an important role in achieving monitoring required under the MERF. This potential role is summarized in Table 6. The results of the analysis suggest that community based monitoring has particular potential to undertake:

- Surveys of vegetation condition and extent
- Surveys of wetland condition, extent and connectivity
- Fish surveys

There are other measures of condition where community groups have a valuable role to play in monitoring, but there is still no agreed methodology (for example: lake edge erosion). Community groups should be encouraged to be involved in deciding what monitoring methodologies are appropriate, as community participants can bring a wealth of experience and a broad perspective in developing practical solutions to technical problems.

**Table 6: Potential for community based monitoring identified in the MERF**

RCT	Required Info	Details	Potential Community Monitoring	Methodology
1. Maintain and improve the extent and condition of 65% of current floodplain vegetation communities in areas of high priority by 2020	Floodplain vegetation condition, extent, composition and structural classifications	On going vegetation survey: River Murray floodplain region of SA - SA/Vic/NSW border to the barrages - extending to the 1956 flood level; every 15 years for floodplain vegetation extent, composition and structural classifications and every 5 years for floodplain vegetation condition	Yes	Guide to a Native Vegetation Survey Using the Biological Survey of South Australia Methodology. Dept Housing and Urban Development. 1997
	Priority system to define or identify areas not established with native vegetation	Priority system - potential methodology and output under progress through Department for Environment and Heritage (completion expected mid 2005) - to be applied to the SAMDB and potentially remaining SA NRM regions - anticipated output includes ecological classification of landscape with polygons of vegetation communities based on landform, soil type and habitat value for regional and sub-regional priority	Yes with some direction	

RCT	Required Info	Details	Potential Community Monitoring	Methodology
2. By 2020, a 30% reduction in priority areas of floodplain currently affected by salinity from groundwater discharge.	Salt affected floodplain extent	'On going vegetation survey and Flood Impacts Model (revised) incorporated: River Murray floodplain region of SA - SA/Vic/NSW border to the barrages - extending to the 1956 flood level; Every 5 or 10 years		
3. Maintain and improve the condition and connectedness of 60% of wetlands of high priority by 2020	Wetland condition	Wetland condition - "condition" difficult to assess in an efficient manner due to variety of potential condition parameters - methodology used in Tree Health dataset has been adapted and used in "Your Wetland: Monitoring Manual - Data Collection" (Tucker P 2004) and Floodplain Impacts Model (CSIRO 2003). No planned, systematic monitoring program - option RMCWMB Wetlands Community Monitoring Program: need to investigate data quality and timing of availability; Every 5 or 10 years	RMCWMB Community Wetland Monitoring Program	Tucker. P. (2004) Your Wetland: Monitoring Manual - Data Collection. River Murray Catchment Water Management Board, Berri and Australian Landscape Trust, Renmark
	Wetland "connectedness"	Wetland connectedness/connectivity - Systematic monitoring program not in place - Incorporating wetland management licence system Every 5 or 10 years	RMCWMB Community Wetland Monitoring Program	
4. Maintain and improve the condition of 60% of the littoral zone of high priority and high significance by 2020	Health of the littoral zone of the River Murray and Coorong	Monitoring program and vegetation survey for the littoral zone of Coorong, River Murray and waters	Potential with support	Standards developed by DEH and David Paton (University of Adelaide)



RCT	Required Info	Details	Potential Community Monitoring	Methodology
5. By 2020, improve the habitat in all waters to permit successful recruitment of native fish, particularly Murray Cod, resulting from natural or manipulated flows.	River health	Additional monitoring sites are needed to develop regional models (autumn edge, spring edge and combined edge models for the River Murray) and from selected sites yearly to show temporal patterns in response to different source water effects (e.g. Murray River or Darling floods, drought effects, managed flows from Lake Victoria) along selected section of River Murray and tributaries twice annually	Potential - develop simpler monitoring programs to complement the more detailed sampling and analysis of the larger program	<a href="http://ausrivas.canberra.edu.au/Bioassessment/Macroinvertebrates/Man/Sampling/SA/SA_Training_Manual.pdf">http://ausrivas.canberra.edu.au/Bioassessment/Macroinvertebrates/Man/Sampling/SA/SA_Training_Manual.pdf</a>
	Native fish numbers	Ongoing fish monitoring at key sites along selected section of River Murray and tributaries every three years	Yes	Methodologies developed for Baseline Survey (Community Wetland Management Program)
	Murray Cod recruitment	Ongoing fish monitoring at key sites along selected section of River Murray and tributaries every year	Yes	
6. Recover 30% of water dependent ecosystems from pest infestation and minimize any further infestations by 2020.	Aquatic pest extent and distribution	Fish survey annually	Yes	Methodologies developed for Baseline Survey (Community Wetland Management Program)
6. Recover 30% of water dependent ecosystems from pest infestation and minimize any further infestations by 2020.	Wetland condition	A number of attributes would determine 'condition' which would be monitored at differing times in the year to detect change. No protocol developed yet.	RMCWMB Community Wetland Monitoring Program	
7. By 2020, to have salinity of water in the River Murray less than 800EC for 95% of the time at Morgan to ensure drinking water standards	In river salinity	Mostly achieved through modelling with BIGMOD. Contextual information would be valuable	Waterwatch Program - neighbouring location for contextual information	Internal Standards - meet and exceed National Standards

RCT	Required Info	Details	Potential Community Monitoring	Methodology
14. Maintain and improve the stability of river banks, lake edges, sanddunes and cliffs by 2020	River bank erosion	Systematic monitoring program not in place	Develop a River bank watch program	
	Lake edge erosion		Inclusion of monitoring with Waterwatch program groups	Informal methodologies developed and tested as part of trials
	Sand dune erosion		Develop a Sand dune watch program	
	River cliff erosion		Develop a Cliffwatch program	
21. Recover 30 % of quality native vegetation, habitat and agricultural production areas from pest infestation and minimize any further infestations by 2020	Vegetation habitat extent	Habitat extent monitoring	Yes	
22. By 2020 improve or maintain condition of terrestrial native vegetation focusing on identified priority areas and improve condition of 50% or remnant vegetation on private land as well as increasing vegetation cover by 1% in the agricultural region.	Vegetation condition Extent of native vegetation	Surveys of vegetation condition Habitat extent monitoring	Yes Yes	Guide to a Native Vegetation Survey Using the Biological Survey of South Australia Methodology. Dept Housing and Urban Development. 1997

## 4.5 Community Consultation

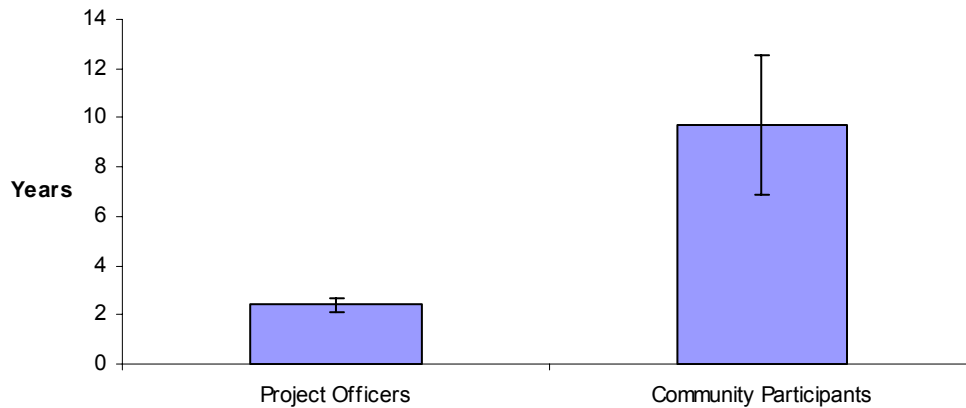
Consultation with project officers and participants in community based monitoring programs revealed that these two levels of participation contribute a set of complementary strengths and skills to community based monitoring (Table 7). Key difference between community participants and project officers stem from differences in the time available for the monitoring, length of involvement in NRM in the region (Fig 1), training and technical skills, proximity to and use of the resource/site monitored, and connections to resource users and decision makers at the local/regional/State level.

**Table 7: Strengths and skills that community participants and project officers bring to community monitoring programs (*represents an average set of strengths and skills for individuals and groups and are not mutually exclusive*)**

Community Participants	Project Officers
Long-term local knowledge & experience of the resource/site	Dedicated time for the project
Long-term involvement in the monitoring	Organisation/coordination time & skills
Enthusiasm & concern for the resource/site	Technical skills &/or access to skills
Local networks with resource users & decision makers	Analysis and interpretation training
Technical skills	Access to regional/State information systems
	Connections to other local/regional groups
	Connections to regional decision makers

Community based monitoring is largely dependent on the participation of volunteers supported by paid project officers and coordinators. To understand why community members become and remain involved in monitoring we examined the motivation for involvement and the best and most challenging parts of the monitoring activities. Individuals (both community participants and project officers) were asked to give general reasons why community members were motivated to become involved in each monitoring program and the answers were collated to examine themes (Table 8).

Figure 1: Average number of years community participants and project officers have been involved in the monitoring programs consulted (each bar represents the mean of 15 respondents  $\pm$  standard error)



Project officers and community participants provided consistent answers about the motivation for community member involvement in monitoring programs. The strongest themes related to a desire of community members to make a contribution to maintaining the health of the environment (and natural resource management) and to increase their own knowledge and understand of natural resources. Other reasons for involvement included care and enjoyment of individual sites/resources, a desire to contribute to the community and concern about problems facing the site/resource (Table 8).

The strongest themes emerging from responses to the question “What are the three best things about the monitoring program”, were:

- the benefits of seeing changes and receiving feedback on changes in the condition of the site/resource and
- the use of monitoring data to inform action at the site/resource.

A number of respondents noted the benefits of detecting changes over the “long-term”.

The benefits of learning about the resource/site, using the monitoring as a teaching tool (particularly for schools in Waterwatch), and building an appreciation, understanding and awareness of the resource assets and threats to the resource was also a strong theme supporting the use of community based monitoring as a capacity building tool. A particularly strong theme amongst responses indicating the benefits of capacity building was the opportunity for practical learning.

**Example: community participant statements on what the best things about the monitoring program are:**

*“Practical hands-on learning about the environment”*

*“Generates enthusiasm through hands-on”*

Other responses referred to the benefits of social interaction, interaction between participants with different ages and backgrounds, and the enjoyment of the monitoring activities themselves. Several project officers also noted the benefit of community groups becoming independent in their activities.

Having examined what motivates and encourages participation in community based monitoring we also examined what the biggest challenges facing the monitoring programs were. Project officers and community participants showed consistency in the major themes from responses, while there were some differences between respondent groups for minor themes. These differences reflect the different objectives and operational environments of project officers and community participants and provide a more complete picture of ongoing challenges to community based monitoring in the region.

The strongest themes highlighted the challenge of continuously renewing the membership and enthusiasm of community groups involved in monitoring. Both project officers and community participants saw this as a problem; however, project officers were also concerned about losing experienced and skilled participants from groups with declining membership.

The challenge of maintaining the level and long-term security of resources (funding, equipment etc.) for long-term monitoring was also a strong concern for both community participants and project officers. It was recognized that change in resource condition may take a long time to manifest whilst monitoring effort is clearly vulnerable to short term fluctuations in resource allocation. Several community participants also expressed an associated perception that decision makers at the regional and State levels did not necessarily support community based monitoring. This challenge was associated with recognition that it is difficult to keep experienced and capable monitoring project officers, who were seen as essential to the continuation and improvement of community based monitoring.

**Example: community participant statements on what the biggest challenges facing the monitoring program are:**

“The support from [*Project Officers Names*] – they are so necessary to keep the morale up and facilitate the flow of information – be our guiding lights”

A number of respondents also commented that it was difficult to share data and results with managers and decision makers and difficult to influence management actions. This was a more common response from project officers than community participants. This may reflect the different understanding of the purpose and importance of the monitoring from the perspectives of community participants and project officers.

Several challenges were identified by project officers or community participants but not by both. Project officers expressed the view that some members of community groups involved in monitoring could be difficult or obstructive and resisted the uptake or improvement of community based-monitoring by the group. Community participants recognized that there were often practical constraints to undertaking or improving community-based monitoring and that the type, number and coverage of measured parameters were sometime inadequate to meet the objectives of the monitoring program.

**Table 8: Groups reporting different types of participant motivation for involvement in community based monitoring programs**

Motivation Type	% Groups
Contribution to environment/NRM	40
Increased knowledge	40
Concern about problems at the site	23
Care/enjoyment of the site	20
Sense of community	20
Increased skills	16
Increased awareness	13
Adaptive management	7
Marketing tool/EMS for production	7
Requirement to report	3
Social interaction	3
Want to demonstrate achievement from the project	3

## 4.6 Community Participation

An effective monitoring program incorporates all the stages of a planning and implementation cycle. Figure 2 illustrates the community based monitoring planning cycle. Each stage in the cycle requires specific skills to be contributed by community participants, project officers or others involved in the monitoring program. One measure of the success of implementing a community based monitoring program is the satisfaction of all parties in the levels of involvement in each stage of the monitoring and whether each stage has sufficient input from community participants to build and maintain community ownership of the program. We examined project officer and community participant perceptions of the level of importance of community participant involvement and the current level of involvement in components of community based monitoring in the SAMDB.

There was strong agreement between project officers and community participants on the importance of community member participation in the different components of community based monitoring (linear correlation;  $r^2 = 0.87$ ). Both project officers (Fig. 4 A) and community participants (Fig 3 B) expressed the view that community member participation in planning, coordination, equipment management and communication was quite important, while involvement in data entry, analysis and interpretation was seen as less important. The same trends were observed for the current level of participation of community members in each component of the monitoring program (good correlation between project officers and community participants for current level of participation for all components;  $r^2 = 0.67$ ); however, the project officers rated the current level of involvement of community members lower than the community participants did for all components except data collection (Fig 3). Project officers and community participants agreed that the current level of involvement in data entry, analysis and interpretation was relatively low, and project officers rated the current level of community member participation in planning and communication was also relatively low.



Almost all programs reported that data analysis was limited to different forms of data display – eg. tables, graphs, maps (Table 9). Most programs also reported that any data analysis was undertaken by project officers, some was undertaken by government agency staff and only 20% of programs reported that the project group/members undertook data analysis (Table 10). These figures are associated with similar rates of project officer, government agency staff and project group/member involvement in data interpretation (Table 11).

Figure 2: Community based monitoring planning cycle.

