



**Government  
of South Australia**

# **Strategic Water Information and Monitoring Plan, South Australia 2011**

**Prepared by the Strategic Water  
Information Coordinator**

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## Acknowledgements

Contributing organisations and agencies

### State government organisations

Adelaide and Mount Lofty Ranges Natural Resources Management Board [**AMLR NRM Board**]

Alinytjara Wilurara Natural Resources Management Board [**AW NRM Board**]

Department of Environment and Natural Resources [**DENR**]

Department of Primary Industries and Resources South Australia [**PIRSA**]

Department for Transport, Energy and Infrastructure [**DTEI**]

Department for Water [**DFW**]

Environment Protection Authority [**EPA**]

Eyre Peninsula Natural Resources Management Board [**EP NRM Board**]

Forestry South Australia [**ForestrySA**]

Kangaroo Island Natural Resources Management Board [**KI NRM Board**]

Northern and Yorke Natural Resources Management Board [**NY NRM Board**]

Office of the Chief Information Officer [**CIO**]

South Australian Arid Lands Natural Resources Management Board [**SAAL NRM Board**]

South Australian Murray-Darling Basin Natural Resources Management Board [**SAMDB NRM Board**]

South Australian Water Corporation [**SA Water**]

South Eastern Water Conservation and Drainage Board [**SEWCDB**]

South East Natural Resources Management Board [**SE NRM Board**]

### Local government organisations

City of Salisbury

### Private sector organisations

Central Irrigation Trust [**CIT**]

## Foreword

<i>The issue</i>	In recent years water has become a pressing public policy issue for Australian society. As water demand increases and supply dwindles, the strain on existing water supplies has reached new heights. Protracted drought and mounting evidence of climate change have added momentum behind a growing community and political will to see improvements in both our understanding of water resources and the way we manage them.
<i>The challenge</i>	Better management of water poses a national challenge, requiring a coordinated response. Our ability as a community to reach agreement on the tough issues relies on access to accurate, reliable water information that is freely available and of suitable quality. Key to making these decisions and arriving at sound policy is a definitive water data source that stands above reproach.
<i>Australian Government response</i>	Aligned with this need, the Australian Government assigned the Bureau of Meteorology (the Bureau) responsibilities under the <i>Water Act 2007</i> to compile and deliver comprehensive water information for the country. As part of the Australian Government's long term framework for water security, Water for the Future, \$450 million was allocated to the Bureau over 10 years to deliver the Improving Water Information Program. This program includes development and maintenance of an integrated, national water information system which will be freely accessible to the public. Details of the full suite of Bureau objectives and deliverables can be found at <a href="http://www.bom.gov.au/water">www.bom.gov.au/water</a> .
<i>A partnership model...</i>	Vital to the success of the Bureau's mission is the partnership and cooperation of all State and Territory Governments and all water data collecting organisations in each jurisdiction. One of the vehicles for effective collaboration is the Jurisdictional Reference Group for Water Information (JRGWI), established to provide regular input to the Bureau's activities, and bringing to the table the experience and wisdom of respected senior officials from across the water sector.
<i>...and putting it into practice</i>	The Modernisation and Extension of Hydrologic Monitoring Systems Program (the M&E Program) is an \$80 million fund administered by the Bureau and available to organisations named under the Water Regulations 2008. The M&E Program is aimed at improving technologies employed by those who collect water information, and enabling better approaches to data transfer and standardisation. Coordination activities are also supported through the M&E Program via funding for Strategic Water Information Coordinators (SWICs) in each State and Territory. SWICs have been tasked with bringing together key stakeholders in their jurisdiction to distil State/Territory priorities in water data collection, and to set these out in a series of Strategic Water Information and Monitoring Plans (SWIMPs).
<i>Strategic plans...</i>	The SWIMPs provide a framework for describing where we are going and how we will get there. Each SWIMP has been produced with a whole of jurisdiction focus to encapsulate the current state of play in water

information and monitoring, describe the gaps, issues and opportunities that exist, and articulate a series of priorities, strategies and actions that will bring us closer to the end vision of better water information for all.

*...and how  
they contribute  
to the solution*

Through the M&E Program the Bureau is able to assist the States and Territories to get closer to our agreed view of what constitutes a fit-for-purpose hydrologic observing system in each jurisdiction. The Bureau looks to the SWIMPs to provide guidance on how best to invest M&E Program funds to achieve this goal. In this regard, the SWIMPs are a vital product.

*The future*

In closing, the Bureau appreciates the energy and expertise that has been applied in the preparation of this SWIMP, and thanks all of the officers that have participated in its development and review. Our special thanks go to the lead author of the SWIMP, Trent Daley.

A handwritten signature in blue ink, appearing to read 'Rob Vertessy'.

Dr Rob Vertessy  
Deputy Director (Climate and Water)  
Bureau of Meteorology

13 May 2011

## Building on the foundation for water information planning and investment in South Australia

### *Building a new and enduring water information capability for our state and nation*

Water is our most valuable resource. It is fundamental to our health, our way of life and our environment. It underpins growth in our population and economy and these are critical to the future prosperity of our state and our nation.

South Australia has long led the nation in water resource management. We've led the nation in stormwater harvesting, wastewater recycling, irrigation practices and rainwater tank ownership – and we must continue to be leaders in this space to ensure that South Australia has access to a diverse portfolio of water sources and is using its natural resources wisely and within sustainable limits. The impact of climate change and extensive periods of drought have challenged water resource management practices across Australia. This challenge has demanded major reforms in the way water is managed and knowledge about it is understood.

The *Water Act 2007* (Cwlth) [the **Act**] was promulgated with bi-partisan support as the statutory response to the nation's long-standing difficulty in collectively and effectively managing our continent's valuable water resources, with particular emphasis on improving the nation's water information capability and the management of the Murray-Darling Basin. It sets out a vision for a more fundamental and open approach to the sharing of information between all respective governments and the general public. A key intent of the Act has been to significantly improve both the scope and quality of water information for use by decision makers and the community.

Experience to date highlights that ad hoc, time-limited investment, allied with an entrenched paradigm of control, can only deliver marginal improvements in the state's and nation's water information capability.

The Act heralded opportunities to build a new and enduring water information capability for our nation, both in breadth and depth. However, robust and well coordinated government investments in water information are the cornerstone in delivering this enduring capability, vital to achieving national and state water policy imperatives.

### *Progress through co-investment*

Through the recent experience of the Bureau of Meteorology [**Bureau**] and the Murray-Darling Basin Authority [**MDBA**], strategic coordination across all levels (Commonwealth, state, and local) has proven to be a key enabler to in transforming delivery of information services. Establishing real partnerships and collaboration in this area of inter-governmental business has also allowed the parties to appreciably leverage mutual benefits from other resources and programs at minimal cost.

As a result, the parties are now effectively part of each other's business. Data collected by South Australia now also impacts the information products and services of Commonwealth organisations. Through this partnership, South Australia has made significant progress in improving its water information capabilities. However, there is still a way to go.

### *The challenge*

Under the Act, the provision of the state's water data and information is ongoing. The current challenge is how to create an enduring and sustainable

business model through which the benefits of the state's investment in water information can be realised, while maintaining the momentum that has already been generated.

*Coordinating the state's Water information-related activities*

The South Australian government established the South Australian Water Information Program Board [the **Board**] to coordinate state water information activities and investments with those of the Bureau, Commonwealth agencies and other jurisdictions.

The vision statement of the Board articulates the state's water information goal well. In order to progress this vision, the Board is addressing many extant coordination and organisational issues.

The vision statement is:

*"Anyone interested in water will be able to use the internet to readily access the information they require about the supply, demand, state, condition, management and access to the state's water and know that this information will be complete and authoritative."*

The Board's Water Information Program is bringing together and aligning the activities, strategies, outcomes and benefits that are happening at the state, national and cross-jurisdictional levels, and providing two-way line-of-sight between them. The program is structured around a coherent vision geared toward delivering the following key benefits:

- **Improved prosperity** - better decision-making through improved awareness and access to water information.
- **Improved water safety** - reduced risk to life and property from water-related events such as flooding.
- **Improved water security** – through improved monitoring, supply and forecasting.
- **Improved environmental resilience** – through integrated understanding of water and the environment.

The program is delivering capabilities that support *Water for Good*, the state's plan to ensure water supplies to 2050, through which progress is being made to diversify, allocate and use water supply more wisely.

*Taking the lead*

It has been almost one year since the Government of South Australia moved to reinforce the importance of water management and the information arrangements that underpin it, by establishing the Department for Water to lead South Australia's water reforms. The Department for Water has made significant improvements in the services and administrative structures that support the priorities of the government and the nation in the key areas of water management and ecologically sustainable development. As a result, the Board acknowledges there is now a case for the strategic coordination function to be driven from within the lead water agency. Initial transition planning is underway for this to occur in early 2011-12.

Nationally, the Department for Water is actively participating in significant reform designed to bring about a greater level of transparency and consistency in water management and reporting. This is driven through the National Water Initiative, Water for the Future and Murray-Darling Basin Monitoring and Evaluation Strategy. Our state's relationship with the Bureau, the MDBA and the Department of Sustainability, Environment, Water, Population and Communities has strengthened considerably through these

initiatives. We are also working with the Australian and state and territory governments to develop a National Water Market System [NWMS].

Locally, the Department for Water is concurrently driving reform in this area starting with water allocation planning, licensing, water trading and compliance. We have invested heavily in improving our monitoring network, science, modelling and our information infrastructure and technology. This positions us well to achieve substantial reform within our business. All of which will also benefit the community and industry.

Central to our ability as a state to meet these challenges is high-quality science, monitoring and management of water resources. We will need to be modern, dynamic and agile-supported by high quality policy advice, sound objective science, a timely water planning regime and solid reliable information that is freely available.

*Going forward in partnership*

Currently, there is a window of opportunity to build a truly national, robust, enduring and highly efficient water information capability based on the strength of the relationships developed through the state's approach to strategic coordination.

Accordingly, it is the strategic intent of the Government of South Australia, the Bureau and the MDBA to collectively provide strategic information services to engineer reform in water information. This will be achieved through a new tripartite co-investment agreement, for a period of one - three years initially, to deliver a range of integrated information services of mutual benefit.

Joining up the state's capacity through integrated water data management services and infrastructure will be facilitated by the Board in 2011-12 through the partnership with the Bureau and the MDBA, and partnership between the Department for Water and all 16 Name Persons and the Department for Environment and Natural Resources. This requirement for this capability has been conceptually defined. The next step is to determine a funding model to ensure it is enduring and sustainable on an ongoing basis.

At a state level, a joined-up water information service will enable initiatives, such as the Goyder Institute, to more readily access quality and comprehensive data in a timely manner. (Is this more about innovation?)

*The SWIMP as a state planning tool*

While the 2011 SWIMP builds on last year's, it still predominantly relates to the Bureau's water information requirements. As the state and Commonwealth move ahead in partnership, the SWIMP will no-doubt change to reflect the maturing business model. Regardless of what future plans may look like, the process of developing the SWIMP has been, and remains, valuable to the state's future success.



Scott Ashby  
Chair, South Australian Water Information Program Board  
Chief Executive, Department for Water



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## Executive Summary

### Preamble

The Bureau of Meteorology [the **Bureau**] has been tasked through legislation and resourced through the Australian Government's Improving Water Information Program to develop and manage the Australian Water Resources Information System [**AWRIS**]. The system is being built with data provided by water management organisations in all states and territories. To assist the jurisdictions with their involvement in building AWRIS, \$80 million has been provided to the Bureau, who, through a merit based funding program, allocate this investment towards supporting the data transfer from the jurisdictions to the Bureau.

Improving water information is part of the Australian Government's \$12.9 billion water reform program, *Water for the Future*, and is one of the outcomes sought through the Council of Australian Governments water management reforms and the National Water Initiative.

Through the cooperative venture with the Bureau, South Australia, and the nation, is seeking answers to eight key questions:

1. How much water is available in different parts of the state and country today and how does this compare with past availability?
2. Who is entitled to use water and how much is being used?
3. How much water is being allocated and how is the security of particular water entitlements changing?
4. How much water is being traded and to where?
5. How much water is the environment getting?
6. How much water is being intercepted by farm dams and land management practices?
7. How flood risk is changing in response to climatic and land management practices?
8. How is the quality of water in rivers and aquifers changing?

The Strategic Water Information and Monitoring Plan [**SWIMP**] is a requirement under the Strategic Water Information Coordination Program and the purpose of the 2011 plan is to assist South Australia and the Commonwealth to:

- articulate South Australia's water information needs and plans
- provide guidance for investment in water information and, in particular, to assist the Bureau to target future rounds of the Modernisation and Extension of Hydrologic Monitoring Systems Program [the **M&E Program**] funding in the state
- contribute toward a national picture of water information activities in Australia
- update and build upon material detailed in the 2010 SWIMP.

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## Strategic water management issues in South Australia

The increasing importance of water management in South Australia is being driven by:

- economic growth and land use changes that affect water demand
- increasing use and pressure on water supply
- being at the 'end of the line' for the River Murray and a number of significant groundwater resources
- a drying and warming climate accentuating demand and supply pressures
- growing recognition of the need to account for environmental flows, as well as critical human needs.

Successful management of water resources now and in the future relies on access to information of suitable quality about water at the state and national levels.

## Structure of this report

The SWIMP is based on the Bureau's *Framework Guidance* document and standardised template. It consists of four sections:

**Section A** identifies the important water information drivers for South Australia. These underline the strategic and operational challenges facing water managers in this state.

**Section B** provides detail on the current investment in South Australia in water information assets, including data collection networks and information management systems and arrangements.

**Section C** describes the assessment of the state's water information and provides a statement of gaps, issues and opportunities existing in South Australia's water information and monitoring investment and systems. The information in this section was derived from extensive engagement with the 16 Named Persons in the state. It also includes a common reporting framework that will be utilised by all states in reporting the M&E funding contributions and their alignment to the gaps identified in the 2010 SWIMP.

**Section D** is a strategic summary of the key priorities and identified strategies for investment in water monitoring and information. This section of the report brings together the outputs of Sections A, B, and C, and includes an assessment of priorities for which Bureau investment is being sought.

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## **Summary**

This updated version of the 2010 SWIMP shows the current situation of the state's water monitoring, data and information system assets. The SWIMP provides an important foundation for deciding upon future investments and forms a state-wide plan for evaluating progress and improvement over time.

Moreover, a structured approach to improving the state's evidentiary base will better guide resource management decision making into the future. Developing reliable points of access to state-wide and national water data and information will inform evidence based policy, planning and decision making.

The SWIMP is a state-wide, coordinated approach to value investment in enduring water observation networks and water information systems that aim to produce benefits to a wide variety of users across government, industry and the community.

## 1 Introduction

Strategic Water Information and Monitoring Plans [**SWIMPs**] were first produced in each jurisdiction during 2009/10 under the coordination of Strategic Water Information Coordinators [**SWICs**]. The 2010 SWIMP was delivered to the Bureau of Meteorology [the **Bureau**] in June 2010, in accordance with project funding under Round 3 of the Modernisation and Extension of Hydrological Monitoring Systems Program [the **M&E Program**]. SWIMPs were developed with input from a wide range of South Australian stakeholders involved in water information.

### 1.1 Purpose of the 2011 SWIMP

The purpose of this plan is to:

- articulate South Australia's water information needs and plans
- provide guidance for investment in water information and, in particular, to assist the Bureau to target future rounds of M&E funding in the state
- contribute toward a national picture of water information activities in Australia
- update and build upon priorities detailed in the 2010 SWIMP.

### 1.2 Context of the South Australia SWIMP

#### 1.1.1 Bureau requirements

The Bureau is seeking assistance in targeting M&E investment in all jurisdictions. It has elected to allocate funding on the basis of merit evaluation of projects formulated by individual Named Persons and lodged in line with a formal application process. The SWIMP details South Australia's key priorities to assist the Bureau's evaluation of project funding applications.

#### 1.1.2 Murray-Darling Basin Authority context

In addition to setting up new roles for the Bureau, the *Water Act* formalised the establishment of the Murray-Darling Basin Authority [**MDBA**].

As was the case for the Bureau, the *Water Act* specifies a number of information roles for the MDBA. Since water in and from the Murray-Darling Basin is critical to South Australia; the state has an interest in ensuring that the Authority's information requirements and arrangements are well coordinated.

The MDBA has approached all basin states seeking to formally establish data access and delivery arrangements to support the forthcoming Basin Plan. The MDBA is seeking to leverage investment in the existing coordination arrangements between the Bureau and the basin jurisdictions.

This version of the SWIMP only relates to the Bureau and state's requirements.

## Introduction

### 1.1.3 State context

South Australia is often referred to as the driest state in the driest inhabited continent on earth; water is extremely important for this state!

South Australians rely heavily on water from three major sources and numerous smaller local sources. The primary resources are the River Murray, surface water catchments in the Mt Lofty Ranges and significant groundwater reserves.