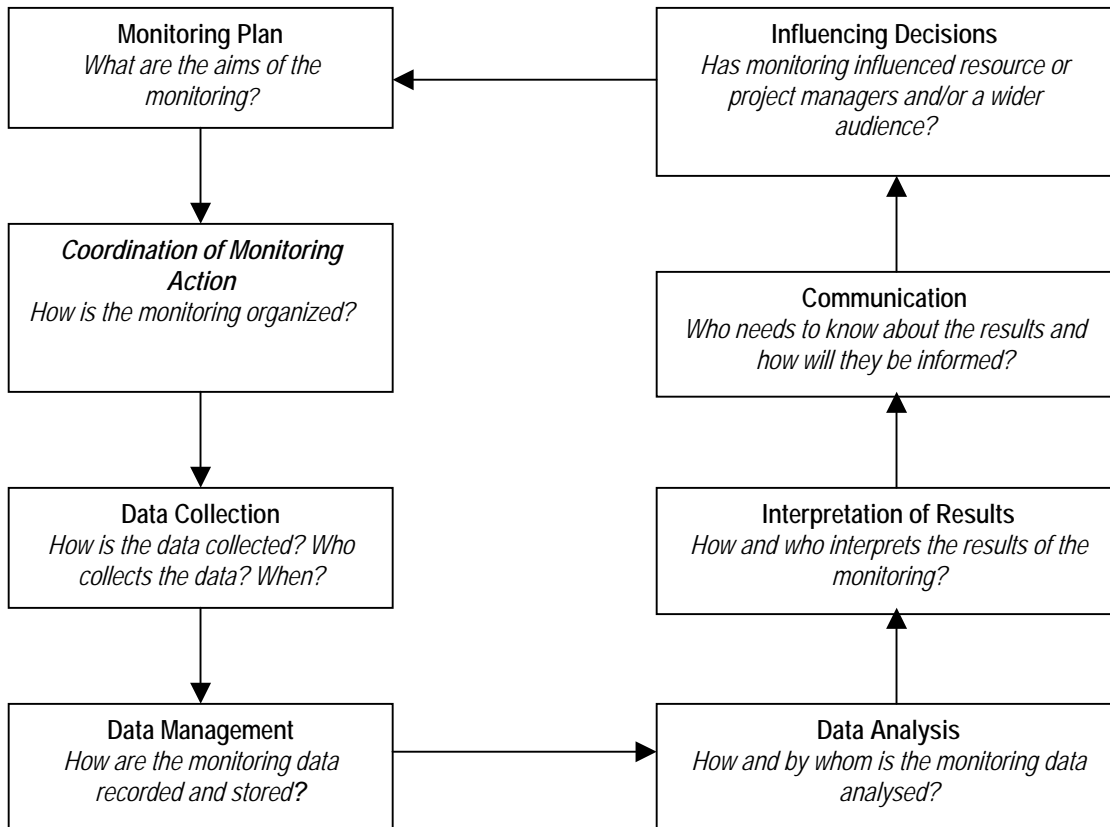
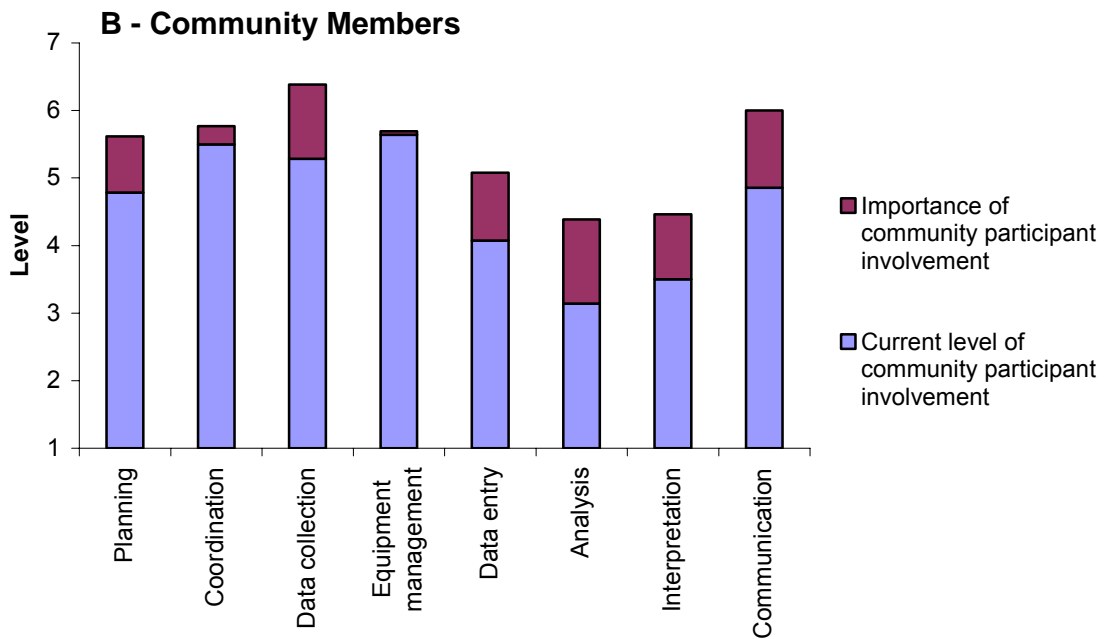
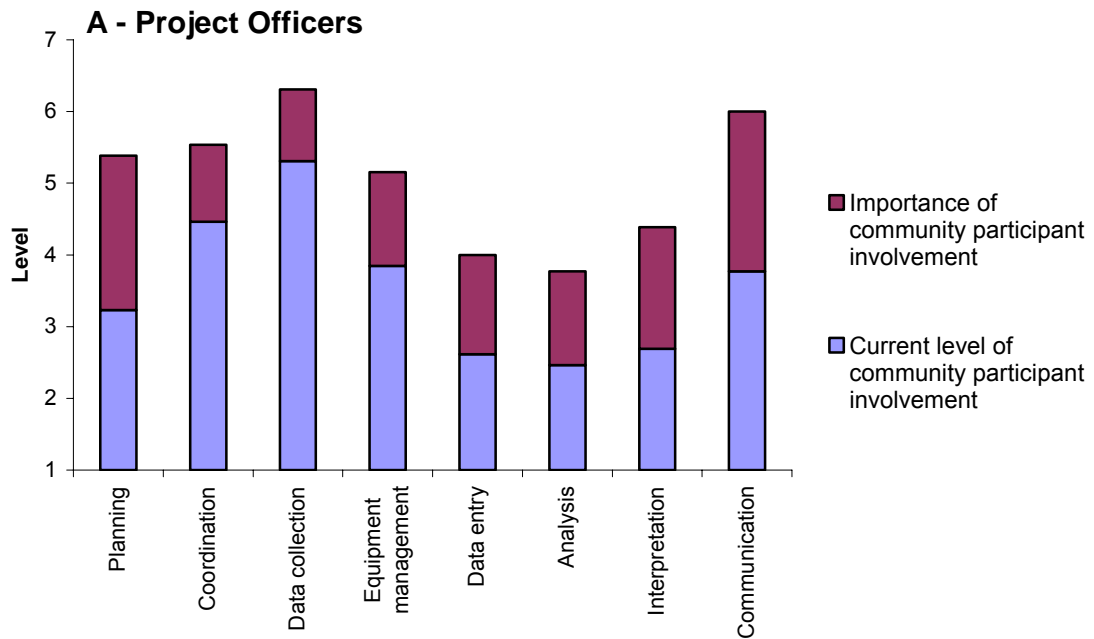


Figure 3: Community Participation in Monitoring Activities (A = Project Officer Perspective, B = Community Participant Perspective) On a scale of 1 to 7 where 1 is not at all involved/not at all important and 7 is very involved/very important



**Table 9: Types of analysis tools used by community based monitoring groups**

<b>Analysis method</b>	<b>% Groups</b>
None	13
Graphs	40
Tables	20
Statistical analysis	7
Model	7
Map/GIS	30

**Table 10: Classes of individuals or organisations analysing the data collected through community based monitoring**

<b>Who analyses the data?</b>	<b>% Groups</b>
Project staff	40
Other regional group staff	0
Project/community group	20
Government agency staff	23
Regional/local expert	0
Consultant	3

**Table 11: Classes of individuals and organisations interpreting data for community based monitoring groups collected through community based monitoring**

<b>Who interprets the data?</b>	<b>% Groups</b>
Project staff	43
Other regional group staff	0
Project/community group	30
Government agency staff	23
Regional/local expert	0
Consultant	3

## 4.7 Influence on Local and Regional Decisions

Stated motivations for community members to participate in community based monitoring include a wish to contribute to the management of natural resources and remediation of environmental problems (Table 8). One of the key objectives of many monitoring program is to influence management, however, it is not always easy to either influence management decisions or attribute management decisions to evidence provided by monitoring programs. Project officers and community participants were asked to rate their level of confidence in the current and potential influence of each community based monitoring program on local and regional decisions about natural resource management. Project officers and community participants expressed similar levels of confidence (combined results in Fig 4).

There were relatively high levels of confidence that community based monitoring programs influence decisions about natural resource management at the local level but low levels of confidence about influence at the regional level (Fig 4). The level of confidence at the local level was supported by examples of action or influence on action following direction from the monitoring program.

**Examples: community participant statements on the influence of community based monitoring on local decisions about NRM:**

"...the group chose to draw down the wetland water levels based on the condition of young River Red Gums (yellowing) after a monitoring day."

"Community thought wetland was in poor condition but monitoring showed it was OK. ....may have prevented undertaking unnecessary work"

"Dying gumtrees (>100 year old) – [group] requested environmental allocation after monitoring showed decline. Hypersalinity showed up in monitoring, also an argument for [an] environmental allocation [of water]

"Monitors fresh water into saline wetland [near a] new housing development - currently collecting 'before' data, may influence council decisions on stormwater

Some examples also highlighted the potential influence that community based monitoring has across the region.

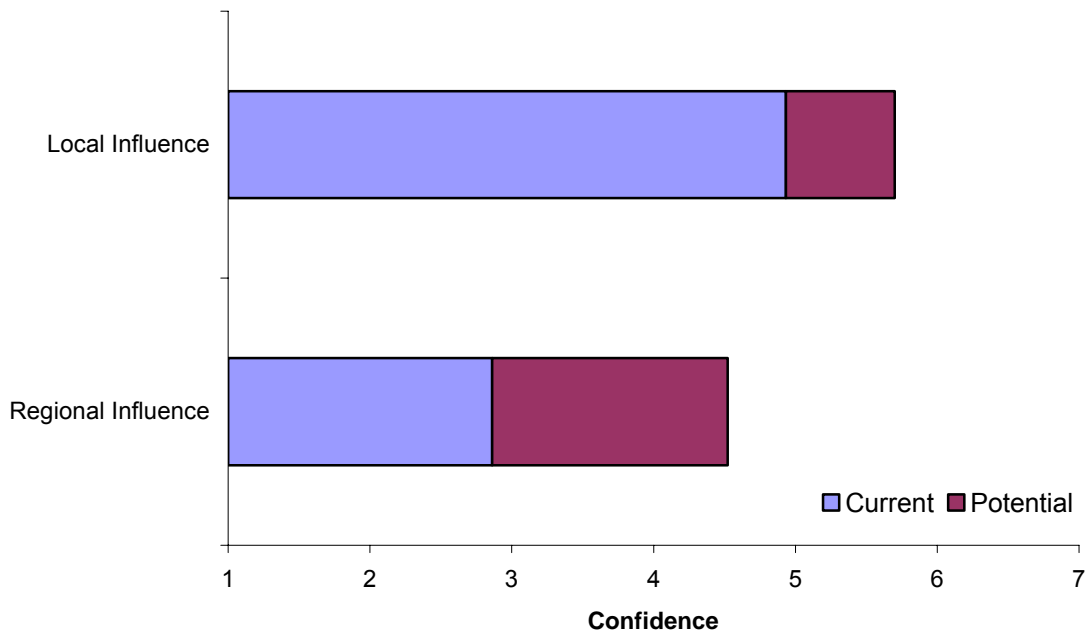
**Examples: community participant statements on the influence of community based monitoring on regional decisions about natural resource management:**

"Information collected regarding weeds effects where and when weed control is undertaken"

"Some landholders changed irrigation practices and improved efficiency of water use"

Project officers and community participants expressed high levels of confidence that community based monitoring could potentially influence decisions at the regional and local level more than they currently do. Again the confidence that the monitoring could influence management decisions at the local level was high and suggests that there is belief that the influence could be greater than at present. The level of confidence in the potential influence of community based monitoring on decisions about natural resource management at the regional level was only moderate but demonstrates belief that influence at this level could increase.

**Figure 4: Project officer and community participant confidence in the current and potential influence of community based monitoring on local and regional decisions about natural resource management (1 = not at all confident; 7 = very confident)**



## 4.8 Communication of the monitoring results

The influence of community based monitoring on local and regional decisions about the management of sites and natural resources is dependent on the effective dissemination and communication of monitoring results and interpretations. We examined the range of communication tools currently used by community based monitoring programs in the SAMDB and the audiences and organizations the programs aim to inform and influence.

Project officers and community participants had similar ideas about the audiences and organizations that the monitoring programs aimed to inform. The only exception to this was the high proportion of project officers (10 project officers) who wanted to inform the Catchment Board (RMWMCB) compared to community participants (2 community participants). The main audiences for the communication of results were the project group itself, government agencies (staff), the Catchment Board (RMWMCB) and LAP groups (Table 12). The main tools used by projects to communicate the results of monitoring programs were reported as word-of-mouth, project meetings, field/demonstration days, project newsletters and brochures/pamphlets (Table 13).

The match between the communication tools employed and the target audiences is not high (Table 13). Approximately 50% of projects used project reports to communicate results while this is probably the most effective tool for informing key audience sectors such as Catchment Boards and Government Agencies. Similarly, almost 50% of projects had communicated monitoring results through local newspapers, an effective tool for informing the general public and local land managers, both groups who were only target audiences of around 30% of groups.

**Table 12: Organizations and agencies that community based monitoring groups aim to inform**

Organizations/Agencies	% Groups
NRM Board	13
RMCWMB	40
LAP group	36
Animal Plant Control Board	10
Soil Board	6
land managers	23
Government agency	50
Local government	23
Project/community group	53
General community	30

**Table 13: Media and communication tools used by community based monitoring groups to communicate the results of monitoring**

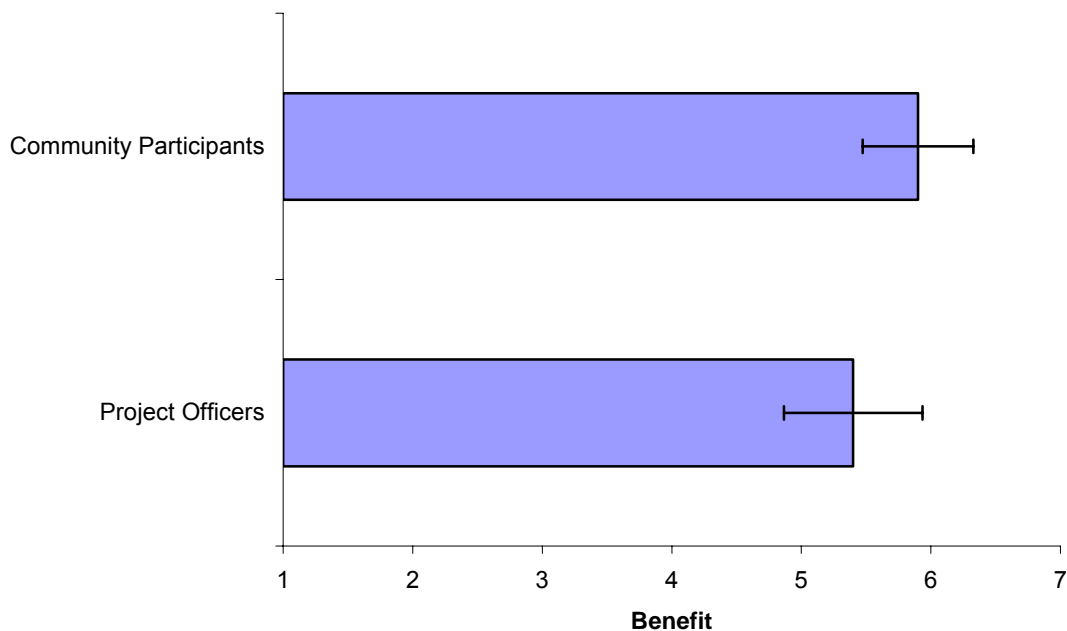
Media/Communication Tools	% Groups
Pamphlets/brochures	40
Project newsletters	47
Region wide newsletter	30
Field/demonstration days	50
Project meetings	57
Word-of-mouth	80
Project report	53
Local newspaper	47
State newspaper (Advertiser)	7
Local radio	13
State or national radio	7
TV (local/state/national)	13
Conference/forum	23
Magazine	17
Scientific journal	10



## 4.9 Data Storage and Access

One of the limitations to improved data analysis and interpretation is the level of access to monitoring program data and other data sources that provide context at the interpretation stage. Project officers and community participants in community based monitoring recognized the high level of benefit to community based monitoring effort from having a single data storage and access point in the region (Fig 5) The benefits of a single data storage and access point were considered to include access to data collected by the group on previous occasions, access to the data of other community based monitoring groups in the region, access to resource and monitoring data collected by government agencies and others, and provision of access to community based monitoring data for other natural resource monitoring programs, managers and decision makers.