The state does not maintain large constructed dam storages of a scale comparable to those in other states and territories. Mt Bold is the largest of the state's constructed reservoirs with a capacity of about 46 Giga Litres. There are a large number of small dam storages on farms, but only the Mt Lofty Ranges and Kangaroo Island offer reliable surface water catchments.

In June 2009, the South Australian Government released *Water for Good* – a plan to ensure secure and reliable water supplies for South Australia to 2050. The plan has put in place measures to improve the allocation and use water, and improve and modernise the water industry.

Strategies within *Water for Good* are adaptive and multi-faceted so as to be resilient to climate change, demand change and economic circumstances.

Recent focus and investment in stormwater harvesting, wastewater recycling and desalination, constitutes significant effort to reduce the state's dependency on limited rainfall dependent sources of water. Further programs to improve the efficiency of water use are reducing the demand for the state's precious water resources. South Australia is at the end of the Murray River and since the river passes through multiple jurisdictions before its water reaches South Australia, water quality and volume is substantially determined by policies and practices applying outside of the state. Reducing this dependency is crucial to securing a resilient water supply for a growing population in a backdrop of climatic extremes and climate change.

With a changing water industry in South Australia, the governance and institutional arrangements are also changing. The *Water Industry Bill*, tabled in November 2010, proposes to appoint the Essential Services Commission of South Australia [**ESCOSA**] to licence and regulate prices for the water industry, and it allows for the improvement of customer and industry dispute resolution through an Ombudsman scheme.

South Australia is striving to become smarter about water management in its urban environments, through research and innovation. The Goyder Institute for Water Research is assisting the Government to progress the implementation of water-sensitive urban design. South Australia continues to participate in the national Cities as Water Supply Catchments project, led by Monash University.

## Introduction

Under *Water for Good*, the government is developing demand and supply statements for the eight natural resource management regions of the state. The *Eyre Peninsula Demand and Supply Statement*, the first of eight regional statements to be developed, was released in April 2011. These statements will ensure that long-term water security solutions for each region are based on a thorough understanding of the state, demand and associated pressures on local water resources.

Water is significant to South Australia's economy. Mining is seen as one key driver for future economic development and state prosperity. As much of this activity occurs in the arid areas, access to reliable and sustainable groundwater supplies in remote arid areas is vital to a successful mining industry. Similarly, with low rainfall over most of the state, irrigated agriculture is heavily dependent on groundwater. In the light of evidence that groundwater supplies are declining in many areas of South Australia and forecasts of a dryer climate, the availability of low salinity groundwater will be a significant matter of public policy for the foreseeable future.

As the Government of South Australia implements its *Water for Good* strategy and continues to address the realities of water resource management, the information and knowledge that supports decisions is coming under increasing scrutiny. There is broad agreement about the need for a robust, cohesive, and whole of state information and evidence base to guide the future path. Whilst much information exists, it is often fragmented, inaccessible, unavailable and undiscoverable beyond the organisation that holds it. Water information is crucial to the successful ongoing management of water resources.

Complementing its investment in water data, the state has made significant investment in water-related knowledge and retains specialist staff and significant modelling capability. Maintenance and enhancement of this technical capacity is one component of the state's overall water information strategy.

South Australia's water management challenge is complex and it is clear that continued fragmentation and uneven development of both monitoring and information management capacity is unlikely to serve the state well in the future. It is also clear that the total water information management task involves more than one organisation, and that all parties need to join their efforts in effective and enduring partnership. Collaborative activities, such as the State Water Monitoring Network Optimisation Project<sup>1</sup>, are examining the ways in which the state's monitoring networks can be optimised to efficiently provide the information required for assessment of the sustainability of water resources.

If the state is to effectively manage South Australia's water resources, comprehensive information sharing agreements will be critical. This will also necessitate investment in information management systems that facilitate information sharing along with improved information management business processes. New and connected ways of operating will also require ongoing commitment to influencing cultures and behaviours within and between organisations and to developing institutional arrangements that actively support ongoing collaboration.

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<sup>1</sup> The State Water Monitoring Network Optimisation Project is being undertaken by the Department for Water and is a key initiative of the South Australian Water Information Program Board (see Section 1.3 State's program governance).



## Introduction

South Australia is keen to participate in cooperative and collaborative programs for the management of the nation's water information. The *2011 SWIMP*, which describes current activity, gaps and plans, is a key component of this effort.

### 1.3 State's program governance

Within the state, the need has been recognised for new governance arrangements to facilitate and support individual organisations changing their business methods and cultures to function as collaborative units in a collective endeavour. A new, high level board (the South Australian Water Information Program Board) has been set up under the state's ICT Board (which reports directly to Cabinet). This new board is the primary vehicle for strategically coordinating the state's water information activities and investments. This board will:

- drive the direction of the Strategic Water Information Coordination Program
- make decisions about the state's investment in water information
- coordinate the delivery of strategic initiative outcomes and benefits

Currently the program is focussed on a dossier of six strategic water information initiatives:

- **State Water Data Acquisition**  
Establishing a completely connected state water information capability. This encapsulates data acquired by direct measurement ('monitoring') as well as by interpretation ('scientific modelling'). Treatment of the data itself as a state asset is also a focus.
- **Hydrological Geospatial Information [Geofabric]**  
Establishing an effective way of ensuring coordinated delivery of geofabric data to the Bureau of Meteorology.
- **Water Register** (National Water Market System [NWMS])  
COAG reform project to ensure a nationally consistent, interoperable system of recording and reporting water trading. Significant transformation of existing government business will be required in order to gain maximum state benefit from this initiative.
- **Water Accounting Balance Assessment [WABA]**  
Production of scalable water accounts, including regional forecasts of water demand and supply.
- **Water and Environment Franchise**  
An integral part of South Australian Government's 'single entry point online' program for online common Internet access to government services.
- **Water Information Licensing and 'Creative Commons'**  
Implementation of National Government Information Licensing Framework (including Creative Commons) across all Water Regulations Named Persons and focussed on electronic licensing of the state's water information.

Each initiative comprises one or more specific projects undertaken by the organisation(s) best placed to complete them.

## Introduction

## 1.4 Scope of state's SWIMP

The SWIMP for South Australia has the following objectives:

- to provide a state-wide view of investment in water monitoring systems and water information priorities within South Australia leading to enhanced water data capture and delivery processes to the Bureau
- to support and inform a new state water information program
- to support and improve the wider business of government.

This version of the SWIMP (2011) is targeted to meet the partnership requirements of the Bureau and the state. The plan has been approved by the state's Water Information Program Board and will be revised and extended over time.

## 1.5 State's SWIMP development

A staged approach was taken when preparing this *2011 SWIMP*.

Stage 1: A refresh of the 2010 SWIMP was initiated, and additional information required by the Bureau for 2011 established. A project initiation brief was developed outlining the process and timeframes for the project. Stakeholders were identified, an engagement plan established and mini-SWIMPs prepared.

Stage 2: The creation of the common reporting elements, including graphs and tables, was initiated and distributed to Named Persons for completion and comment. At the same time mini-SWIMPs were distributed to Named Persons for updating.

Stage 3: Gap analysis on available data/information was commissioned, including the undertaking of the Water Information Investment Priority Setting Activity [**WIIPSA**] initiative under the direction of South Australian Water Information Program Board [**SAWIP** Board].

Stage 4: Issues were identified and strategic solutions developed, including priorities for future investment in short, medium and long-terms.

Stage 5: The SWIMP was prepared, reviewed and approved by the SAWIP Board.

## Section A – Why do we need water information?

**2 Section A – Why do we need water information?****2.1 Introduction**

The ability to effectively understand and manage water resources is highly dependent on access to accurate, reliable water information that is freely available and of suitable quality.

Having a strategic information and monitoring plan for the state aligns with South Australia's Strategic Plan, including the following targets:

- T1.7 Performance in the Public Sector – customer and client satisfaction with government services
- T1.8 Performance in the Public Sector – government decision- making
- T1.9 Performance in the Public Sector – administrative efficiency.

As South Australia implements strategies such as *Water for Good* and its water sources continue to diversify, the collection of, and access to, data and information regarding water sources and water use is fundamentally important.

*Water for Good* is an adaptive plan that includes 94 actions to diversify the state's water resources and improve the way it allocates and uses water. Responsibility for the implementation of *Water for Good* actions is shared among a number of agencies, with the Department for Water responsible for over half of these actions. The Department for Water is also responsible for monitoring and reporting the implementation of *Water for Good*, and for the development of regional demand and supply statements. The purpose of these statements is to identify the state of all local water resources, the demand for these resources, and the likely pressures and will be used to guide future water security decisions. The Minister for Water will report on the implementation of *Water for Good* and water security on an annual basis.