**Figure 5: Perceived benefit for monitoring programs from a single data storage and access unit in the region (1 = no benefit at all; 7 = very beneficial)**



The value of improving access to existing data through a single or linked systems has also been recognized by previous studies in the region. The River Murray Wetlands Data Management Project<sup>27</sup> recommended that stakeholders in regional wetland data:

*“...work towards live connections between different datasets held by different organisations, with custodianship remaining with those organisations who have expertise in those areas. This would allow organisations like the Board [RMCWMB] to expand their available knowledge without reinventing the wheel. An ideal place to start this kind of information transfer would be to put in place agreement that spatially based data is submitted to Atlas SA on a regular basis. This would enable public access to this data and could serve as a model for sharing of other information.”*

This report also identified the preferred systems for storage and management of wetland data, set out interim arrangements for management of data on wetlands, and provided guidelines for incorporating wetland data into preferred data systems. However, this study identified a number of steps which need to be taken by database custodian organizations before consistency and efficiency in data storage, management and access for wetland related data in the region could be achieved. Recommendations from The River Murray Wetlands Data Management Project are currently being implemented by State government agencies and regional bodies (SAMDB NRM Board/RMWMCB).

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<sup>27</sup> River Murray Wetlands Data Management Project (Final Report 2003) Hydro Tasmania

Project officers and community participants were asked about the data and data sources they currently have access to and use in the planning, implementation or interpretation of their own monitoring data. Most groups had access to very few and limited data and data products from external sources (median of 1 dataset/product) but thought that there were a number of datasets/products that could be used in their community based monitoring program (median of 8 datasets/products). The only commonly accessed datasets/products were aerial photographs and the status of threatened species (Appendix 12). The datasets/products thought useful for each community based monitoring program were specific to each program, however, there was substantial interest from the large community based monitoring programs (Waterwatch and Wetland Monitoring) to have access to data on land use and the status and distribution of threatened species.

Appendix 12 lists the datasets and products that are currently and could be used for community based monitoring. While community groups are accessing some of the information and tools available, there is a significant potential for groups to access more data, information and tools that may assist them in their monitoring and interpretation activities.

## **5. Discussion**

### **5.1 Improving the Value of Community Monitoring**

#### **5.1.1 Community Interests and Objectives**

Community based monitoring is only likely to be successful where the monitoring activities align closely with the individual interests and objectives of participants. While the views of members of the community who live in the Murray Darling Basin region of South Australia were sought in the preparation of the NRM Management Plan for the region<sup>28</sup>, it is doubtful that any individual is

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<sup>28</sup> Integrated Natural Resource Management Group for the South Australian Murray Darling Basin Inc. (2003) Integrated Natural Resource Management Plan for the South Australian Murray-Darling Basin

strongly committed to achieving a regional target. Rather, these targets are the collective aspirations of many community members. Community members or groups will almost certainly be keen for information they collect to be used at a regional level, however this does not seem to be a sufficient motivating factor for someone to get involved in community monitoring on its own.

When asked during consultation, the main motivations for participants in community based monitoring were expressed as the desire to improve their knowledge and better manage local habitats or issues of interest (Table 8). This is supported by the earlier survey of Frears & Steggles<sup>29</sup> which identified that wetland community groups were mostly interested in monitoring to indicate wetland condition and inform management decisions (Section 4.1.1). The challenge then for regional planners, investors and supporters of community based monitoring is to ensure that the participants reap the benefits of a) increasing their knowledge and b) feeding the information back into better management. However, community participants are often not involved in data analysis and interpretation (Table 9,10,11) and information collected through community based monitoring is not usually communicated adequately to the participants, local community nor decision makers (Table 12,12). It is clear that the community have a stronger interest in planning, coordination, equipment management and communication than data entry, analysis and interpretation (Section 4.6) and so the latter functions may require support from a third party. Indeed, community groups involved in wetland monitoring paid little heed to the data they collected on its own for management decisions, and indicated a strong preference for expert interpretation of data before it is used for influencing management of wetlands (Section 4.1).

**Recommendation:** To ensure participants receive benefits from their involvement in monitoring, provide adequate support through the provision of technical advice, data analysis and interpretation support and require a communication strategy be developed by each group (See Framework).

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<sup>29</sup> Frears, A and Steggles, T (2004) Community Wetland Monitoring Questionnaire Results. Unpublished.

The main use of information collected by the community identified through the survey is to inform decisions at a local scale. This makes sense; it is the scale at which individuals and groups have the greatest interest and ability to impact on resource condition. This is an important consideration in developing a community based monitoring framework. Community based monitoring must be driven by local concerns, and made use of at a regional level where possible. However, it is unlikely that information gaps at a regional level can be filled using a community based monitoring methodology if there are no compelling local reasons for the work to be undertaken. Table 6 lists the resource condition targets that could be monitored through community based monitoring.

These can mostly be grouped under three headings:

- Surveys of vegetation condition and extent;
- Surveys of wetland condition, extent and connectivity
- Fish surveys.

While a quarter of the community groups surveyed expressed an interest at collecting information to report against resource condition targets, there was also a strong view that groups did not want to spend a lot of extra time doing it (Appendix 3). This is consistent with an interpretation that community groups are mostly interested in spending their time to find out about their own patch. Those wishing to make use of community groups to collect information to report against larger scale trends and issues should be cautious about how much extra community groups will be willing to spend on activities not deeply relevant to their local area.

If communities become involved in monitoring to inform local decision making, then efforts to improve the quality of the data are only likely to succeed in the longer term if the community participants believe that improved data quality improves management decisions at a local level. For example, if community members or groups are required to expend significant extra effort to improve data quality simply to ensure data standards are consistent across the region, it is unlikely that they will maintain higher data standards over time.

**Recommendation:** Any extra effort sought from community participants in monitoring should be demonstrably relevant to improving management decisions at a local scale.

### 5.1.2 Gaps and Barriers for Community Monitoring of NRM

The two main areas where gaps exist in the community based monitoring framework in the SAMDB region are:

1. Data management
2. Communication of information.

Data collected through community based monitoring could be improved in some areas to make the efforts of participants more valuable to themselves and the broader region. Data that is collected by community groups could have greater input from experts in its analysis and interpretation, and this analysis should be fed back to the community participants in monitoring, as well as regional NRM managers. There are a wide range of data and information sources that community groups would be interested in for their own management of local assets, which they are currently unaware of that could be made available to them. These themes are explored in more detail in section 5.2.

Participants in community based monitoring were keen to inform Catchment Boards, the project group itself, government agencies (staff), the Catchment Board (RMWMCB) and LAP groups and to a lesser extent the general community (Table 12). The match between the communication tools employed and the target audiences is not high (Table 13). Improving the communication of information collected through community based monitoring is likely to lead to greater appreciation by decision makers and the broader community of participants in community based monitoring and may improve the motivation of participants who may feel their efforts are more appreciated.

**Recommendation:** The Community Based Monitoring Framework include a guide to developing a communications plan for monitoring groups.

Information collected through community based monitoring is often not analysed sufficiently to be properly interpreted. The information is therefore not communicated to a broader audience, because the implications of the data are unclear. If data collected through community based monitoring was of high quality and was analysed/interpreted by experts, the information generated should be communicated through appropriate tools to a broader target audience. Currently, communication tools employed by community groups can be poorly matched to their target audience (Section 4.8).

### 5.1.3 The Opportunity for Community Monitoring of Institutional Arrangements

The new NRM Board and associated Programs are meant to reflect the aspirations of the broader community. However, there are very few opportunities for the broader community to assess and influence the Board and its Programs other than through formal arrangements to seek input on the Management and Investment Plans. Board members are appointed by the Minister and not elected by the community.

There is an opportunity for the Board to use the principle of community monitoring to assess its own performance and the performance of its programs. Members of the broader community could be asked to monitor and report on the performance of the Board and evaluate the implementation of the Plans. This would demonstrate that the Board truly does value community input and believes in the concept of community monitoring. This concept could be extended to involved community members, rather than or in addition to, government officers in the evaluation of projects funded through the Board.

The Alinytjara Willurara region is considering implementing a “scorecard” for evaluating the performance of the Board and individual projects. The scorecard involves a separate assessment of progress (which is an objective measure of what has been done) and performance (which is a subjective comparison of progress against expectation). The scorecard may be filled out by community members and/or Board members in assessing the performance of the Board, the regional secretariat and individual projects.



#### 5.1.4 The Role of Community Monitoring in Capacity Building

Both the INRM Plan and the Catchment Plan for the region identify the central importance of community capacity building (see 2.3 for a definition of capacity building) to achieve the goals and objectives of their plans.

*"Community capacity building provides a foundation to this plan and the strategies it contains"* <sup>30</sup>

Craig *et al*<sup>31</sup> suggest that community-based monitoring offers a method to move from raising awareness of community members about environmental degradation to participatory action. Canada employs a Community Based Monitoring Framework as part of its NRM program delivery. The Framework is based on the assumption that community based monitoring is an effective tool for building community capacity and local networks as well as stewardship and public education<sup>32</sup>.

Both the community participants and project officers in the Stage 2 Survey agreed on the importance of community participation in monitoring activities, particularly planning, coordination, equipment management and communication. There was a perception that the level of community involvement could be increased even further (Fig 3), although there was also a reluctance on behalf of some groups to spend more of their time on community monitoring. The motivation of individuals to participate was driven by their desire to better understand and protect the natural resources in their local area (Table 8), which is presumably results in a virtuous cycle whereby individuals who get involved and better understand their local area have a greater appreciation for it which reinforces their desire to become more involved in other NRM activities. A recent review

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<sup>30</sup> Integrated Natural Resource Management Group for the South Australian Murray Darling Basin Inc. (2003) Integrated Natural Resource Management Plan for the South Australian Murray-Darling Basin

<sup>31</sup> Brian Craig, Graham Whitelaw, Jeff Robinson and Paula Jongerden. COMMUNITY-BASED ECOSYSTEM MONITORING: A TOOL FOR DEVELOPING AND PROMOTING ECOSYSTEM-BASED MANAGEMENT AND DECISION MAKING IN THE LONG POINT WORLD BIOSPHERE RESERVE. <http://www.sampaa.org/PDF/ch4/4.4.pdf>

<sup>32</sup> Canada Community Monitoring Framework  
<http://www.ccmn.ca/english/library/whitelaw/introduction.html>

from Queensland demonstrated that community based monitoring provided a mechanism for communities to learn about issues relating to sustainability of local habitats under threat from development. The review found that through monitoring, communities are able to take greater responsibility for stewardship of their local environment while enhancing their capacity to contribute more effectively to management of coastal ecosystems<sup>33</sup>. The increased awareness of the marine life and local ecology by both staff and passengers as a result of their participation in reef monitoring encouraged a keener sense of stewardship and caring for the reef. This, in turn, has led to positive changes in attitude and environmentally friendly behaviour<sup>34</sup>.

All of this suggests that getting people involved in community based monitoring is a positive outcome in its own right. Individuals who have had the experience of observing their local environment may be more motivated to take on an even greater involvement in natural resource management

**Recommendation:** Community based monitoring be supported as a valuable end in itself because of its ability to generate a greater appreciation and interest in natural resource management by participants in the monitoring.

## 5.2 Improving the Value of Community Monitoring Data

Whilst the authors believe that community based monitoring has an inherent value, they are also of the view that the community members want their monitoring to influence local, and to a lesser extent, regional NRM planning, and that regional planners and government would like to make use of the data collected through community participation. The application of standardised community

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<sup>33</sup> Brad Zeller, Andrew Petroeschevsky and Christina Dwyer (2003) Monitoring coastal marine habitats and waterways: Government and community partnerships in action.  
<http://www.regional.org.au/au/apen/2001/r/ZellerB.htm>

<sup>34</sup> Barbara Musso, Graeme Inglis. Developing Reliable Coral Reef Monitoring Programs For Marine Tourism Operators And Community Volunteers. CRC REEF RESEARCH CENTRE TECHNICAL REPORT No. 24 <http://www.reef.crc.org.au/publications/techreport/TechRep24.html>

based monitoring methods is becoming increasingly significant in providing knowledge to management agencies to reduce uncertainty in decision-making<sup>35</sup>. Despite the variable expertise levels of volunteers, non-professional data collection can be accurate, reliable and a valuable contribution to the scientific understanding of the environment<sup>36</sup>. However, deliberate strategies need to be put in place to ensure adequate data quality, storage, retrieval and interpretation.

### 5.2.1 Data quality

The Environment Protection Authority (EPA) is working with Waterwatch programs across the State to develop a framework for community water monitoring in an effort to improve the value of data collected. The goal is to enable the quality of community data to be clearly identified, and therefore enable data from programs such as Waterwatch to be more confidently used in environmental reporting (eg. State of Environment Reporting). Rather than repeat the work of the EPA, it is suggested that the EPA framework be modified to be more general and used to assess the quality of data collected through community based monitoring in the SA MDB region.

The 'EPA Data Categories for Community Monitoring' are divided into three monitoring levels (refer to Table 14 for more details)

- 'General' level monitoring
- 'Standard' level monitoring
- 'Advanced' level monitoring

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<sup>35</sup> Brad Zeller, Andrew Petroschevsky and Christina Dwyer (2003) Monitoring coastal marine habitats and waterways: Government and community partnerships in action.  
<http://www.regional.org.au/au/apen/2001/r/ZellerB.htm>

<sup>36</sup> Barbara Musso, Graeme Inglis. Developing Reliable Coral Reef Monitoring Programs For Marine Tourism Operators And Community Volunteers. CRC REEF RESEARCH CENTRE TECHNICAL REPORT No. 24 <http://www.reef.crc.org.au/publications/techreport/TechRep24.html>

**Table 14: Modified characteristics of the EPA Data Categories for Community Based Monitoring**

Data Category	Requirements	Desired result	Potential Uses of Data
General/ Educational level monitoring	<ul style="list-style-type: none"> <li>participation in 'general' monitoring training</li> <li>provision of data to NRM Officers or environmental managers</li> </ul>	Unknown or variable data quality	<ul style="list-style-type: none"> <li>educational tool in the classroom</li> <li>trend data about catchment health (note there will be limitations for providing accurate site information on water quality)</li> </ul>
Standard/ Reportable level monitoring	<ul style="list-style-type: none"> <li>meeting the requirements of the 'general' level monitoring</li> <li>participation in training</li> <li>use of a standard/recognised monitoring protocol and design including necessary controls (eg. annual testing against standard "mystery solutions for water quality monitoring)</li> <li>calibration of equipment prior to sampling</li> </ul>	Known quality of data, but not the highest attainable	<ul style="list-style-type: none"> <li>educational purposes</li> <li>catchment and natural resource management reporting</li> <li>general trend data about resource condition</li> </ul>
Advanced/ Publishable level monitoring	<ul style="list-style-type: none"> <li>meeting the requirements of the 'standard' level monitoring</li> <li>development of a monitoring plan</li> <li>keeping a logbook of monitoring activities</li> <li>use of a protocol and design which is statistically sound and meets requirements for statistical power.</li> </ul>	Known quality of data – highest quality attainable for community based monitoring	<ul style="list-style-type: none"> <li>State of Environment Reporting</li> <li>catchment and natural resource management reporting</li> <li>information about specific sites for academic or scientific studies</li> </ul>

A modified table that describes for each Data category the QA/QC requirements, desired results and potential uses of data for community based monitoring has been prepared based on the EPA material and is documented in Appendix 8.

In order to obtain known quality data, records must be kept of equipment and its maintenance (including information on calibration of equipment) and data must be recorded accurately (ie. in the correct units or using standard terminology and nomenclature). The EPA have prepared a Data Category Questionnaire for Waterwatch programs (Appendix 9) which can be used to determine what level of data confidence communities are willing to strive for. The EPA have also prepared a monitoring checklist (Appendix 10) and Logbook (Appendix 11) for those groups who wish to

achieve data standards of “standard” or “advanced”. These could be simply modified for any other community based monitoring activity.

Based on a survey of data quality assurance of community based monitoring groups in the SA MDB, 54% of the groups were collecting data at the “Educational level”, 21% were collecting data at a “Standard level” and 26% at an “Advanced level” (Appendix 3). This level of data confidence across the region is encouraging, and there were a further 24% of groups who would be willing to contribute to monitoring against RCTs and MATs who currently do not do so, although there was a strong resistance generally across the groups about spending significantly more time on monitoring activities.

**Recommendation:** The steps required to improve the quality of data collected via community-based monitoring is to:

- Widely publicise where high-quality data that is collected with the assistance of community participants is being used to influence investment and management decisions across the region. People will only be willing to spend the extra time and resources to improve data quality if it is clear that there is likely to be a positive outcome from their extra efforts;
- Provide community groups with tools to identify appropriate standards (many of the Waterwatch groups are already using the EPA data standards) and record the process of collecting data as well as the data itself (eg through the EPA Logbook);
- Provide community groups with technical assistance, advice and support if they are willing to improve their data quality standards. Half of the groups who were collecting data at an “Advanced level” were doing so the assistance of state agency or university staff. Working collaboratively with “experts” obviously ensures that advice on how to maintain high data standards is on hand but also helps keep motivation levels high for maintaining quality data standards and with analysing and interpreting the data once it is collected.

## 5.2.2 Data interpretation

The relatively low current level of participation and perceived importance of community member involvement in analysis and interpretation of monitoring results (Section 4.10) is an area requiring some consideration in the development of a community based monitoring framework. Analysis of the monitoring program often requires technical skills and analysis tools that may not be available to most community members and groups. The ability to analyse the monitoring data is also related to access to the data in a form which can be analysed (most groups did not enter the data or hold a database of previous results). In most cases, the project officer associated with each monitoring program stores and analyses the data.

The analysis and interpretation components of monitoring programs require further support to ensure data is correctly analysed, interpreted in the context of local knowledge and community member input and communicated to appropriate organizations and interested parties.

**Recommendation:** Restructure the role of the Monitoring and Evaluation Coordinators to include the role of providing assistance to community based monitoring groups and project officers on the analysis and interpretation of their data.

## 5.2.3 Data storage and retrieval

The results of the Stage 2 Survey demonstrate that both the community participants and project officers assign a high level of value to having a single data storage and access point in the region (Fig. 6). This outcome has been repeated in another analysis of community based monitoring. A review of quite sophisticated community monitoring on grasslands in New Zealand recommended a support officer, provision of a secure, centralised and standardised database for the monitoring data and access to expert scientific advice to help interpret data collected<sup>37</sup>. Furthermore in 2003,

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<sup>37</sup> Grant Hunter, Claire Mulcock and Roger Gibson (2003) We mustn't lose the plot – community-based tussock grassland monitoring: A review of the REDIS initiative. <http://www.maf.govt.nz/sff/about-projects/pastoral-farming/redis-review-02-138.pdf>

Tasmania Hydro prepared a final report for the River Murray Catchment and Water Management Board to identify options for data management and storage which recommends that the Catchment Board gain access to the StateNet framework. This could be achieved through the proposed Regional Information Centre (RIC).

Most of the groups surveyed had access to very few and limited data and data products (Appendix 12). There was significant interest in expanding the data resource base that was accessible to community based monitoring groups, particularly to data on land use, and the status and distribution of threatened species. Both of these datasets are available within the state government, and systems could be implemented to access these resources. One of the more obvious benefits of implementing the Resource Information Centre in the region would be an increased opportunity for community based monitoring groups to access a wider variety of data sources and products.

**Recommendation:** Establish the Resource Information Centre in the SA MDB Region

#### 5.2.4 Data relevance

As discussed in Section 5.1.1, most community monitoring is likely to be undertaken to inform local decision making and so it is most likely to be relevant at a local scale. However, with extra support and encouragement the data may be able to be collected and managed in a way that makes it relevant at a regional or state level. Ways to achieve this are discussed in Section 5.3.1.

### 5.3 More Effective Support for Community Based Monitoring

The identification of support mechanisms for Community Based Monitoring is one of the main objectives of this report, and the subject of all of the recommendations. Rather than repeat all of the justification, the key recommendations from the report are listed in this section.

**Recommendation:** To ensure participants receive benefits from their involvement in monitoring, provide adequate support through the provision of technical advice, data analysis and interpretation support and require a communication strategy be developed by each group (See Framework)

**Recommendation:** Any extra effort sought from community participants in monitoring should be demonstrably relevant to improving management decisions at a local scale.

Eg Groups monitoring threatened species might be encouraged to also monitoring vegetation condition using a standard protocol where the additional monitoring will provide additional information on changes in the habitat or resources available to the threatened species.

**Recommendation:** The Community Based Monitoring Framework include a guide to developing a communications plan for monitoring groups.

**Recommendation:** Community based monitoring be supported as a valuable end in itself because of its ability to generate a greater appreciation and interest in natural resource management by participants in the monitoring.

Eg Participants in the Waterwatch program are learning about the impact of land use around water bodies and influencing decisions about local-level natural resource management as a consequence.

**Recommendation:** The steps required to improve the quality of data collected via community based monitoring are:

- Widely publicise where high-quality data that is collected with the assistance of community participants is being used to influence investment and management decisions across the region. People will only be willing to spend the extra time and resources to improve data quality if it is clear that there is likely to be a positive outcome from their extra efforts;



- Provide community groups with tools to identify appropriate standards (many of the Waterwatch groups are already using the EPA data standards) and record the process of collecting data as well as the data itself (eg through the EPA Logbook);
- Provide community groups with technical assistance, advice and support if they are willing to improve their data quality standards. Half of the groups who were collecting data at an “Advanced level” were doing so the assistance of state agency or university staff. Working collaboratively with “experts” obviously ensures that advice on how to maintain high data

**Recommendation:** Restructure the role of the Monitoring and Evaluation Coordinators to include the role of providing assistance to community based monitoring groups and project officers on the analysis and interpretation of their data.

**Recommendation:** Establish the Resource Information Centre in the SA MDB Region to promote wider access and use of existing data by all users and improve spatial data and Metadata management.

**Recommendation:** Continue project officer support of community based monitoring groups to maintain the effectiveness of the groups to undertake monitoring activities

**Recommendation:** Continue to provide community based monitoring groups with necessary consumables for recognised monitoring programs conforming to the standards set out in the Community Based Monitoring Framework

## **5.4 Evaluation of the Framework**

This section summarises the information gathered during consultation and review of community based monitoring in the SAMDB and evaluates it against the principles of best practise for monitoring and evaluation in the South Australian Murray-Darling Basin NRM Region.

Section 5.4.2 sets out a recommended plan for future evaluation of the implementation of the community based monitoring framework. The evaluation plan also aims to evaluate the effectiveness of the framework in supporting community interest and involvement in community based monitoring as well as assessing the use of monitoring results in decision making at different levels of resource management.

### **5.4.1 Evaluation of current community based monitoring program achievement against best practise.**

This section summaries an evaluation of the current community based monitoring program achievement (baseline) against the principles of best practise for monitoring and evaluation in the South Australian Murray-Darling Basin NRM Region. The evaluation summarises the information provided during consultation with the Project Steering Committee, community based monitoring project officers and community group members.

## Legend

<b>High</b>	<b>Medium</b>	<b>Low</b>
Achieves or sets best practise	Medium to high standard but below best practise	Low to medium to standard, well below best practise

NB: scores based on the objective of community monitoring to detect change and influence decisions at the local scale

Principle of best practise monitoring in the SAMDB		Current level of operation	
		Average program	Best program
be practical and objectively verifiable;	practical objectively verifiable		
be complementary to existing systems;			
be developed and implemented in partnership with existing data managers and users;	data managers data users		
recognise the need for regular, long-term data collection to enable credible scientific investigation and assessment;			
enable the determination of baseline conditions (or benchmarks), important and emerging issues, and trends over time;	baseline conditions Important and emerging issues trends over time		
provide data that can be aggregated for reporting at a property, local, regional, state or basin scale;	property local regional state basin		
inform a periodic review against objectives, targets and desired outcomes;			
adapt over time as new knowledge enables refinement of monitoring activities;			
be cost effective to implement and maintain.			

## 5.4.2 Evaluation Plan for the Community Based Monitoring Framework for Natural Resource Management in the South Australian Murray-Darling Basin

NB: The following evaluation plan is suggested only. Finalisation of the evaluation plan should be done in consultation with project officers and community group members. The timing and resources for evaluation should also be clarified.

Objective	Action	Performance Indicators	Information Sources	Assumptions
To ensure participants receive benefits from their involvement in monitoring and maintain community involvement and motivation in monitoring	Provide adequate support through the provision of technical advice, data analysis and interpretation support and require a communication strategy be developed by each group	<ul style="list-style-type: none"> <li>No. communication strategies developed</li> <li>No. monitoring programs in "Advanced" data category</li> <li>Change in level of involvement in analysis and interpretation</li> <li>Turnover rate of support staff</li> </ul>	<ul style="list-style-type: none"> <li>NRM Board records</li> <li>Participant/Group survey</li> <li>Program reports</li> <li>Project officer records</li> </ul>	<ul style="list-style-type: none"> <li>Participants will benefit from greater use and understanding of community based monitoring</li> <li>Involvement in analysis and interpretation adds value to participation</li> <li>Communication of program activities and results leads to greater awareness of program and issues</li> </ul>
	Any extra effort sought from community participants in monitoring should be demonstrably relevant to improving management decisions at a local scale.	<ul style="list-style-type: none"> <li>Level of confidence in influence on local management</li> <li>Type and extent of expansion of programs</li> </ul>	<ul style="list-style-type: none"> <li>Participant/Group survey</li> <li>Program reports</li> <li>Project officer records</li> </ul>	<ul style="list-style-type: none"> <li>Benefit of monitoring for local scale management motivates participants</li> </ul>
	Widely publicise where high-quality data that is collected with the assistance of community participants is being used to influence investment and management decisions across the region.	<ul style="list-style-type: none"> <li>Level of awareness of community participants</li> <li>No. media articles/Communique stories</li> <li>Reference in key documents</li> </ul>	<ul style="list-style-type: none"> <li>NRM Board records</li> <li>Participant/Group survey</li> <li>NRM Plan &amp; Investment Strategy</li> </ul>	<ul style="list-style-type: none"> <li>Feedback on the use of community data motivates participants</li> </ul>

Objective	Action	Performance Indicators	Information Sources	Assumptions
	Continue project officer support of community based monitoring groups to maintain the effectiveness of the groups to undertake monitoring activities	<ul style="list-style-type: none"> <li>No. and turnover rate of project officers</li> <li>Level of satisfaction with project officer support</li> <li>No. of groups and no. participants in groups</li> </ul>	<ul style="list-style-type: none"> <li>Participant survey</li> <li>NRM Boards records</li> </ul>	<ul style="list-style-type: none"> <li>Project officer support is critical to participant involvement and achievement</li> <li>Level and type of current support is optimal</li> </ul>
Increase the value of data collected through community based monitoring	Provide community groups with technical assistance, advice and support if they are willing to improve their data quality standards.	<ul style="list-style-type: none"> <li>No. monitoring programs in "Advanced" data category</li> <li>% of project officer time spent on groups in "Advanced" data category</li> </ul>	<ul style="list-style-type: none"> <li>Participant/Group survey</li> </ul>	<ul style="list-style-type: none"> <li>Data from "Advanced" data category groups is used in decision making</li> <li>Groups in "Advanced" data category require higher level of support than other groups</li> <li>Resources and arrangements (other than assistance, advice and support – eg. databases, other data, mapping) are available</li> </ul>
	Restructure the role of the Monitoring and Evaluation Coordinator to include the role of providing assistance to community based monitoring groups and project officers on the analysis and interpretation of their data.	<ul style="list-style-type: none"> <li>Position descriptions identify expanded responsibilities</li> </ul>	<ul style="list-style-type: none"> <li>M&amp;E coordinator(s) position description</li> </ul>	<ul style="list-style-type: none"> <li>Data quality high enough for required analysis</li> <li>Purpose and timing of current monitoring appropriate for decision-making cycle</li> </ul>
	Establish a single point of resource monitoring data access (eg. Resource Information Centre) in the SA MDB Region	<ul style="list-style-type: none"> <li>RIC is established and has facility to support storage and management of community based monitoring data</li> </ul>	<ul style="list-style-type: none"> <li>RIC records</li> <li>NRM Board records</li> </ul>	<ul style="list-style-type: none"> <li>Data access &amp; storage arrangements are limiting the use of community based monitoring data</li> </ul>

## Appendix 1: Community Monitoring Programs and Resources from Canada

CitizenScience.ca	An on-line space for people who are interested in community-based environmental monitoring (CBM). The Citizen Science site features many tools and resources to support your CBM activities, including: a directory and map of monitoring initiatives across Canada, protocols for monitoring, data management tools, funding support, and training opportunities. <a href="http://www.citizenscience.ca/">http://www.citizenscience.ca/</a>
NatureWatch	Aimed at families, schools, naturalist groups, community service clubs, Scout or Guide troops. Informal monitoring of frogs, plants, ice and worms <a href="http://www.naturewatch.ca/">http://www.naturewatch.ca/</a>
Canadian Community Monitoring Network	A "how-to" model for linking community-based monitoring with local decision-making based on a review of experiences from 31 communities across Canada. The website also offers a rich set of links to tools for citizen scientists. <a href="http://www.ccmn.ca/">http://www.ccmn.ca/</a>
Bird Studies Canada	Bird Studies Canada offers opportunities and programs to watch birds on your backyard feeder, during certain times of the year, and to look at birds and amphibians in the marshes around your home and community. Observations contribute to international reports, around Canada and the Great Lakes Region. <a href="http://www.bsc-eoc.org/">http://www.bsc-eoc.org/</a>
Canadian Wildlife Federation	An inventory of programs of plants and animals to observe, track and report on. <a href="http://www.cwf-fcf.org/">http://www.cwf-fcf.org/</a>
Taiga Net	Community Programs, monitoring and research findings from across Northern Canada. Includes opportunities to participate, and status and trends reporting <a href="http://www.taiga.net/">http://www.taiga.net/</a>
Canadian Aquatic Biomonitoring Network	CABIN is a collaborative programme developed and maintained by Environment Canada to establish a network of reference sites available to all users interested in assessing the biological health of fresh water in Canada <a href="http://cabin.cciw.ca/cabin/">http://cabin.cciw.ca/cabin/</a>

Watersheds InfoXchange	<p>Search watershed information and find out what organizations are observing and how communities can help them in collecting information to improve their local environment.</p> <p><a href="http://cabin.cciw.ca/cabin/">http://cabin.cciw.ca/cabin/</a></p>
Biosphere	<p>This amazing "Museum of Water" located in Montreal will supply you with your information needs and attach youth and communities to monitor and collect observation through their network of organizations. Visit the exhibitions in the building or the website to become involved as an individual, classroom or organization.</p> <p><a href="http://biosphere.ec.gc.ca/">http://biosphere.ec.gc.ca/</a></p>
Community Based Environmental Monitoring Network	<p>Support for study design and the assessment of information for community groups</p> <p><a href="http://www.envnetwork.smu.ca/">http://www.envnetwork.smu.ca/</a></p>
Stewardship Canada	<p>A portal or overview of resources, organizations, reports meetings and projects from across Canada.</p> <p><a href="http://www.stewardshipcanada.ca/">http://www.stewardshipcanada.ca/</a></p>
Streamkeepers	<p>As volunteer streamkeepers, citizens are able to monitor and evaluate stream conditions, alert authorities when there are problems with local streams.</p> <p><a href="http://www.pskf.ca/">http://www.pskf.ca/</a></p>
Volunteer activities at Environment Canada	<p>Inventory of programs and activities for volunteers related to environmental monitoring and protection</p> <p><a href="http://www.ec.gc.ca/volunteers-benevoles">http://www.ec.gc.ca/volunteers-benevoles</a></p>

## Appendix 2: Metadata for Community Based Wetland and Waterwatch Monitoring in the SAMDB

### Waterwatch Monitoring Program Metadata

Waterwatch groups monitor biological, physical and chemical parameters related to water quality. These include salinity, turbidity, nutrients, pH, temperature and macroinvertebrates. Groups generally monitor six times a year in 'Snapshot' weeks. The data is sent to the Regional Coordinator who provides feedback to participants on the health of their catchment.