South Australia is also working with the Murray-Darling Basin Authority to ensure the best possible outcome for South Australia in the delivery of the *Murray-Darling Basin Plan*. Provision of data and information is a key component in ensuring the success of the Plan, both in its implementation and reporting in the future.

Data and information is required to not only inform the state's water management decisions, as well as providing the mechanism to track progress in implementing projects, and key strategies such as *Water for Good* and *South Australia's Strategic Plan*.

**2.2 Need for data**

The pressing need for water data is a challenge that is ever increasing. It has been said that '*there can never be too much data*', but what to do with it presents fundamental challenges to agencies. Collecting data for data's sake is not a wise investment. The total cost of ownership for collecting, managing and storing data can be significant. The operational data collection infrastructure costs are many times greater than the up-front capital costs. Investment decisions about new data collection capabilities must account for criticality and utility across the whole asset lifecycle.

The issue of collaboration in collecting data, and its management, is one that will need addressing in the future. The issues of data and its management are universal, and

## Section A – Why do we need water information?

South Australia is managing its data in a number of formats, and with differing standards. Water Data Transfer Format **[WDTF]** is forging ahead in this realm, with South Australia's ongoing implementation improving its ability to transfer data to the Bureau in a standardised format.

The disparate methodologies and legacy collection regimes means that the data that South Australia is collecting is difficult to integrate with systems, either internally to the organisations, as well as delivering the data to external clients such as the Bureau. Consistent collection methodologies will need to be developed based on best practice and this should be undertaken in a national framework approach.

Questions of who owns the data are emerging as co-funded monitoring is becoming the norm. If a monitoring site is established using other organisations funds, but the data is stored in the Lead Water Agencies **[LWA]** repository and delivered as its own data to the Bureau, who owns the data? Realistically, the data is owned by both, but the question of custodianship and funding to maintain the data remains.

Data is crucial in managing the nation's water resources, it informs decisions and policy frameworks, and can be used to manage the resource by establishing baselines and trends through modelling. There is a push within South Australia to investigate the ability to model data based on the current monitored data. This brings on other issues of not just validating the models against the 'real' data, but with storage capacity and integration with business. The development and implementation of model repositories is being investigated within the state, and the ability for these models to be implemented across borders will present new business opportunities in the future.

### 2.3 Need for information

Management of water, as one of the state's natural resources, is a key activity for which water information is collected, analysed, reported and distributed. Primary concerns from a natural resource management perspective are the state and condition of the resource, environmental requirements for water and the determination of sustainable levels of human and economic use.

There is, however, an inherent conflict between short-term demands on the resource for social and economic purposes and long term sustainability of water resources and environmental requirements. The state's ability to resolve this conflict relies on access to accurate, reliable water information that is freely available and of suitable quality.

The increasing importance of water management in this state is being driven by:

- economic growth and land use changes that affect water demand
- increasing use and pressure on water supply
- being at the 'end of the line' for the River Murray and a number of significant groundwater resources
- a drying and warming climate accentuating demand and supply pressures
- a growing recognition of the need to provide and account for environmental flows as well as critical human needs.

## Section A – Why do we need water information?

While these drivers have been widely accepted for some time, it is only more recently that there has been a growing awareness that every water management decision, irrespective of who makes it or the geographic and/or temporal scale to which it applies, depends on sufficiently complete, accurate and up-to-date data and information. Water data and information services are critical to support evidence-based policy and decision making.

### 2.4 Why collect data?

The questions that South Australia is attempting to address, and that contribute to these business drivers include:

- What is the state and condition of South Australia's water resources and how have they changed over time?
- What are the trends in the condition of the resource and the ecosystems that are dependent on it?
- What is the extent of the resource?
  - How much is available?
  - Where is it located (particularly groundwater)?
- What level of usage is sustainable?
- What are the processes that drive groundwater recharge?
- What are the impacts of the resource management practices?
- What are the impacts of climate change?
- What water conservation measures will provide the biggest benefit to the water resource?

The key to answering these questions is to find a balance between supply and demand that is both acceptable to the community and within the sustainable limits of the state's natural resources.

### Water information drivers

Drivers for water information occur at a number of levels extending from legislation and government programs to local issues relating to water quality and scarcity. There are many levels of drivers for water information; these are illustrated in the following figure and tables (pages 22-23):

- Figure 1 outlines the policy framework and where the drivers feed into policy development.
- Table 1 details the high level drivers for the state.
- Table 2 details the business drivers that influence policy and decision making.

These high level drivers define the local, regional and state agency activities which in turn define the business drivers for the creation and maintenance of water information. The business drivers in table 2, for the sake of clarity, have been separated, although in reality, they are often inextricably linked.

## Section A – Why do we need water information?

Figure 1: Water information policy framework for South Australia

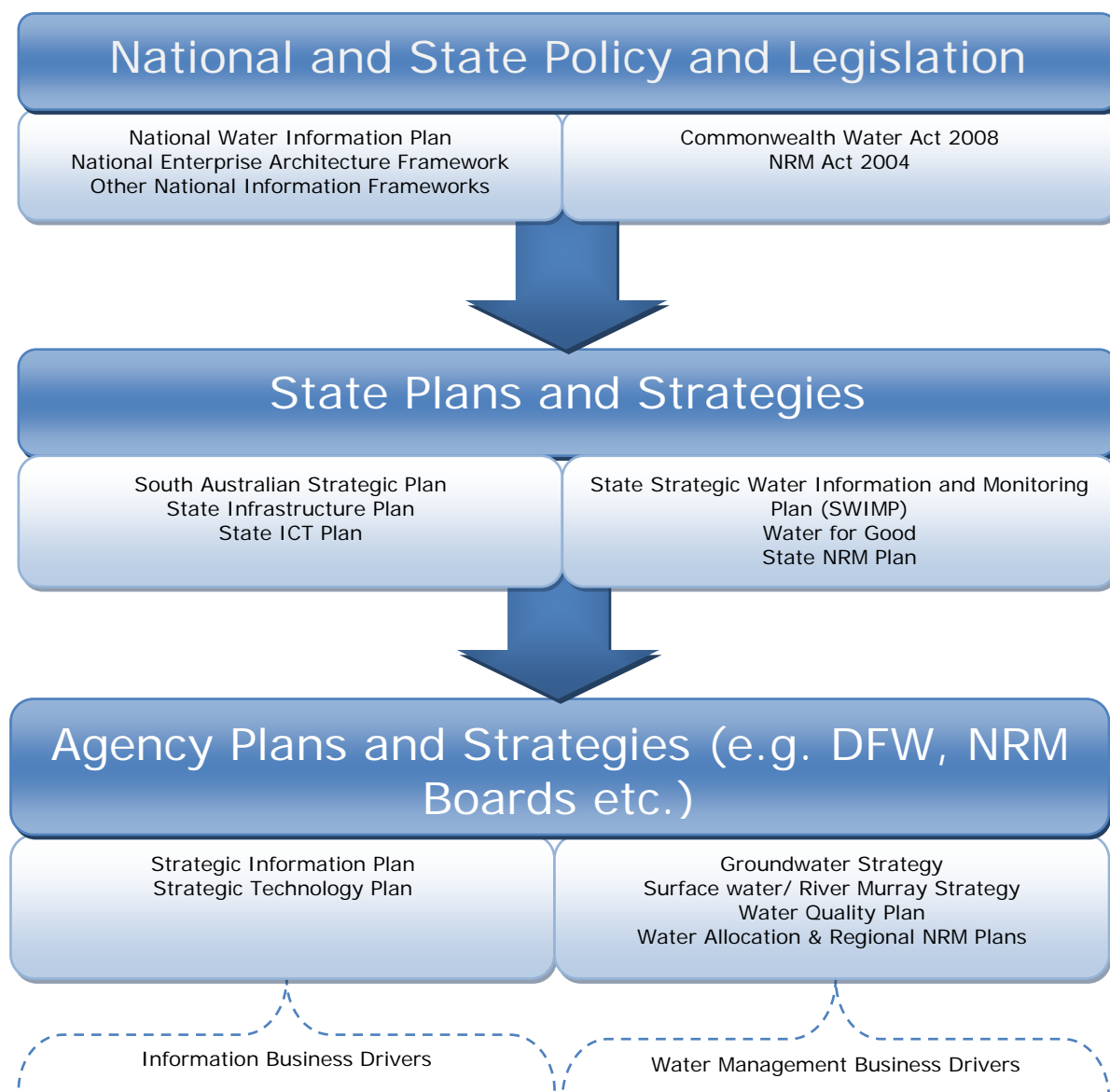


Table 1: High level drivers

<b>Legislation</b> <i>Water Act 2007 (Commonwealth)</i> <i>Natural Resources Management Act 2004</i> <i>South Eastern Water and Conservation &amp; Drainage Act 1992</i> <i>River Murray Act 2003</i> <i>South Australian Water Corporation Act 1994</i> <i>Waterworks Act 1932</i>	<b>Cross-border Agreements</b> Murray-Darling Basin Agreement Great Artesian Basin Agreement South Australia/VIC Border Groundwater (Management) Agreement National Bio-security Agreement
<b>National Program Initiatives</b> National Water Initiative COAG Water accounting Adaptation and climate change Water market registers National enterprise architecture framework National information sharing strategy National government information licensing framework	<b>State and Regional Plans</b> State and regional water security statements: <i>Water for Good</i> State and regional natural resource management plans Regional water allocation plans State infrastructure plan South Australia's strategic plan State ICT strategy <i>Ask Just Once</i>
<b>Private Indenture Agreements</b> Two private agreements	