There are three types of data collection categories, General, Standard and Advanced. Explanation of the divisions between data categories is provided in Appendix 9.

Examples of data collected by Waterwatch Groups in different data categories

Lower Murray		Upper Murray	
General Groups	Advanced/Standard Groups	General Groups (parameters differ between sites)	Advanced/Standard Groups
Code	Site Code	Code	Site Code
Easting	Easting	Easting	Easting
Northing	Northing	Northing	Northing
Date	Nitrates	Phosphorous	Nitrates
Electo conductivity	Site Description	Macro Diversity	Phosphorous
Group	Date	Air temperature	Site Name
Nitrates	National Map Number	Water temperature	Turbidity
Phosphorous	Phosphorous	Group	Date
Site	Electo conductivity	EC	Electro conductivity
Site Code	Turbidity	Turbidity	
Turbidity	Group	Site	
		pH	
		Nitrates	



## Wetland Monitoring Program Metadata

The data recorded at these wetland sites are listed below. Much information is gathered at these sampling sites including information on; birds, macroinvertebrates, fish, frogs, groundwater and water quality. A different set of parameters are monitoring in each wetland according to type. The frequency of wetland monitoring is also dependent on the wetlands characteristics. A list of metadata for the suite of monitoring parameters is set out below<sup>38</sup>

### **Bird survey**

#### **Birdspecies1**

Wetland - Wetland where bird site was located  
Method - Bird survey method using codes defined by SA biological survey  
Observers - Initials of persons making survey  
Code - Code for wetland (used by pocket pc to generate 'sitename')  
Value - Code for Birds (used by pocket pc to generate 'sitename')  
Bsite - Site number (used by pocket pc to generate ' sitename')  
Sitename - Unique code for site that was sampled for birds  
Property - name of property where site was located  
Owner - owner of property where site located  
Amg - map amg (54 for all sites)  
Eaststart - easting of location where observations were started  
Northstart - northing of location where observations were started  
Accuracy - accuracy of gps reading (as indicated by handheld gps)  
Gpsmethod - method of finding location (uses code from SA biological survey site description guidelines) most will be 3  
Mapdatum - code for datum of gps/map used to locate sites (SA biological survey code)  
Date - date survey was conducted  
Tstart - time survey was started  
Tfinish - time survey finished  
Wdirection - direction that wind was coming from  
Wdepth - estimation of average water depth

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<sup>38</sup> information drawn from Sinclair Knight Merz (2004). *River Murray Wetlands Baseline Survey*.

Wlevel - indication of water level change (stable, rising, falling)  
Cloudcover - percentage cloud cover  
Eastfinish - easting of location where observations were finished (if not a single point)  
Northfinish - northing of location where observations were finished (if not a single point)  
Notes any relevent notes regarding site  
Shoreline - complexity of shoreline  
Fringingveg - brief description of fringing veg  
Reeds - estimate of abundance of reeds in fringing veg  
Sedges - estimate of abundance of sedges in fringing veg  
Herbs - estimate of abundance of herbs in fringing veg  
Wetmud - estimate of abundance of wet mud at site  
Drymud - estimate of abundance of dry mud at site  
Hollowtrees - estimate of abundance of hollow trees at site  
Perchtrees - estimate of abundance of perching trees at site  
Wateredge - description of water level relative to vegetation  
Fringerrg - estimate of abundance of fringing RRG

#### **Birdsample2**

Sitename - unique code for site (and sample) links BIRDSITE and BIRDSAMPLE tables  
Commonname - commonname for bird observed  
Species - scientific name for bird observed (not comprehensive and it is best to use query to link BIRDSAMPLE and BIRDSPECIES tables to get scientific name)  
Abundance - number of birds observed  
Idquality - confidence in indentification of bird  
Breeding - breeding condition of bird  
Strata - strata that bird was observed in (using SA Biological survey codes)  
Habitat - habitat bird was observed on (based on SA biological survey list)  
macrohabitat2 - macrohabitat bird observed in (as developed by RMWBM team)  
Notes Any notes on survey

#### **Birdspecies2**

Species - scientific name of bird  
Commonname - common name of bird

## **Macroinvertebrate Survey**

### **Bugsite**

Wetland - Wetland where bird site was located  
Map - bitmap of site  
Msite - site number code (used by pocket pc to create sitename)  
Sitename - unique code for site  
Date - date when sample was collected  
Time - time that sample was collected  
Name - initials of staff who collecte sample  
Agency - Agency of staff who collected sample  
Notes - any notes regarding site  
Easting - easting of site location  
Northing - northing of site location  
Datum - map datum of gps/map used to locate site  
Mapname - name of topo map where site was located  
Mapnumber - number of topo may where site was located  
Property - name of property where site located  
Owner - owner of property where site located  
Accuracy - accuracy of gps when point taken  
Method - collection method  
Haba - description of habitat a sampled  
Habalength - length of habitat a sampled  
habbq - description of habitat b sampled  
Habblength - length of habitat b sampled  
Habbc - description of habitat c sampled  
Habclength - length of habitat c sampled  
Habd - description of habitat d sampled  
Habdlength - length of habitat d sampled  
Code - Wetland code (for sitename)  
Value - code used by pocket pc to create site code (MI = macroinvertebrates)  
Airtemp - description of air temperature at time of samplin  
Cloud - description of cloud cover at time of sampling  
Precip - description of precipitation conditions at time of sampling  
Wind - description of wind conditions at time of sampling

### **Bugsample**

Familynumber - AWQC taxa code  
Taxacode - AWQC taxa code

Family - Macroinvertebrate family (or larger taxonomic group)  
Species - Macroinvertebrate species  
Speciesno - AWQC taxa code  
Sitename - Unique site code  
Analyst - Initials of person who processed sample  
Analystagency - Agency that processed samples  
Abundance - Number of macroinvertebrate taxa recorded at site

## **Fish Surveys**

### **Fishsite**

Wetland - Wetland where fish site was located  
Code - Code for wetland (used by pocket pc to generate 'sitename')  
Survey - SA biological survey field (never filled)  
Value - Code for Fish (used by pocket pc to generate 'sitename')  
Staff - Initials of persons undertaking fish sampling  
Fsite - Site number (used by pocket pc to generate ' sitename')  
Sitename - Unique code for site that was sampled for fish (links table to FISHSAMPLE)  
Habitat - One of four habitat types  
Date - Date samples were collected  
Amg - map amg (54 for all sites)  
Northing - northing of site location  
Easting - easting of site location  
Accuracy - accuracy of gps when point taken  
Temp - description of air temperature at time of sampling  
Cloud - description of cloud cover at time of sampling  
Precip - description of precipitation conditions at time of sampling  
Wind - description of wind conditions at time of sampling  
Gpsmethod - method that location point was collected (all should be 3 for gps)  
Gpsdatum - Datum code used by the biological survey of SA (SA DEH)  
Map - bitmap of site  
Notes any relevent notes regarding site

### **Fishcatch2**

Commonname - common name of fish species  
Length - length of fish (mm)  
Weigh - t Code for Fish (used by pocket pc to generate 'sitename')  
Abundance - number of fish species caught  
Samplecode - unique code for sample (links table with FISHSAMPLE)

Comment - any relevant comments  
Health - any noticeable health problems  
Fishnumber - code used to track order in which fish were processed (provides no useful data and can be removed once data is QA'd)  
Fsite - sitenumber (used for operation of pocket pc, can be removed)  
Sitename - unique site code (used for operation of pocket pc, can be removed as long as samplecode - is retained)

## **Fishsample2**

Fsite - site number (used for operation of pocket pc, can be removed)  
Sitename - unique site code (used for operation of pocket pc, needed to link to FISHSITE)  
Samplenum - sample number (used for operation of pocket pc to create the sample code, can be removed)  
Samplecode - unique code for sample (links table with FISHCATCH)  
Gear - fishing gear used to collect sample  
Comment - any comments regarding the sample  
Gearnumber - two different meanings (fyke nets = net 1 or net 2) (bait traps = number of traps set at site should = 10)  
Set date - and time gear was set  
Retrieve date - and time gear was retrieved  
Length - length of sample (usually only used for seine net samples)  
Direction - direction in which fykes were set or seines were hauled

## **Frogs**

### **Frogsite2**

Wetland - Wetland where fish site was located  
Value - Code for Frogs (used by pocket pc to generate 'sitename')  
Frsite - Site number (used by pocket pc to generate 'sitename')  
Sitename - Unique code for site that was sampled for frogs (links table to FROGSAMPLE)  
Amg - map amg (54 for all sites)  
Easting - easting of site location  
Northing - northing of site location  
Datum - Datum used by GPS  
Property - name of property where site located

Accuracy - accuracy of gps reading (as indicated by handheld gps)  
Date - Date samples were collected  
Tstart - time survey was started  
Tfinish - time survey finished  
Notes - any relevant notes regarding site  
Recorder - person who recorded tapes  
Code - Code for wetland (used by pocket pc to generate 'sitename')

## **Frogsample2**

Site - sitenumber (used for operation of pocket pc, can be removed)  
Sitename - unique site code (needed to link to sample to FROGSITE)  
Species - scientific name of frog species  
Number - estimate of number of frogs heard of each species  
Airtemp - description of air temperature  
Cloud - description of cloud cover  
Precip - description of precipitation conditions  
Wind - description of wind conditions  
Notes - any relevant notes  
Commonname - common name of frog species

## **Frogspecies2**

Species - Scientific name  
Commonname - Common Name

## **Groundwater Survey**

### **GWSite**

Wetland - Wetland  
BoreID - Unique code for bores that are monitored. There may be more than one boreID for each bore, because the height of bores may change over time (eg. vandalism)  
Borename - ID for each bore  
Unitnumber - Bore unit number for govt database  
Easting - Easting co-ordinate of bore  
Northing - Northing co-ordinate of bore  
ReferenceDate - Date reference elevation measured, or new stick up measured (where bores had been damaged)  
ReferenceElevation - Elevation of top of PVC, unless other reference point use

ground\_elevation - Elevation of ground level at bore (m AHD)  
BM\_elevation - Elevation of benchmarks that were added to some bores (m AHD)

### **GWSurvey**

BoreID - ID for bore, determined before survey  
Date - Date bore sampled  
Depth Water - depth from top of casing  
Elevation - RSWL AHD, Elevation of water level  
TDS - TDS in mg/L  
ElectricalConductivity - EC in mS/cm  
Collection - Notes Any relevent notes to accompany sampling  
Recorder - Person or persons who undertook sampling

### **Water Quality Survey**

#### **WQSite2**

Wetland - Wetland where fish site was located  
Code - Code for wetland (used by pocket pc to generate 'sitename')  
Value - Code for Frogs (used by pocket pc to generate 'sitename')  
Wsite - Site number (used by pocket pc to generate ' sitename')  
Sitename - Unique code for site that was sampled for water quality (links table toWQPARAM)  
Map - bitmap of site  
Date - date water quality was measured at site  
Time - time of day water quality was measured at site  
Name - initials of person who recorded water quality  
Agency - agency of person who recorded water quality  
Notes - Any relevent notes  
Amg - map amg (54 for all sites)  
Datum - Datum used by GPS  
Easting - easting of site location  
Northing - northing of site location  
Accuracy - accuracy of gps reading (as indicated by handheld gps)  
Property - name of property where site located  
Owner - owner of property where site located

#### **WQParam2**

Wsite - sitenumber (used for operation of pocket pc, can be removed)  
Sitename - unique site code (needed to link to sample to WQSITE)

Turbidity - Turbidity  
Turbunits - units used to measure turbidity  
Do - dissolved oxygen recorded  
Dounits - units used to measure dissolved oxygen  
Salinity - electrical conductivity measure (actually EC)  
Salunits - units that electrical conductivity was measured in  
Temp - water temperature  
Tempunits - units that water temperature was measured in  
Ph - PH  
Device - device used to record water quality  
Notes - any relevent notes  
Airtemp - description of air temperature at time recordings were made  
Cloud - description of cloud cover at time recordings were made  
Precip - description of precipitation at time recordings were made  
Wind - description of wind conditions at time recordings were made

## **Appendix 3: Summary Table of Survey Responses (Stage 1 – Inventory of community based monitoring programs)**

APPENDIX 3 is attached as an electronic file (Microsoft Excel Spreadsheet).

## Appendix 4: Community Monitoring Questionnaire

Interviewer \_\_\_\_\_  
Date Collected \_\_\_\_\_  
Group Name \_\_\_\_\_  
Respondent Name \_\_\_\_\_  
Respondent Phone No. \_\_\_\_\_  
Same Respondent as First Survey? Yes  No   
Start Time \_\_\_\_\_  
Finish Time \_\_\_\_\_

# Community Based Monitoring Framework

## SAMDB

### Participation Survey

Good ..... my name is ..... We are conducting a survey of community monitoring programs in the South Australian Murray-Darling Basin on behalf of the SAMDB NRM Board. Your name was put forward as a key contact for the .....monitoring program. The survey will take about 20 minutes, is now a convenient time for me to ask you some questions about the .....monitoring program?

if YES – “can you please answer the following questions with respect to the .....monitoring program; if NO – “can you suggest a time that would be more convenient and I will call back”.

i. What is your role in the community monitoring program?

- |                           |                            |
|---------------------------|----------------------------|
| a. project officer        | d. coordinator/facilitator |
| b. community group member | e. other                   |
| c. monitoring officer     |                            |

ii. How many years have you been involved with the monitoring program? \_\_\_\_\_ total years involvement

## PROJECT OBJECTIVES

### Community interests & objectives

1. What do you think motivates community members to get involved in this monitoring program? **Unprompted – multiple response – max 5**

- |   |   |
|---|---|
| a. social interaction                             | h. want to demonstrate achievement from the project |
| b. increased awareness                            | i. requirement to report                            |
| c. increased knowledge                            | j. care/enjoyment of the site                       |
| d. increased skills                               | k. adaptive management                              |
| e. sense of community                             | l. marketing tool/EMS for production                |
| f. contribution to NRM                            | m. concern about problems at the site               |
| g. part of the whole project activity/involvement | n. other  |

## PLANNING

### Planning & context

2. What were/are the criteria for choosing monitoring sites? **Unprompted – multiple response – max 5**

- |  |  |
|--|--|
| a. significant site                      | h. near to other activities                        |
| b. only possible site                    | i. near to community group centre                  |
| c. representative site                   | j. identified in an NRM plan(s)                    |
| d. indicator site                        | k. identified in site or local plan(s)             |
| e. problem site                          | l. management responsibility/interest for the site |
| f. previous work at the site             | m. other   |
| g. site expected to show impact/response |  |

## RESOURCING

### Current resources

3. What resources are used in this monitoring project and who supplies these resources? **Read out 1-6 - multiple response - maximum of 6**

	Resource	Level of resource	Source
1.	project coordinator/officer	(days per year)	
2.	technical expert	(days per year)	
3.	training	Number of people receiving one or more days of training last year 1-5; 5-10; 10-20; 20-50; 50+	
4.	equipment	Details	
5.	facilities (meeting rooms, planning space, office space, equipment storage)	Details:	
6.	Other		

### Additional resources

4. What additional resources are needed for this project to effectively undertake the required monitoring? **Record open-ended responses**



## Community resources

5. I will now list a range of different components of a monitoring program. Could you please rate the *current level of involvement* of community members in activities related to the monitoring program. The rating scale is from 1 – 7 where 1 = not at all involved, and 7 = very involved.