## Section A – Why do we need water information?

Table 2: Business drivers

Driver	Activity
Regional Development Plans	Inform the development of regional Natural Resource Management plans and ensure appropriate water management actions and targets are established and reported on.
Prescriptive Management	Water Allocation Plans - Identify an economic, social environmental, imbalance and ensure appropriate prescriptive management practices are put in place. Licensing – Control of licence arrangements for the use of water for urban, mining, agricultural and industrial purposes and the imposition of conditions on water access and use. Compliance – Ensure compliance with restrictions and allowances in prescribed areas or under licensing arrangements.
Human Needs	Appropriate development and management of infrastructure for the storage, treatment and supply of water for residential, commercial, non-commercial, agricultural and industrial purposes.
Regional/Local Water Management	Monitor the impact and effectiveness of water management practices on regional/local water resources. Design, implement and maintain local management systems. Identify, analyse and report on emerging water resource issues.
Community Engagement	Increase community awareness of the need for sustainable water resource usage and acceptance of water restrictions. Identify and report on emerging local water resource issues. Engage the community in water resource management.
Groundwater Program	Implementation of a program to maintain the technical information base about the state's groundwater resources to support planning and management capabilities within the state.
Environmental Management	Legislation requires that natural resources are sustainable for both current and future use and that ecosystems that depend on natural resources are protected in doing so. Provide and account for environmental flows as well as human needs.
Inform Policy Development	Provide all levels of government with sound evidence-based policy advice.
Modelling	Assess alternate management actions. Predicting future events and impacts. Analyse system behaviour. Analyse the impacts of climate change over time.
Emergency Management	Planning response and recovery actions to critical situations, such as drought and flooding.
Water Sharing	Negotiate and implement water sharing agreements within the Murray-Darling Basin and for large regional groundwater resources that cross jurisdictional boundaries.
Reporting and Water Accounting	Reporting across all tiers of government, farming, industry and business sectors, and to the community on resource availability and management.
Water Trading	Trading (purchase, sale or exchange of) entitlements to water allocation.

## Section B – Where are we now?

### 3 Section B – Where are we now?

#### 3.1 Introduction

Section B of the SWIMP contains information on South Australia's data collection networks and data management systems. This section has been updated from previous versions of SWIMPs and includes information from Named Persons mini-SWIMPs, included as attachments.

##### 3.1.1 Data management

The state's data storage arrangements are held on a variety of information technology hardware and software platforms ranging from specialist water data systems, such as Hydstra, through to relational database management systems and Excel spreadsheets.

The variety of storage systems used also has implications for data formatting and supply. While the Bureau of Meteorology supports the Hydstra export format and the WDTF currently not all South Australia custodians can deliver accordingly. Some have managed to implement the WDTF technology to deliver their data to the Bureau and it is envisaged that the release of the latest version of Hydstra will enable more to do so.

This variety of storage options and supply formats poses some challenges for future data consolidation and harmonised delivery. With the postponement of the Southern Water Information Management Organisation program [**SWIMO**], the ability to progress collaboration and delivery of information has been restricted. The state still sees potential for this program to deliver collaborative data to both the Bureau and the state through the provision of a single delivery framework that satisfies all needs of the stakeholders.

##### 3.1.2 Data integration

A key challenge to data within South Australia is ensuring that it is being collected only once and that the data are able to be integrated within Named Persons own internal systems, and shared with external Named Persons systems and the Bureau. The adoption of standards and procedures in collaboration with stakeholders is a priority for success in data integration for the future.

Stakeholder consultation identified strong and consistent need to understand the interaction between rainfall, surface water and groundwater. Senior managers within state government have also recognised this need and agree that spatially referenced and integrated datasets (primarily surface and groundwater) are required for the appropriate analysis necessary to develop this understanding.

There is currently no single dataset available that shows the state's surface water, groundwater, and meteorological monitoring sites. If integrated with the large number of meteorological sites owned by the Bureau in South Australia, a spatial dataset of this type could substantially aid in identifying gaps in the monitoring network and assist in investment decision making and setting of state-wide priorities. In addition to integrating the many disparate water datasets, there would be significant benefits to building more interoperable data management and delivery systems.



## Section B – Where are we now?

With the assistance of Bureau funding the DFW has begun to integrate this data and make it available to a limited number of agencies internally, and to the Bureau. The DFW has begun to combine data from a number of agency sources into a consolidated dataset for streams and farm dams, as well as drill holes and geology through the geofabric and National Groundwater Information System [NGIS] projects. The geofabric project will also utilise a shared editing environment delivering increased business benefits to multiple agencies with diverse needs such as fire mapping, topographic mapping and hydrologic mapping.

Changing requirements for managing water information has revealed that a number of the state's information systems are no longer able to adapt to the changing needs of the business. Each agency has typically developed their own information management systems tailored for their specific business requirements often resulting in a mix of incompatible technologies. Sharing data between these disparate systems requires bespoke technical solutions that are difficult and expensive to implement, maintain and adapt over time.

Adopting a more coordinated and integrated approach to information management would allow much more value to be extracted from the state's various information repositories. The ability to leverage systems that are currently in place to report water data will minimise the risk and resources needed to deliver this data to all stakeholders. Ideally a single entry point for water data and information would be established so that all stakeholders have access to the same information that can be utilised inform decisions.

## 3.2 Information management

### 3.2.1 Surface water resource information (Regulations Subcategory 1)

The rarity of rainfall in the northern half of the state means that surface water monitoring activities tend to be focused in the coastal and southern portions of the state. The current surface water monitoring network in relation to NRM regions is depicted in Table 3 (over page) and Figure 2 (p.33).

South Australia does not have a single complete repository for all of its surface water/meteorologic monitoring information. The Hydstra database maintained by the DFW forms the core of South Australia's surface water monitoring information. It contains current and historical information on both surface water and meteorological monitoring from ten different organisations. Some individual agencies also elect to maintain their own separate repositories such as the SCADA database at SA Water, and the Electronic Data Management System [EDMS] database at the Environment Protection Authority South Australia [EPA]. In addition, a number of agencies outsource their monitoring to private companies and some have meteorological monitoring stations that feed data directly to the Bureau. Table 4 (over page) outlines the current technology used to manage the states surface water data.

A number of NRM Boards also rely on community data collection schemes, such as rainfall and stream condition from landholders, and from surveys conducted as part of the former *Waterwatch* program. Data from these sources tends to be in paper format, requiring additional resources to translate in electronic format. Community data collection is recognised as a possible untapped resource of water resource data, with some landholders having decade's worth of information holdings. However, there are additional challenges in ensuring the quality and accuracy of these data are appropriate for their intended use.

## Section B – Where are we now?

In addition to the uneven geographic distribution of surface water monitoring, there is significant variation in what is monitored throughout the state. For example, in the case of South Australia's rainfall-related monitoring, the data collected is based on specific needs; some sites collect PH and salinity while others focus only on flow. Although a wide range of attributes are recorded for each monitoring site in Hydstra, there is significant variation from point to point. Some agencies report that the current distribution of monitoring sites makes it difficult for water resource managers to compare regions with sufficient confidence. There is a clear desire among the Named Persons to see more consistency in what is being monitored and how.

Table 3: Number of surface water sites and the length (in years) of record

NRM Region	Nos. of Sites	years of record						
		<5	>5	>10	>20	>30	>40	>60
Adelaide & Mt Lofty Ranges	69	22	11	8	4	14	4	6
Eyre Peninsula	2	0	0	1	0	1	0	0
Kangaroo Island [KI NRM]	4	0	3	0	0	0	1	0
Northern & Yorke	9	1	2	0	0	3	2	1
South Australian Arid Lands	4	0	0	0	1	2	1	0
South Australian Murray-Darling Basin	29	4	15	5	0	3	2	0
South East	29	5	1	8	2	13	0	0
<b>Total</b>	<b>146</b>	<b>32</b>	<b>32</b>	<b>22</b>	<b>7</b>	<b>36</b>	<b>10</b>	<b>7</b>

Table 4: Surface Water – data and technology

Custodian	Dataset Name	Water Reg Data Cat	Data Format	Spatially Enabled	Technical Platform
CIT	Trade Now	6b 6c	SQL	No	TBC
CIT	Bill Now	5e	SQL	No	TBC
DFW	Hydstra	1a 9a; 9b; 9c; 9d; 9e; 9f; 9g; 9h	Foxpro	No	Hydstra
EPA	Water quality	9d 9e 9f	Oracle Table	No	SQL Server 2000
ForestrySA	Weir data	4a	TBC	TBC	TBC
KI NRM	Save our Seagrasses	9a 9e 9f	Shapefile	Yes	ArcGIS
KI NRM	Rivers of Life	9a 9d 9e 9f 9g 9h	Shapefile	Yes	ArcGIS
KI NRM	Landcare	9a 9d 9e 9f	Excel Spreadsheet	No	Office 2003
NY NRM	Waterwatch Data	1a 1b 9a 9d 9g	3.2.2 Access DB	3.2.3 No	3.2.4 Office 2003
SA Water	Master Meters	3a 3b 3c 3d 3e	SDE Feature Class	Yes	SQL Server 2000
SA Water	Water Sampling Points	9a 9c 9d 9e 9f 9g 9h	SDE Feature Class	Yes	SQL Server 2000
SA Water	Gauging Stations	TBC	Foxpro	Yes	Hydstra (DFW)
SA Water	Extraction Points	7a-7o	SQL Server Table	No	SQL Server 2000

## Section B – Where are we now?

Custodian	Dataset Name	Water Reg Data Cat	Data Format	Spatially Enabled	Technical Platform
SAMDB NRM	Waterwatch	9a 9b 9d 9e 9f 9g	Excel Spreadsheet	No	Office 2003
SAMDB NRM	EMLR Monitoring Program	1a 9a 9h	Excel Spreadsheet	No	Office 2003
SEWCDB	AWS Surface Water Archive	1a 1b 9a 9d 9g 9h	Foxpro	No	Hydstra

### 3.2.5 Groundwater resource information (Regulations Subcategory 2)

Groundwater monitoring information held by South Australian Named Persons is predominantly stored in systems managed by DFW, PIRSA and SA Water.

All drilling in South Australia requires prior authorisation and details of all drill holes and approvals are recorded in the SAGeodata system jointly administered by DFW and PIRSA. While the database holds monitoring information from a wide range of organisations over an extended period of time, significant amounts of groundwater data exist in other repositories such as those maintained by the mining industry. This data is not made readily available to government and limits the ability to manage the resource. Mechanisms for the reporting of groundwater for mining and extraction activities are in place for prescribed wells areas [PWAs] but not for non-prescribed areas unless detailed in an indenture.

The current groundwater monitoring network (from SAGeodata) in relation to NRM regions is depicted in Figure 3 (p. 35). Table 5 outlines the current technologies used to manage the states groundwater data.

Table 5: Groundwater – data and technology

Custodian	Dataset Name	Water Reg Data Category	Data Format	Spatially Enabled	Technical Platform
DFW	Aquifers	NA	SDE Feature Class	Yes	SQL Server 2005
DFW	Aquifers - MLR	NA	SDE Feature Class	Yes	SQL Server 2005
DFW	Groundwater Basins	NA	SDE Feature Class	Yes	SQL Server 2005
DFW	Depth to Groundwater	NA	SDE Feature Class	Yes	SQL Server 2005
PIRSA	Drill holes	2a; 2b	SDE Feature Class	Yes	SQL Server 2005
PIRSA	SAGeodata	2a; 2b; 9a; 9b; 9h	Oracle Table	No	Oracle
DFW	Great Artesian Basin	NA	SDE Feature Class	Yes	SQL Server 2005
DFW	Groundwater Provinces	NA	SDE Feature Class	Yes	SQL Server 2005
EPA	Water quality	9d 9e 9f	Oracle Table	No	Oracle
SA Water	Extraction Points	7a-7o	SQL Table	No	SQL Server 2000
SA Water	Bores – Stored in SAGeodata	9b	Oracle Table	No	Oracle
SAMDB NRM	Waterwatch	9a 9b 9d 9e	Excel	No	Office 2003

## Section B – Where are we now?

Custodian	Dataset Name	Water Reg Data Category	Data Format	Spatially Enabled	Technical Platform
		9f 9g			

SAGEodata is an Oracle database linked with three government web-based applications (DES, OBSWELL and SARIG) for the querying and entry of data. While SAGEodata effectively contains 100% of the state's knowledge about wells and drill holes, such as location, drill date, purpose etc, there is enormous variation in the information being captured at each point. While some wells are regularly monitored and have detailed water chemistry and physical properties recorded, other wells have no information beyond basic details, even though the owner may be monitoring a range of groundwater properties (e.g., mining operations).

SA Water also has a number of applications for the recording and storage of water information including SCADA, the ODS, LIMS and Waterscope. It is currently in the process of implementing a new Enterprise Data Warehouse that will improve the integration of these systems.

### 3.2.6 Major and minor water storages (Regulations Subcategory 3)

'Category 3' data relates to major and minor water storages. In South Australia, the DFW, SA Water, ForestrySA, PIRSA, EPA and CIT are all required by the Regulations to give to the Bureau some or all of the specified Category 3 data that is in their 'possession, custody or control'. Of these organisations, only the DFW and SA Water hold relevant data. This data is a key input to the Bureau's first water storage information product to be released through AWRIS. The relevant data held by both organisations is being routinely supplied to the Bureau. The data held does not, in itself, support straightforward calculation of storage volume for river locks and weirs as it is usually level which is supplied. Reservoirs operated by SA Water across the state are both regarded as and operated as storages. Level and volume data relating to the reservoirs is routinely reported to the Bureau.

In South Australia, River Murray monitoring has traditionally been focused on river operational management and, other than water held in Lake Victoria and the lower lakes, river water retained behind locks and weirs is not regarded as 'stored water'. Consequently, routine monitoring is not done in order to establish 'storage volume' nor is level-to-volume rating relationships maintained for these sites. The monitoring that is done establishes level and rating relationships (level to flow), which are used to derive flow rates. As the stream profiles behind constructed locks and weirs change over time, and other physical changes occur, routine height to level gauging and bathymetric/digital elevation work would be required in order to establish the validity of reported storage volumes. Such routine work is not currently undertaken and therefore, AWRIS reported 'storages' along the South Australian end of the River Murray are effectively approximate estimates. This approximation of storage means that the true capacity of the resource on South Australia's side of the border could be grossly exaggerated, or grossly underestimated. Without the regular surveying of these areas this data will continue to be the best approximation with available information.

## Section B – Where are we now?

**3.2.7 Meteorological information (Regulations Subcategory 4)**

The majority of meteorological information within South Australia is collected by the Bureau directly, although some Named Persons supplement this with their own focused meteorologic monitoring activities. These records may be limited by comparison to the Bureau meteorological data parameters. Indeed the data parameters collected between jurisdictional organisations varies, for example the EPA measures ambient temperature, barometric pressure, wind speed and direction, solar radiation, dew point and relative humidity, whereas the majority of DFW sites mainly collect rainfall data.

State meteorological data is transferred to the Bureau as a single repository. There is very limited formal coordination in the establishment of new sites and closure of existing sites. Added to this, agencies may use different station numbers to describe data from the same site as there is no common station equipment numbering system. This has generated some uncertainty about the exact number of meteorological sites controlled by jurisdictional organisations as some appear to be shared between the Bureau and those organisations, whilst others are managed and maintained exclusively by organisations.

Of the known state meteorological monitoring sites, the majority are stored within the DFW's Hydstra database whilst the EPA and ForestrySA maintain their own unique and (currently) unlinked repositories.

The approximate number of state-owned meteorological monitoring sites is detailed in Table 6 below. The current investments in meteorological data and technology are summarised in Table 7 (over page).