	Not at all involved	→	→	→	→	→	Very involved
planning	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
coordination	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
data collection	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
equipment management	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
data entry	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
analysis	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
interpretation	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
communication	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7

6. Could you please rate the *importance of community member involvement* in the following components of the monitoring program you are involved in. The rating scale is from 1 – 7 where 1 = not at all important, and 7 = very important.

	Not at all important	→	→	→	→	→	Very important
planning	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
coordination	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
data collection	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
equipment management	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
data entry	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
analysis	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
interpretation	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
communication	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7

Planning & context (PROJECT OFFICERS/KEY CONTACTS ONLY)

7. What data and data products from other sources have you used or could you use in the monitoring program? Read out datasets from relevant data categories - multiple responses

Data type	Currently Used	Could Use
<b>1) Land Use</b>		
i) Agricultural land area and extent		
ii) Land use		
iii) Aerial photography		
<b>2) Land Condition</b>		
i) Area at risk of wind erosion		
ii) Area and extent of dryland salinity		
iii) Dryland salinity severity		
iv) Lake edge erosion		
v) Dryland water use efficiency		
vi) Salt affected floodplain extent		
vii) Soil carbon measure		
viii) Soil landscapes		
ix) Areas of recharge potential		
<b>3) River System</b>		
i) Flow measurements		
ii) Floodplain extent		
iii) Floodplain vegetation condition		
iv) In river salinity		
v) River "health"		
vi) Volume of water over barrages		
vii) Aerial surveys of Mouth		
<b>4) Wetlands</b>		
i) Wetland extent		
<b>5) Water Quality</b>		
i) E. coli levels		
ii) Total nitrogen		
iii) Total phosphorus		
iv) Turbidity		
v) Blue green algae levels		

Data type	Currently Used	Could Use
<b>6) Native Vegetation</b>		
Floodplain vegetation extent, composition and structural classifications		
i) Native vegetation extent		
ii) Vegetation condition		
iii) Vegetation habitat extent		
<b>7) Threatened Species</b>		
Extent and distribution of regionally threatened species		
i) Extent and distribution of State and National listed species		
ii) Recovery Plans		
iii) National and State status for listed species		
iv) Regional status for threatened species		
v)		
<b>8) Native Fauna</b>		
i) Native fish numbers		
ii) Fauna sites		
<b>9) Littoral Zone</b>		
Littoral zone for River, Coorong and waters		
i) Littoral zones of high priority and significance		
ii) Littoral zone condition		
iii)		
<b>10) Ocean</b>		
Diurnal tide ratio (DTR) and water level analysis		
i)		
<b>11) Groundwater</b>		
i) Depth to groundwater		
ii) Recharge rate		

**Data quality assurance and control** (Check preliminary survey if more detail is required for each project)

8. What verification or quality assurance of the data is undertaken? **Record open-ended response**

**Data storage**

(Check preliminary survey if more detail is required for each project)

9. Who is the officer responsible for data management? **Record open-ended response**

10. Where is the monitoring data stored? **Record open-ended response**

**Data access**

11. Who has access to the monitoring data? **Unprompted – multiple response**

- a. project staff
- b. other regional group staff
- c. project/community group
- d. government agency staff
- e. regional/local experts
- f. consultants
- g. other

**Data management (PROJECT OFFICERS/KEY CONTACTS ONLY)**

12. How much do you think the project would benefit from a single data storage/management unit in the region? Please rate the benefit on a scale of 1 – 7 where 1 = no benefit at all, and 7 = very beneficial.

No benefit at all      →      →      →      →      →      Very beneficial

Single regional data storage unit       1       2       3       4       5       6       7

## EVALUATION

### Analysis & interpretation

13. How is the monitoring data from the project analysed? **Unprompted – multiple response**

- |  |   |
|--|---|
| a. not analysed                                      | e. statistical analysis (which analysis package.....) |
| b. graphed   | f. model (which model.....)                           |
| c. tabulated   | g. mapped   |
| d. statistical analysis (which statistic tests.....) | h. other  |

14. Who analyses data from the monitoring program? **Unprompted – multiple response**

- |                               |                          |
|-------------------------------|--------------------------|
| a. project staff              | e. regional/local expert |
| b. other regional group staff | f. consultant            |
| c. project/community group    | g. other                 |
| d. government agency staff    |                          |

15. Who interprets the results after analysis? **Unprompted – multiple response**

- |                               |                          |
|-------------------------------|--------------------------|
| a. project staff              | e. regional/local expert |
| b. other regional group staff | f. consultant            |
| c. project/community group    | g. other                 |
| d. government agency staff    |                          |

### Continuous improvement (PROJECT OFFICERS/KEY CONTACTS ONLY)

16. Has a review of the monitoring program ever been conducted? **YES or NO answer**

**YES**

 1

**NO**

 2

*If YES to Q 16 ask:*

17. Who undertook the review? **Record open-ended response**

*If YES to Q 16 ask:*

18. What was the scope of the review? **Record open-ended response**

*If YES to Q 16 ask:*

19. What changes were made to the monitoring program after the review? **Record open-ended response**

## IMPACT AND INFLUENCE

### Adaptive management

20. How confident are you that the monitoring program *influences decisions* about natural resource management at the *regional* level? Please rate your confidence on a scale of 1 – 7 where 1 = not at all confident, and 7 = very confident.

Not at all confident    →    →    →    →    →    Very confident

1     2     3     4     5     6     7

21. How confident are you that the monitoring program *influences decisions* about natural resource management at the *local* level? Please rate your confidence on a scale of 1 – 7 where 1 = not at all confident, and 7 = very confident.

Not at all confident      →      →      →      →      →      Very confident

1       2       3       4       5       6       7

*If answer to Q 20 or Q 21 greater than 5 ask:*

22. Are you able to provide an example of how the monitoring program influenced local or regional decisions about natural resource management? **Record open-ended response**

*If answer to Q 20 less than 5 ask:*

23. How confident are you that the monitoring program *could influence decisions* about natural resource management at the *regional* level? Please rate your confidence on a scale of 1 – 7 where 1 = not at all confident, and 7 = very confident.

Not at all confident      →      →      →      →      →      Very confident

1       2       3       4       5       6       7

*If answer to Q21 less than 5 ask:*

24. How confident are you that the monitoring program *could influence decisions* about natural resource management at the *local* level? Please rate your confidence on a scale of 1 – 7 where 1 = not at all confident, and 7 = very confident.

Not at all confident      →      →      →      →      →      Very confident

1       2       3       4       5       6       7

## PROGRESS AND LIMITATION

Future directions

25. What are the three best things about the monitoring program? **Record open-ended response**

1) .

2) .

3) .

26. What are the three biggest challenges facing the monitoring program? **Record open-ended response**

1) .

2) .

3) .

## COMMUNICATIONS

27. Which organisations or agencies does the monitoring program aim to inform? **Unprompted – multiple response**

- |                               |                            |
|-------------------------------|----------------------------|
| a. NRM Board                  | g. land managers           |
| b. RMCWMB                     | h. government agency       |
| c. LAP group                  | i. Local government        |
| d. Catchment Board            | j. Project/community group |
| e. Animal Plant Control Board | k. general community       |
| f. Soil Board                 | l. other                   |

28. What media or communication tools have been used to communicate the results of the monitoring? **Read out 1-14 - multiple response**

- |                             |                               |
|-----------------------------|-------------------------------|
| 1) pamphlets/brochures      | 9) Advertiser                 |
| 2) project newsletters      | 10) Messenger                 |
| 3) region wide newsletter   | 11) local radio               |
| 4) field/demonstration days | 12) state or national radio   |
| 5) project meetings         | 13) TV (local/state/national) |
| 6) word-of-mouth            | 14) conference/forum          |
| 7) project report           | 15) magazine                  |
| 8) Local newspaper          | 16) scientific journal        |

## LOCATION OF MONITORING SITES

29. Could you provide the location of monitoring sites and Metadata on the monitoring? Please send to [patrickoconnor@senet.com.au](mailto:patrickoconnor@senet.com.au)

30. Do you have any other comments you would like to make?

## **Appendix 5: Project Officers Supporting Community Based Monitoring in the SAMDB**

### **Waterwatch**

Pippa Kerby  
Tamara McPherson

### **Groundwater and Water Use Monitoring**

Sarah Kuchel  
Michael Cutting  
Lyz Risby  
Bruce Allnutt  
Noel Johnstone

### **Wetland Monitoring**

Adrienne Frears  
Tracey Steggles

### **Biodiversity Monitoring (general)**

Luke Geelan  
Jody Gates (& DEH staff)  
Steve Coombe

### **Threatened Species Monitoring**

Ben Simon  
Chris Obst  
Jody Gates (& DEH staff)



## **Appendix 6: Summary Table of Survey Responses (Stage 2 – Consultation about community based monitoring programs)**

APPENDIX 6 is attached as an electronic file (Microsoft Excel) on the CDROM accompanying this report.

## Appendix 7: Value of MAT to community monitoring for each Resource Condition Target (RCT)

### *Data generating MATs (as per Investment Strategy Phase 2)*

RCT 1	Value to community monitoring?
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>31:</b> To design and construct a web-based system for cost effective, consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by 2008	Yes, as monitoring tool
<b>61:</b> To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring
<b>68:</b> Identify areas that can be influenced by environmental flow enhancement and groundwater lowering (DTM and surface water modelling)	Yes, to identify priorities for monitoring
<b>70:</b> Commence baseline data collection and develop long-term monitoring program	Yes, as baseline information to compare progress against Perhaps also work together to collect data
<b>71:</b> Identify threatened species, communities or critical habitats within land system units across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>72:</b> Identify priority areas or hot spots across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>133:</b> By 2006, an additional 10% of public land managed to maximise Ramsar values	No
<b>138:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>140:</b> By 2006, a description of the ecological character of the Ramsar site that can be used as the basis for future land, water, species and ecological community management	Yes, to identify priorities for monitoring
RCT 2	
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>22:</b> To have implemented a system for cost effective consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by Dec 2005	Yes, as monitoring tool
<b>37:</b> To increase irrigation efficiency throughout the Tintinara Coonalpyn irrigation area by 20% through improved irrigation management by 2006	No
<b>61:</b> To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring

<b>68:</b> Identify areas that can be influenced by environmental flow enhancement and groundwater lowering (DTM and surface water modelling)	Yes, to identify priorities for monitoring
<b>70:</b> Commence baseline data collection and develop long-term monitoring program	Yes, as baseline information to compare progress against
<b>71:</b> Identify threatened species, communities or critical habitats within land system units across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>72:</b> Identify priority areas or hot spots across the Chowilla RR and GR	Yes, to identify priorities for monitoring
RCT 3	
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>22:</b> To have implemented a system for cost effective consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by Dec 2005	Yes, as monitoring tool
<b>61:</b> To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring
<b>68:</b> Identify areas that can be influenced by environmental flow enhancement and groundwater lowering (DTM and surface water modelling)	Yes, to identify priorities for monitoring
<b>70:</b> Commence baseline data collection and develop long-term monitoring program	Yes, as baseline information to compare progress against
<b>71:</b> Identify threatened species, communities or critical habitats within land system units across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>72:</b> Identify priority areas or hot spots across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>74:</b> regional wetland monitoring networks and data management mechanisms to fill wetland monitoring gaps	Yes, this involves community monitoring as a methodology
<b>108:</b> To have developed and be implementing coordinated control plans for introduced plants and animals for areas of threatened species and ecosystems by 2006	Yes, to identify priorities for monitoring
<b>133:</b> By 2006, an additional 10% of public land managed to maximise Ramsar values	No
<b>134:</b> By 2008, an additional 20% of currently eroding lakeshore is stabilised	No
<b>137:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>138:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>140:</b> By 2006, a description of the ecological character of the Ramsar site that can be used as the basis for future land, water, species and ecological community management	Yes, to identify priorities for monitoring

RCT 4	
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>61:</b> To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring
<b>68:</b> Identify areas that can be influenced by environmental flow enhancement and groundwater lowering (DTM and surface water modelling)	Yes, to identify priorities for monitoring
<b>70:</b> Commence baseline data collection and develop long-term monitoring program	Yes, as baseline information to compare progress against
<b>71:</b> Identify threatened species, communities or critical habitats within land system units across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>72:</b> Identify priority areas or hot spots across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>74:</b> regional wetland monitoring networks and data management mechanisms to fill wetland monitoring gaps	Yes, this involves community monitoring as a methodology
<b>108:</b> To have developed and be implementing coordinated control plans for introduced plants and animals for areas of threatened species and ecosystems by 2006	Yes, to identify priorities for monitoring
<b>133:</b> By 2006, an additional 10% of public land managed to maximise Ramsar values	No
<b>134:</b> By 2008, an additional 20% of currently eroding lakeshore is stabilised	No
<b>137:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>138:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>140:</b> By 2006, a description of the ecological character of the Ramsar site that can be used as the basis for future land, water, species and ecological community management	Yes, to identify priorities for monitoring
RCT 5	
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>61:</b> To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring
<b>68:</b> Identify areas that can be influenced by environmental flow enhancement and groundwater lowering (DTM and surface water modelling)	Yes, to identify priorities for monitoring
<b>70:</b> Commence baseline data collection and develop long-term monitoring program	Yes, as baseline information to compare progress against
<b>71:</b> Identify threatened species, communities or critical habitats	Yes, to identify priorities

within land system units across the Chowilla RR and GR	for monitoring
<b>72:</b> Identify priority areas or hot spots across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>108:</b> To have developed and be implementing coordinated control plans for introduced plants and animals for areas of threatened species and ecosystems by 2006	Yes, to identify priorities for monitoring
<b>133:</b> By 2006, an additional 10% of public land managed to maximise Ramsar values	No
<b>134:</b> By 2008, an additional 20% of currently eroding lakeshore is stabilised	No
<b>137:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>138:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>140:</b> By 2006, a description of the ecological character of the Ramsar site that can be used as the basis for future land, water, species and ecological community management	Yes, to identify priorities for monitoring
RCT 6	
<b>108:</b> To have developed and be implementing coordinated control plans for introduced plants and animals for areas of threatened species and ecosystems by 2006	Yes, to identify priorities for monitoring
<b>115:</b> To have identified pests of significant impact by June 2005	Yes, to identify priorities for monitoring
<b>116:</b> To have identified priority pest plant and animal locations in areas of cultural and conservation significance and/or greatest need by June 2005	Yes, to identify priorities for monitoring
<b>123:</b> Identify baseline to establish on-going monitoring schedules by 2005	Yes, as baseline information to compare progress against
RCT 7	
<b>20:</b> To facilitate the availability of information required for the implementation of standardised and consistent annual reporting by licence holders by 2005	Yes, this involves community monitoring as a methodology
<b>21:</b> To enable the baseline information required	Yes, as baseline information to compare progress against
<b>22:</b> To have implemented a system for cost effective consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by Dec 2005	Yes, this involves community monitoring as a methodology
<b>24:</b> By 2007, to have constructed and implemented a rigorously maintained accounting system for recording, monitoring and reporting on salinity impacts of water trade; supporting salinity policy through the provision of up to date, accurate information	Yes, as monitoring tool
<b>31:</b> To design and construct a web-based system for cost effective, consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by 2008	Yes, as monitoring tool