Table 6: State owned meteorological sites

<b>Agency</b>	<b>Number of Meteorological Monitoring Sites</b>
ForestrySA	<b>13</b>
EPA	<b>9</b>
SAMDB NRM Board	<b>35</b>
DFW	<b>50</b>
PIRSA	<b>3</b>
SE Water Conservation & Drainage Board	<b>10</b>
SE NRM Board	<b>14</b>
AMLR NRM Board	<b>14</b>

## Section B – Where are we now?

Table 7: Meteorological – data and technology

Custodian	Dataset Name	Water Reg Data Category	Data Format	Spatially Enabled	Technical Platform
DFW	Hydstra	4a 4b 4c 4h	Foxpro	No	Hydstra
EPA		4a 4b 4f 4g 4h 4i	Oracle Table	No	Oracle
ForestrySA	BOM Pluviometers	4a	Access DB	No	MS Office 2003
ForestrySA	Climatic data	4a 4b 4f 4g 4h 4i	Access DB	No	MS Office 2003
ForestrySA	Climatic data	4c	Access DB	No	MS Office 2003
ForestrySA	Davis weather stations	4a 4b 4f 4h	Access DB	No	MS Office 2003
ForestrySA	Farmers rainfall data	4a	Paper Record	No	Paper Record
SA Water	Weather Stations	4a 4c	Oracle Table	No	Oracle
KI NRM	Farmers rainfall data	4a	Paper Record	No	Paper Record
SAMDB NRM	MET Data	4a 4b 4e 4h	Excel Spreadsheet	No	MS Office 2003
SE NRM	Automatic Weather Station	4a 4b 4e 4f 4h	Excel Spreadsheet	No	MS Office 2003

### 3.2.8 Water use (Regulations Subcategory 5)

The Central Irrigation Trust [**CIT**] holds Category 5 Regulations data and in this they only hold Subcategory 5e (total monthly volume of water supplied to individual irrigators in an irrigation network). They have been identified as being able to supply Subcategories 5a, 5b, 5c, 5d and 5e to the Bureau.

CIT holds their trade data in Comma Separated Values [**CSV**] format, which is stored in their 'trade now' system. Trade data is supplied weekly to the Bureau. Historical data is also supplied to the Bureau.

The DFW also holds current and historical Category 5 data in a number of storage formats, including in Oracle, Access and SQL databases, Excel spreadsheets, and in hardcopy format. The department has, in the past, manually consolidated and provided these data to the Bureau. However, due to the manual nature of this activity, there are significant ongoing resource implications for the department. The department has put forward a number of project proposals through Round 5 M&E to address these issues, and will investigate the resolution of delivery of Category 5 data in the future.

### 3.2.9 Rights allocations and trades (Regulations Subcategory 6)

The *Water Regulations 2008* require the DFW, CIT, EPA, PIRSA and ForestrySA to provide the Bureau with copies of some or all of the specified Subcategory 6a-6g data ('Regulation data'). EPA, PIRSA and ForestrySA have advised the Bureau that they do not hold Category 6 information.

As part of its water licensing responsibilities, the DFW holds some of the specified rights, allocations and trades information and supplies it regularly to the Bureau.

## Section B – Where are we now?

The CIT holds some specified data relating to Trust member licence holding which is routinely, and directly provided to the Bureau.

Water management authorisations granted under the *Natural Resources Management Act 2004* include water licences endorsed with water access entitlements, water allocations, water resources works approvals and site use approvals. The effective management of prescribed water resources across the state is dependent on the maintenance of accurate water access entitlement and water allocation data. The accuracy and availability of the data assists in the development of competitive and innovative water markets. The quantity of water allocation remaining available to be taken is informed by accurate and timely water usage data.

### 3.2.9.1 Bundled licence

A bundled licence is a right to use water based on a volumetric allocation. This is different from the previous allocation based on area. The DFW has moved away from the area based allocation as it sees volumetric allocation as being a fairer type of allocation to the user and environment. It will also protect the rights to water for the licence holder, and allow for trading of the allocation, subject to the rules in the *Water Allocation Plan*.

### 3.2.9.2 Unbundled licence

This is the ongoing right to a specified share of a water resource as specified on the water licence. A water right will be expressed in unit shares language (as it is interstate) and is an asset that can be sold or transferred permanently, or for a limited period. At present only the River Murray is utilising the unbundled system of licensing. An unbundled licence is comprised of ‘three instruments’ outlined below:

#### **Water Account (Allocation)**

This reflects your right to take a specific volume of water for a given period of time, not exceeding 12 months. This right will specify the actual volume of water available for use.

The actual volume may vary from year to year depending on how much water is available. This too, is an asset that can be sold.

#### **Water Resource Works Approval [WRWA]**

This is a permission to construct, operate and maintain works (such as a pump, well or dam) to take water at a particular location in a particular way. This permission is not transferable to another location. The requirement to meter the amount of water taken from the resource will be connected to this approval.

#### **Site Use Approval [SUA]**

This is a permission to use water at a particular location in a particular way. This permission is not transferable to another location.

### 3.2.9.3 Water trading

In unbundled environments, water trading can occur at either the entitlement or allocation level. An allocation of water exists for a period of 1 financial year.

## Section B – Where are we now?

An entitlement of water can be bought, sold, or leased for any length of time. Security interests (including mortgages) can only be entered against an entitlement, and not an allocation.

### 3.2.9.4 Intrastate trades

In unbundled environments, water (entitlement and allocation) can be traded from one client to another. The only requirement for taking and using this water is that the proponent holds a current SUA or WRWA.

### 3.2.9.5 Interstate trades

At present only allocations can be traded across borders. If an interstate client wishes to purchase a River Murray water allocation from South Australia, it is possible, subject to availability. The client may live interstate, but must hold a valid South Australian River Murray Entitlement.

### 3.2.10 Urban water management (Regulations Subcategory 7)

Only one Named Person holds Category 7 data in the form required to be reported under the regulations. This was SA Water the state's only utility dealing in urban water management.

SA Water holds all section 7 Subcategories in their SCADA system. An 'enterprise data warehouse' is being developed and will be a repository of historical and current transaction data and will support data modelling to aid in decision making exercises.

One issue in meeting Regulation requirements was the inability of SA Water to be able to consistently produce 'weekly volume' data as this is currently not a monitoring requirement for the state.

## 3.3 Resource monitoring

### 3.3.1 Surface water

In terms of state and condition monitoring surface water networks differ from groundwater monitoring networks in being relatively sparse. The sparse network of surface water monitoring is due to the predominant ephemeral streams present in the state. As such, a large number of streams are not monitored as they are not suitable to establish long-term monitoring sites.

The DFW maintains 146 surface water monitoring sites established to monitor the state and condition of water resources, for River Murray operations, and to manage and report on the effectiveness of the salt interception schemes. A further 36 sites are maintained for rainfall and climate data. Data is also received from 33 sites maintained by the South East Water Conservation and Drainage Board and a small number of sites maintained by other government agencies, Santos or SA Water.

Approximately 174 surface water monitoring sites (including rainfall and climate sites) maintained by the DFW are connected to the telemetry network, with standardised data loggers and modems. The majority of the other sites have a variety of models of stand-alone loggers which are progressively being moved to a standardised platform where possible. The primary parameters collected are level, flow, salinity and rainfall, with a