<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
<b>54:</b> 45,00 ha perennial vegetation established in high priority areas by 2007	No
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
RCT 8	
<b>20:</b> To facilitate the availability of information required for the implementation of standardised and consistent annual reporting by licence holders by 2005	Yes, this involves community monitoring as a methodology
<b>21:</b> To enable the baseline information required	Yes, as baseline information to compare progress against
<b>22:</b> To have implemented a system for cost effective consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by Dec 2005	Yes, this involves community monitoring as a methodology
<b>24:</b> By 2007, to have constructed and implemented a rigorously maintained accounting system for recording, monitoring and reporting on salinity impacts of water trade; supporting salinity policy through the provision of up to date, accurate information	Yes, as monitoring tool
<b>31:</b> To design and construct a web-based system for cost effective, consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by 2008	Yes, as monitoring tool
<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
<b>54:</b> 45,00 ha perennial vegetation established in high priority areas by 2007	No
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
RCT 9	
<b>20:</b> To facilitate the availability of information required for the implementation of standardised and consistent annual reporting by licence holders by 2005	Yes, this involves community monitoring as a methodology
<b>21:</b> To enable the baseline information required	Yes, as baseline information to compare progress against
<b>22:</b> To have implemented a system for cost effective consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by Dec 2005	Yes, this involves community monitoring as a methodology
<b>24:</b> By 2007, to have constructed and implemented a rigorously maintained accounting system for recording, monitoring and reporting on salinity impacts of water trade; supporting salinity policy through the provision of up to date, accurate information	Yes, as monitoring tool
<b>31:</b> To design and construct a web-based system for cost effective, consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by 2008	Yes, as monitoring tool

<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
RCT 10	
<b>88:</b> To have all water users metered by 30 June 2007	Yes, as monitoring tool
<b>145:</b> By 2006, a comprehensive ecosystem monitoring program that will enable evaluation of the impact of land, water, species and ecological community management actions	Yes, as monitoring tool
<b>149:</b> To restrict stock access to 25% of riparian zones in priority areas by 2006	No
RCT 11	
<b>88:</b> To have all water users metered by 30 June 2007	Yes, this involves community monitoring as a methodology
<b>145:</b> By 2006, a comprehensive ecosystem monitoring program that will enable evaluation of the impact of land, water, species and ecological community management actions	Yes, as monitoring tool
<b>149:</b> To restrict stock access to 25% of riparian zones in priority areas by 2006	No
RCT 12	
<b>88:</b> To have all water users metered by 30 June 2007	Yes, this involves community monitoring as a methodology
<b>145:</b> By 2006, a comprehensive ecosystem monitoring program that will enable evaluation of the impact of land, water, species and ecological community management actions	Yes, as monitoring tool
<b>149:</b> To restrict stock access to 25% of riparian zones in priority areas by 2006	No
RCT 13	
<b>88:</b> To have all water users metered by 30 June 2007	Yes, this involves community monitoring as a methodology
<b>145:</b> By 2006, a comprehensive ecosystem monitoring program that will enable evaluation of the impact of land, water, species and ecological community management actions	Yes, as monitoring tool
<b>149:</b> To restrict stock access to 25% of riparian zones in priority areas by 2006	No
RCT 14	
<b>65:</b> Identify monitoring objectives, appropriate trials and design native fish survey	Yes, to identify priorities for monitoring
<b>134:</b> By 2008, an additional 20% of currently eroding lakeshore is stabilised	No

<b>145:</b> By 2006, a comprehensive ecosystem monitoring program that will enable evaluation of the impact of land, water, species and ecological community management actions	Yes, as monitoring tool
<b>149:</b> To restrict stock access to 25% of riparian zones in priority areas by 2006	No
<b>151:</b> To have commenced a trial by 2004 of an alternative operating regime to enhance the ecological health of the lower Lakes, Coorong and Murray Mouth	No
RCT 15	
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>95:</b> By 2006, to have increased the area of priority native vegetation retained and restored in HA and NPWSA reserves to over 2000ha	No
<b>108:</b> To have developed and be implementing coordinated control plans for introduced plants and animals for areas of threatened species and ecosystems by 2006	Yes, to identify priorities for monitoring
<b>134:</b> By 2008, an additional 20% of currently eroding lakeshore is stabilised	No
<b>137:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>138:</b> By 2008, improved management of 100ha of existing riparian vegetation	No
<b>140:</b> By 2006 a description of the ecological character of the Ramsar site that can be used at the basis for future land, water, species and ecological community management	Yes, to identify priorities for monitoring
<b>145:</b> By 2006, a comprehensive ecosystem monitoring program that will enable evaluation of the impact of land, water, species and ecological community management actions	Yes, as monitoring tool
<b>151:</b> To have commenced a trial by 2004 of an alternative operating regime to enhance the ecological health of the lower Lakes, Coorong and Murray Mouth	No
RCT 16	
Nil	
RCT 17	
<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
<b>54:</b> 45,00 ha perennial vegetation established in high priority areas by 2007	No
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
RCT 18	
<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring



<b>54:</b> 45,00 ha perennial vegetation established in high priority areas by 2007	No
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
RCT 19	
<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
<b>54:</b> 45,00 ha perennial vegetation established in high priority areas by 2007	No
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
RCT 20	
<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
<b>54:</b> 45,00 ha perennial vegetation established in high priority areas by 2007	No
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
RCT 21	
<b>108:</b> To have developed and be implementing coordinated control plans for introduced plants and animals for areas of threatened species and ecosystems by 2006	Yes, to identify priorities for monitoring
<b>115:</b> To have identified pests of significant impact by June 2005	Yes, to identify priorities for monitoring
<b>116:</b> To have identified priority pest plant and animal locations in areas of cultural and conservation significance and/or greatest need by June 2005	Yes, to identify priorities for monitoring
<b>123:</b> Identify baseline to establish on-going monitoring schedules by 2005	Yes, as baseline information to compare progress against
RCT 22	
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>53:</b> High priority target areas for revegetation identified and documented by June 2005	Yes, to identify priorities for monitoring
<b>54:</b> 45,00 ha perennial vegetation established in high priority areas by 2007	No
<b>55:</b> 9,000 ha perennial vegetation established through community engagement program by 2007	No
<b>61:</b> To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring
<b>68:</b> identify areas that can be influenced by environmental flow enhancement and groundwater lowering (DTM and surface water	Yes, to identify priorities for monitoring

modelling)	
<b>70:</b> Commence baseline data collection and develop long term monitoring program	Yes, as baseline information to compare progress against
<b>71:</b> Identify threatened species, communities or critical habitats within land system units across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>72:</b> identify priority areas or 'hot spots' across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>95:</b> By 2006, to have increased the area of priority native vegetation retained and restored in HA and NPWSA reserves to over 2000ha	No
<b>96:</b> By 2006, 50% of regionally identified threatened communities are protected, conserved and managed in HA and DEH reserves	No
<b>103:</b> By 2006, an additional 85km of native vegetation protected and managed along 6 priority roadsides and a Bushcare site established in each area	Yes, this involves community monitoring as a methodology
<b>104:</b> by 2006, to have re-established 950 ha of native vegetation to provide viable habitat and links between vegetation and habitat fragments in priority areas	No
RCT 23	
<b>7:</b> To have completed a biological survey of the River Murray Corridor including the river system by 2005	Yes, as baseline information to compare progress against
<b>61:</b> To identify and develop the zones of high conservation significance, floodplain health and risks to the floodplain	Yes, to identify priorities for monitoring
<b>68:</b> identify areas that can be influenced by environmental flow enhancement and groundwater lowering (DTM and surface water modelling)	Yes, to identify priorities for monitoring
<b>70:</b> Commence baseline data collection and develop long term monitoring program	Yes, as baseline information to compare progress against
<b>71:</b> Identify threatened species, communities or critical habitats within land system units across the Chowilla RR and GR	Yes, to identify priorities for monitoring
<b>72:</b> identify priority areas or 'hot spots' across the Chowilla RR and GR	Yes, to identify priorities for monitoring
RCT 24	
<b>10:</b> To have assessed vegetation health and the potential future impacts of changes in the salt and water balance on vegetation health by 2006	Yes, to identify priorities for monitoring
RCT 25	
<b>10:</b> To have assessed vegetation health and the potential future impacts of changes in the salt and water balance on vegetation health by 2006	Yes, to identify priorities for monitoring
<b>24:</b> By 2007, to have constructed and implemented a rigorously maintained accounting system for recording, monitoring and reporting on salinity impacts of water trade; supporting salinity	Yes, as monitoring tool

policy through the provision of up to date, accurate information	
<b>31:</b> To design and construct a web-based system for cost effective, consistent measurement and recording of water use efficiency at farm, district and regional scales for priority LWMP areas by 2008	Yes, as monitoring tool
<b>42:</b> To establish an inventory of assets currently or in the future likely to be affected by increasing dryland salinity by June 2005	Yes, to identify priorities for monitoring
RCT 26	
<b>88:</b> To have all water users metered by 30 June 2007	Yes, this involves community monitoring as a methodology

## Appendix 8: Modified EPA Data Confidence Framework

### Introductory Information

In order to obtain known quality data the following Quality Assurance and Quality Control (QA/QC) steps need to be followed:

- records of equipment and its maintenance must be kept (including information on processes for calibration of equipment)
- data must be recorded accurately (ie. in the correct units or using standard nomenclature)
- monitoring design and protocols must be fully described and recorded
- training (including refresher training) is paramount
- verification of data is required to support an assessment of the accuracy of the data (eg. testing water samples against known controls for water quality testing)

Data from community groups or individuals can be compared with known values to determine the level of accuracy of measurements. For Waterwatch programs control solutions (samples of known value) are sent in unidentified bottles to monitoring groups for testing. The level of accuracy of community group measurements of these standards can be used to evaluate the data collected by the group against accepted tolerance levels. For other monitoring programs, calibration of the accuracy and precision of the group or individuals can be determined using methods a mixture of methods. Eg for vegetation surveys, estimations of plant density can be checked using transects and quadrats over a small area.

It is possible that many community groups are already meeting most requirements to have their data identified to a known quality level, but this information needs to be documented to enable community collected data to be more confidently used in environmental reporting.

The 'EPA Data Categories for Community Monitoring' are divided into three monitoring levels.

- 'General' level monitoring
- 'Standard' level monitoring
- 'Advanced' level monitoring

Table One provides a summary of the data categories and Tables Two to Four provide detailed information on the QA/QC requirements for each data category in the EPA Data Categories for Community Monitoring (Waterwatch)..

Table One: Characteristics of the EPA Data Categories for Community Monitoring

Data Category	QA/QC Requirements	Desired result	Potential Uses of Data
General/ Educational level monitoring	participation in 'general' monitoring training provision of data to NRM Officers or environmental managers	Unknown or variable data quality	educational tool in the classroom Trend data about catchment health (note there will be limitations to providing accurate site information on water quality)
Standard/ Reportable level monitoring	Meeting the requirements of the 'general' level monitoring Participation in 'standard' equipment training Participation in one control/reference testing per year Calibration of equipment prior to sampling	Known quality data, but not the highest attainable through community based monitoring	educational purposes catchment and natural resource management reporting General trend data about catchment health
Advanced/ Publishable level monitoring	Meeting the requirements of the 'standard' level monitoring Development of a monitoring plan Keeping a logbook of monitoring activities Participation in an additional control testing	Known quality data – highest quality attainable using community-based monitoring equipment	State of Environment Reporting Catchment and natural resource management reporting information about specific sites for academic or scientific studies

**Table Two: General Level Monitoring – QA/QC Requirements**

<b>Category</b>	<b>QA/QC Requirements</b>	<b>Monitoring Requirements</b>	<b>Tolerance Levels</b>
<p>General/ Educational level monitoring</p> <p>Data is of unknown or variable quality, as this is data about which there is missing, little or no QA/QC information.</p> <p>Data is analysed for trends at a catchment level by regional NRM programs.</p> <p>Data can be entered into the Community-based data systems at the regional level such as Waterwatch Australia Data Management (WADM) System at the regional level.</p> <p>Data can be made available to external users, with the proviso that the data is of unknown or variable quality.</p>	<ul style="list-style-type: none"> <li>• Participation in ‘general’ monitoring training</li> <li>• Provision of data to NRM Officer or environmental managers</li> <li>• Participation in control/reference testing is optional</li> </ul> <p>Data sheets are completed to the best of the group’s ability, but may not be complete.</p> <p>All conversions and averages to be calculated at the regional offices.</p>	<ul style="list-style-type: none"> <li>• Development of a monitoring plan is optional.</li> <li>• Sites are tested at least once per year.</li> </ul>	<p>No tolerance levels calculable due to lack of information on equipment, incomplete data sheets, site information unavailable, etc.</p> <p>It is possible that some parameter data submitted may be of standard or advanced quality and will be analysed accordingly if groups participate in control testing.</p>

**Potential Data Users for General Level Data:**

- Educators; for classroom analysis of data and awareness of water issues.  
Can be used as part of the mathematics, science and society and environment curricula.
- Regional programs may use all levels of monitoring data to produce feedback maps.  
Such maps will indicate the overall trends in water quality across a catchment or sub-catchment.

Note: there will be limitations to providing accurate site information due to the uncertainty about the data quality.

**Table Three: Standard Level Monitoring – QA/QC Requirements**

Category	QA/QC Requirements	Monitoring Requirements	Examples of Tolerance Levels
<p>Standard/ Reportable level monitoring</p> <p>Quality of data can be identified and data can be analysed for trends.</p> <p>Sample collected and analysed to standard community monitoring procedures, including all listed QA/QC requirements.</p> <p>Data can be entered into the Community-based data systems at the regional level such as Waterwatch Australia Data Management (WADM) System at the regional level.</p> <p>Data can be made available to external users, with the proviso of the tolerance limits for the quality of the data.</p>	<p>Participation in ‘general’ and ‘standard’ monitoring training</p> <p>Participation in one control/reference testing event.</p> <p>Data record sheet completed in full for each monitoring event.</p> <p>Results of training and control/reference testing within wide acceptable tolerance limits.</p> <p>Provision of data to NRM Officers or environmental managers</p> <p>All conversions and averages to be calculated at the regional offices.</p>	<p>Development of a monitoring plan is optional.</p> <p>Sites are tested at least four times per year.</p> <p>Equipment to be calibrated before any testing.</p> <p>Correct units to be recorded on data sheets.</p> <p>Measurements to be made on same day.</p>	<p><b>pH</b> ± 1.0 increment</p> <p><b>EC</b> ± 20% range for acceptance of data for all equipment</p> <p>Phosphates AquaspeX low ± 0.10mg/L AquaspeX high ± 0.20mg/L, above 1.5mg/L ± 1.00mg/L Visicolor ± 0.10mg/L Palintest ± 0.10mg/L</p> <p>Nitrates AquaspeX low ± 0.50mg/L, above 1.5mg/L ± 1.00mg/L AquaspeX high ± 1.0mg/L Palintest ± 0.10mg/L</p> <p>Turbidity Low ± 10 NTU’s High ± 20 NTU’s</p> <p>Note: high readings are not as accurate using this equipment.</p> <p>Temperature ± 0.50 degrees Celsius</p>

**Potential Data Users for Standard Level Data:**

- Educators; for classroom analysis of data and awareness of NRM issues.  
Monitoring measurements can be an integral part of the mathematics, science and society and environment curricula.
- Regional programs may use all levels of monitoring data to produce feedback maps.  
Such maps will indicate the overall trends in resource condition across a catchment or sub-catchment.
- The general public through media reports and feedback
- Educational, scientific research and community groups involved in natural resource management may use data to complement their research and on-ground monitoring activities.
- NRM Boards, Local Government, and State Government Agencies; for reporting on trends in catchment condition.  
eg. State of the Environment Reports, Catchment reports etc.



**Table Four: Advanced Level Monitoring – QA/QC Requirements**

Category	QC Requirements	Monitoring Requirements	Examples of Tolerance Levels
<p><b>Advanced/ Publishable level monitoring</b></p> <p>This is the best quality data achievable through community monitoring programs.</p> <p>Quality of data can be identified and data can be analysed for trends.</p> <p>Samples are collected and analysed according to community monitoring QA/QC requirements.</p> <p>Data can be entered into the Community-based data systems at the regional level such as Waterwatch Australia Data Management (WADM) System at the regional level.</p> <p>Data can be made available to external users, with the proviso of the tolerance limits for the quality of the data.</p>	<ul style="list-style-type: none"> <li>• Participation in ‘general’ and ‘advanced’ monitoring training</li> <li>• Participation in two control/reference testing events.</li> <li>• Log of equipment, training and control/reference testing recorded on Logbook Proforma.</li> <li>• Data record sheet completed in full for each testing.</li> <li>• Results of training and control/reference testing within acceptable tolerance limits, equivalent to the tolerance ranges for equipment.</li> <li>• Groups can calculate conversions and averages if desired.</li> <li>• Provision of data to NRM Officer or environmental managers.</li> </ul>	<ul style="list-style-type: none"> <li>• Development of a monitoring plan, which is submitted, to regional programs as required.</li> <li>• Sites are tested at least 4 times per year and up to 6 times a year (or even more often if required). The same sites must be visited on each occasion.</li> <li>• Equipment to be calibrated before any testing.</li> <li>• Correct units to be recorded on data sheets.</li> <li>• Measurements to be made on same day.</li> </ul>	<p><b>pH</b></p> <ul style="list-style-type: none"> <li>• ± 1.0 increment</li> </ul> <p><b>EC</b></p> <ul style="list-style-type: none"> <li>• ± 10% range for acceptance of data for all equipment</li> </ul> <p>Phosphates</p> <ul style="list-style-type: none"> <li>• Aquaspex low ± 0.05mg/L</li> <li>• Aquaspex high ± 0.10mg/L, above 1.5mg/L ± 0.50mg/L</li> <li>• Visicolor ± 0.01mg/L</li> <li>• Palintest ± 0.01mg/L</li> </ul> <p>Nitrates</p> <ul style="list-style-type: none"> <li>• Aquaspex low ± 0.25mg/L, above 1.5mg/L ± 0.50mg/L</li> <li>• Aquaspex high ± 0.50mg/L</li> <li>• Palintest ± 0.05mg/L</li> </ul> <p>Turbidity</p> <p style="padding-left: 40px;">Low ± 10 NTU’s</p> <p style="padding-left: 40px;">High ± 20 NTU’s</p> <p>Note: high readings are not as accurate using this equipment.</p> <p>Temperature</p> <ul style="list-style-type: none"> <li>• ± 0.50 degrees Celsius</li> </ul>

**Potential Data Users for Advanced Level Data:**

- Educators; for classroom analysis of data and awareness of issues.  
Monitoring measurements can be an integral part of the mathematics, science and society and environment curricula.
- Regional programs may use all levels of monitoring data to produce catchment feedback maps.  
Such maps will indicate the overall trends in resource condition across a catchment or sub-catchment.
- The general public through media reports and feedback.
- Educational, scientific research and community groups involved in natural resource management may use data to complement their research and on-ground monitoring activities.
- NRM Boards, Local Government, and State Government Agencies; for reporting on trends in catchment condition.  
eg. State of the Environment Reports, Catchment reports etc.

**Note:**

The highest level of scientific data may not be attainable through community water monitoring programs, due to the limitations of the inexpensive equipment used by community groups.

For further information about the EPA Data Categories or for assistance in meeting the requirements for your data category please contact:

- your regional NRM program by obtaining details South Australian NRM web site [www.dwlbc.sa.gov.au/nrm](http://www.dwlbc.sa.gov.au/nrm)
- EPA Community Monitoring Scientific Officer (Water Quality) phone 8204 2099 or e-mail [linda-marie.mcdowell@state.sa.gov.au](mailto:linda-marie.mcdowell@state.sa.gov.au)

## Appendix 9: Modified EPA Data Category Questionnaire

The following questions will help you determine which data category you want to aim for in your monitoring activities for 2005. Please tick the relevant options.

If you require assistance completing these questions contact:

- Regional Coordinator on 8532 3573
- or the EPA Community Monitoring Scientific Officer on 8204 2099

Name of Group: \_\_\_\_\_

Suburb/ town or region where group is monitoring: \_\_\_\_\_

Contact for Person: \_\_\_\_\_

Phone Number: \_\_\_\_\_

### Determining your Data Category

All groups need to participate in a 'general' level of training to be proficient in monitoring. In order to meet 'standard' or 'advanced' level monitoring, you will need to receive additional training and take extra steps in your monitoring.

#### 1. Is your group willing to receive additional training in monitoring procedures, and undergo quality assurance and quality control (QA/QC) checks?

If no go to Option A, if yes go to Option B.

- Option A Excellent! Your data will be a valuable educational tool for determining trends in catchment health.

You will be aiming for the 'general' level of monitoring

- Option B Fantastic! Your monitoring data will be of a known quality, proceed to question 2.

#### 2. Please select the option that best suits, and can be reasonably achieved, by your monitoring group in 2004.

- Option C - Annual equipment training  
- Calibration of equipment prior to sampling  
- One standard/reference testing event per year

You will be aiming for the 'standard' level of monitoring

- Option D - Annual equipment training  
- Calibration of equipment prior to sampling  
- Two standard/reference testing events per year  
- Completing a monitoring plan  
- Keeping a logbook of equipment maintenance and monitoring activities

You will be aiming for the 'advanced' level of monitoring

## Appendix 10: EPA Monitoring Checklist

*for 'advanced' and/ or 'standard' community water monitoring groups*

This is a checklist for you work through each time you monitor to ensure you have completed all the required Quality Assurance and Quality Control (QA/QC) steps to aim towards advanced or standard community monitoring data.

Please make multiple copies of this checklist and complete it each time you undertake monitoring. Keep a copy of the completed checklist along with your Monitoring Logbook proformas for future reference if required.

**Group Information** **Date of monitoring:**    /    /200....

Group Name: \_\_\_\_\_

Contact person: \_\_\_\_\_

Circle yes or no for the questions below each time you monitor.

### **Before Monitoring**

1. Have you completed a monitoring plan? Yes / No
  - if not contact your regional NRM Officer to complete a monitoring plan before you start monitoring
  
2. Do you have a copy of the following information? Yes / No
  - Data Record Sheet
  - Log Book Proforma to record your equipment maintenance and training information
  - Monitoring Instructions for each test you are going to undertake
  
3. Have you cleaned and maintained your equipment since your last monitoring event? Yes / No
  
4. Have you calibrated your equipment? Yes / No
  
5. Do you have all the required equipment and solutions to undertake your monitoring? Yes / No
  - do you have the appropriate reagents?
  - have you checked the expiry date for your reagents and solutions?

6. Do you have the required safety equipment? Yes / No

**During Monitoring**

7. Have you followed the instruction sheets for each test step by step? Yes / No

8. Have you recorded all your monitoring information on your data record sheet?  
Yes / No

9. Have you indicated the units for all your measurements? Yes / No

**After Monitoring**

10. Have you cleaned and maintained all equipment as required once measurements have been completed? Yes / No

12. Have you faxed your data record sheet to your regional NRM Officer Yes / No

For further information about the EPA Data Categories or for assistance in meeting the requirements for your data category please contact:

- your regional NRM Officer by obtaining details from the SAMDB NRM Board website
- EPA Community Monitoring Scientific Officer (Water Quality) phone 8204 2099 or e-mail [linda-marie.mcdowell@state.sa.gov.au](mailto:linda-marie.mcdowell@state.sa.gov.au)

## Appendix 11: EPA Monitoring Logbook Proforma

*for 'advanced' and/ or 'standard' community water monitoring groups*

Please complete this logbook each time you monitor to provide evidence that you have completed all the required Quality Assurance and Quality Control (QA/QC) steps to aim towards advanced or standard community water monitoring data.

### Group Information

Group Name: \_\_\_\_\_

Contact person: \_\_\_\_\_

### Record of training and QA/QC workshops attended

Date eg. 12/4/04	Time eg. 2pm to 3pm	Training Topic eg. Waterwatch equipment training	Training Provider eg. Onkaparinga Waterwatch Network (OWN)

### Record of Equipment Calibrations

Date eg. 12/4/04	Time eg. 2pm to 3pm	Solutions used for calibration eg. 1400u/cm	Reading before calibration	Reading after calibration

### Record of participation in Control/Reference testing events

Date eg. 12/4/04	Time eg. 2pm to 3pm	QA/QC event eg. Saltwatch	Parameters tested eg. salinity (EC)

Thank you for taking the time keep your logbook up to date.

## Appendix 12: Useful datasets and products for community based monitoring

Datasets and products that are currently (O) and could be (X) useful for community based monitoring programs (data from Stage 2 – monitoring evaluation survey)

Group Name	Project Officer PO / Community Participant CP	Area and extent of dryland salinity	Area at risk of wind erosion	Areas of recharge potential	Dryland salinity severity	Dryland water use efficiency	Lake edge erosion	Salt affected floodplain extent	Soil carbon measure	Soil landscapes	Aerial photography	Agricultural land area and extent	Land use (BRS)	Land Condition	Fauna sites	Native fish numbers	Native Fauna	Floodplain vegetation extent	Native vegetation extent	Vegetation condition	Native Vegetation	Vegetation habitat extent	Aerial surveys of Mouth	Floodplain extent	Floodplain vegetation condition	Flow measurements	In river salinity	River "health"	Volume of water over barrages	River System	Blue green algae levels	E. coli levels	Total nitrogen	Total phosphorus	River Water Quality	Turbidity	Extent and distribution of regionally threatened species	Extent and distribution of State and National listed species	National and State status for listed species	Recovery Plans	Threatened Species	Regional status for threatened species	Wetlands
Doctors Creek Landcare Group - Bats for Biodiversity	CP																																										
Friends of Ferries MacDonald and Monarto Conservation Parks	CP										X							X	X																				O	O	O	X	O
Friends of Gluepot Reserve	CP											O						O	O																				O	O	O	O	O

Friends of Riverland Parks	CP				X				X	X	X							X	X	X	O	X									
Gluepot Reserve	CP		X		O		O		O	O	O							O	O	O	O	O									
Mantung-Maggae Land Management Group	CP																														
Regent Parrots, Black-eared Miners and Malleefowl Monitoring	PO																														
Rodewell Creek/Wislow Landcare Group	CP	X	X	X	X			O	X	O	X	X		X	X	X			X	X	X	X	X	X	X	O		O			
Currency Creek Water Use Efficiency Project	PO	X		X	X		X	X	O		O			X	X				X	X	X	X									
EHMP Catchment Group	PO	X	X	O	O		X		O	X	X	X		O	O	X		O							O	O	O	O	O		
Mallee Water Resources Committee	PO			X	X		X	X		X				X																	
Murray Mallee LAP	PO		O				X							O											O	X	O	O	O		
Riverland Irrigators	PO																														
Overland Corner National Trust Wetland Committee	CP	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Ramco Wetland Management Group	CP			X			X	X	X	X				X	X				X	X											
Riverglades Wetland Management Group	CP																														
Brenda Park/Scotts Creek Wetland	PO							O			X	X		O	O				X	X	X	X	X	X	X	X	O	X	O	O	
Martin's Bend Wetland Mangement Committee	PO			X	X	X		O		X	X	X		O	O	X			X		X	X	X	X	X	X	O	X	O		
Milang Wetland Management Committee	PO							X	O					O					X	X	X	X	X	X	X	X	X	X	X	O	X
Ukee Boat Club	PO			X			X	X	O		X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Clayton Lagoon Waterwatch	CP																														
Cornerstone College Waterwatch	CP							O	X	X				X	X											X	X	X	X	X	



Finniss Catchment Group	CP	X	X	X			X	X	X	X	X	X															X	X	X	X	X						
Signal Point - Waterwatch	CP																																				
Strathalbyn Field Naturalists	CP																																				
Unity College Waterwatch	CP																																				
Jervois Primary School Waterwatch	PO								O	O				X		X	X	X	X	X	X	X	X	X	X	X					O						
Renmark North Primary School Waterwatch	PO	X		X		X		X	X	X	X	X			X	X	X	X	X		X	X		X	X	X	X	X	X	X	X						
Signal Point - Waterwatch	PO																																				
Swan Reach Area School Waterwatch	PO	X	X	X	X	X	X	X	X	X	O	X	X	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Waikerie Primary School Waterwatch	PO	X	X	X	X	X		O	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
No. of datasets that could be used by wetland monitoring groups		1	0	4	1	2	0	2	1	4	2	0	4	2	4	2	3	4	3	0	1	2	2	3	2	2	5	4	5	5	5	5	3	5	2	2	
No. of datasets that could be used by waterwatch monitoring groups		4	0	2	4	2	1	3	1	2	3	1	5	4	2	2	4	4	1	1	3	3	4	4	4	1	4	4	3	3	4	5	5	5	5	5	2
Total number of groups currently using the dataset/product		0	1	1	1	0	0	0	0	0	12	0	3	2	2	1	4	2	1	1	0	0	3	3	0	0	0	0	0	0	0	5	4	8	5	9	2
Total number of groups that could use the dataset/product		8	2	10	7	5	1	5	4	8	9	3	11	8	7	5	11	10	7	1	4	5	7	8	6	3	10	10	10	10	11	12	13	9	11	8	4

## Appendix 13: Community Wetland Monitoring Questionnaire used by Frears, A. and Steggles, T. (2004) (See Section 3.4)

The community wetland monitoring program has been running for some time now, and we would like to undertake a review to see how it's going and how you as community members feel about wetland monitoring. Below is a list of questions seeking information about your current level of involvement, your likely future involvement and what you see (or don't see) as important in the program. Where appropriate the questions are multiple-choice, but more than one answer can be selected. Space is provided below each question and at the end of the form for any additional information you would like to provide.

Thank you for taking the time to complete this form. Your answers are important in helping us improve wetland monitoring in the future.

### Your details

Name: \_\_\_\_\_

Contact details: \_\_\_\_\_

Wetland: \_\_\_\_\_

### Questionnaire

1. Have you been involved in the monitoring program at your wetland?

Yes

No

2. If you have not been involved, please indicate why?

Wasn't aware of it

No time

Don't see the point

Haven't been asked

Not interested

Other

\_\_\_\_\_  
\_\_\_\_\_

3. If you have been involved, what parameters have you been involved in monitoring?

Surface water	Fish
Groundwater	Frogs
Vegetation	Birds
Photopoints	None
Macroinvertebrates	Other

---

---

4. Which of these do you think you are capable of monitoring independently (i.e. without assistance from professional staff)?

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5. Would you be interested in being involved in any future monitoring?

Yes  No

6. How would you prefer to be involved?

As a group   
Individually   
Other \_\_\_\_\_  
Regular monitoring days   
As required

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7. How much time (if any) are you willing to commit to monitoring? (If possible provide an estimate e.g. 4 days per year)

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8. What are you interested in monitoring at your wetland?

- Surface water
- Groundwater
- Vegetation
- Photopoints
- Macroinvertebrates
- Fish
- Frogs
- Birds
- None
- Other

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9. Why do you think there is a monitoring program at the wetland?

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10. How do you think decisions should be made about when to change management actions at your wetland (ie wetting and drying/fencing from stock/improving flow)?

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11. What information do you think is important to receive from monitoring at your wetland?

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12. Additional comments:

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## Suggested Community Monitoring Table:

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Hrs/ yr
Groundwater		✓			✓			✓			✓		12
Water quality		✓			✓			✓			✓		4
Fine-scale vegetation											✓		8
Fish											✓		12
Birds		✓									✓		4
Photo-points		✓			✓			✓			✓		6
Water levels (gauge boards) & Mgmt log	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	12
<b>Total</b>													<b>58</b>

Do you think your group is capable of achieving this monitoring program? If not, which parameters are achievable and which would you need help with?

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Please return to:  
*Adrienne Frears*  
*River Murray Catchment Board*  
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