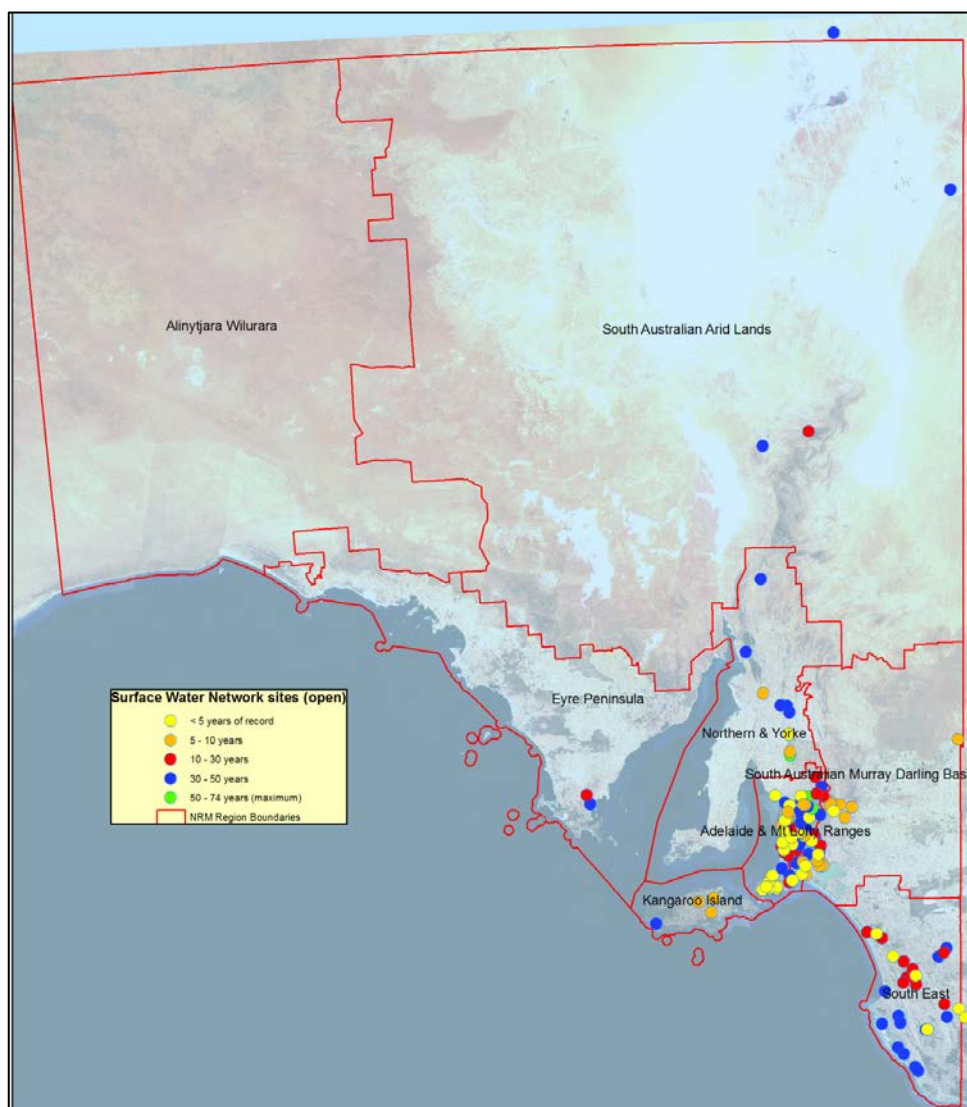


## Section B – Where are we now?

limited number of other water quality and meteorological parameters at some sites including turbidity, pH, redox, and wind.

Figure 2 shows a good distribution of long term surface water monitoring sites (>30 years of record) across most of the state, with a small number, particularly in the AMLR area, of more than fifty years. The AMLR, the EMLR, and the upper South East region also show an increase in the number of sites of five years or less, and between five and ten years of record. This reflects the expansion of monitoring to support water planning.

Figure 2: Location of surface water network monitoring sites



The expansion of the numbers of sites in the South East region is due in part to a need to better measure cross-border flows, particularly in response to land use changes.

As a result of the Upper South East Drainage Program that has been implemented to manage saline drainage from inter-dunal flats and the restoration of environmental flows to wetlands the greatest number of newer sites is in this region. Table 3 (p.26) summarises the distribution of sites of varying record length in the state.

## Section B – Where are we now?

**3.3.2 Groundwater**

The DFW maintains 4564 observation wells in 146 monitoring networks. In addition, the Department has an interest in 7540 private and other government department wells from a monitoring data perspective. Monitoring is generally for either salinity or water level; however both parameters are measured at some wells. There are 24 sites connected to the DFW's telemetry network, providing near real-time data, while approximately 336 sites have stand-alone data loggers.

In addition to the telemetered and standalone data monitoring network, the DFW maintains the water supply process control infrastructure in the APY lands and other Aboriginal communities and records operational and regional water level and water quality data at these sites. Thirty four of these sites are connected to a SCADA network to allow remote monitoring and control of these critical water supply sites.

As part of the water allocation planning process in a number of NRM Board areas, a number of licensed wells in prescribed areas are monitored either yearly or twice yearly for water quality parameters including salinity and pH. This data is maintained in the state groundwater archive.

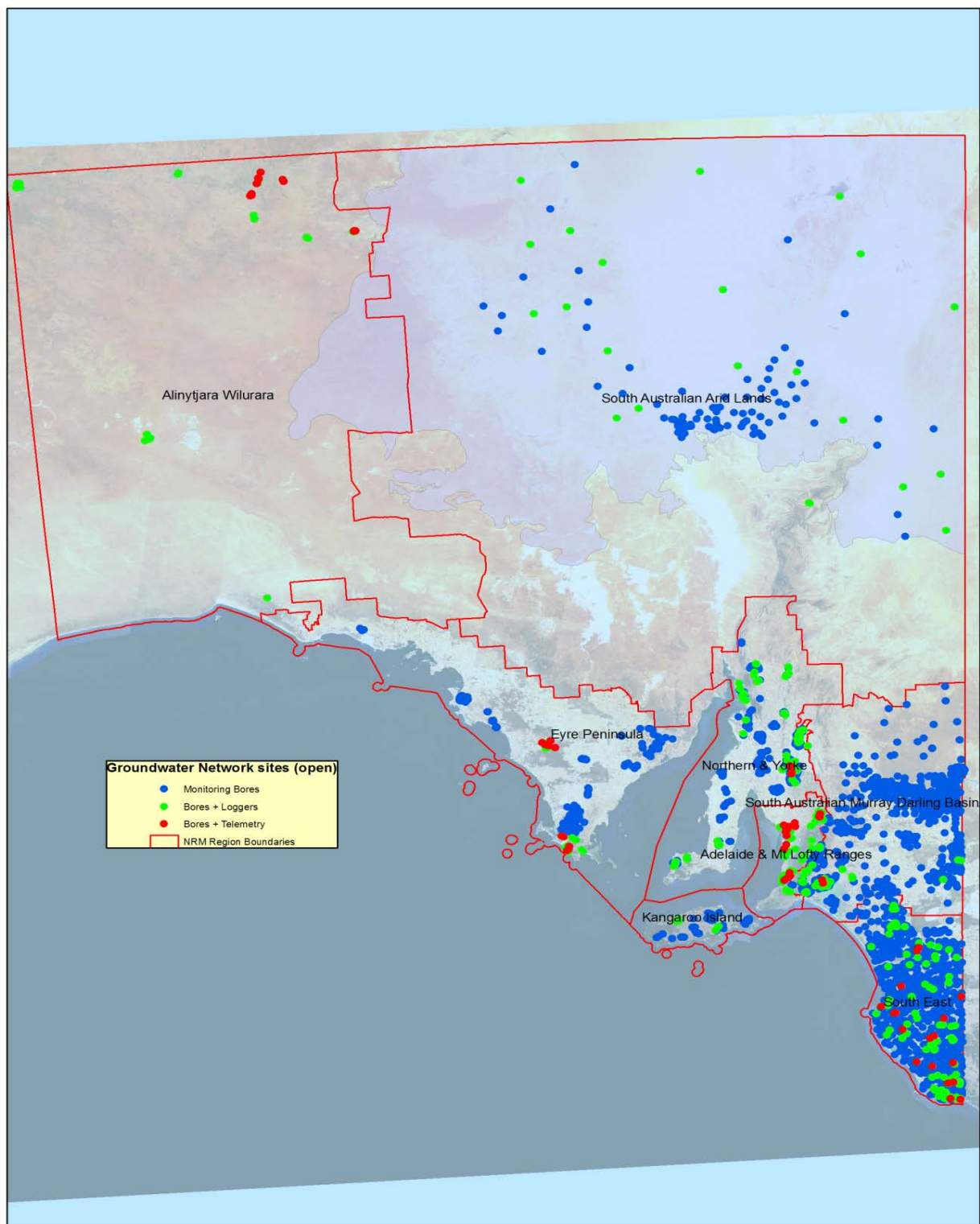
No formal definition of groundwater networks been carried out in South Australia. The options for doing so are a full statistical analysis of well spacing and hydrogeological parameters, or, as proposed by the DFW, a pragmatic approach based on existing networks. It is recognised that the choice of specific wells will need to be carried out by specialists familiar with each monitoring network. Such definition for state and condition monitoring will necessarily require input from other stakeholders such as the DFW's licensing section, and SA Water.

Groundwater networks are defined as a series of monitoring wells that have been developed in response to a perceived need to monitor groundwater levels and water quality, in particular, its salinity, over time. The spatial extent of a monitoring network can vary widely from a few square kilometres to many hundreds of square kilometres. Many are sampled manually for seasonal high and low water levels on a bi-annual basis. Increasingly a number of wells across the state have been fitted with loggers to record shorter term variation in water level, and less often, salinity. A relatively small number of groundwater sites are telemetered, however an increasing number have been telemetered so that variations in well parameters can be assessed remotely and in real time.

Figure 3 (page 35) describes the current South Australian groundwater monitoring networks. The map shows manually sampled wells in blue, wells with loggers in green, and wells with loggers and telemetry in red. The data displayed in Table 8 (p. 36) is based on SAGeodata database records, and information on loggers and telemetry was gathered from monitoring staff in Adelaide and the regions.

## Section B – Where are we now?

Figure 3: Groundwater network sites



## Section B – Where are we now?

Table 8: Summary of groundwater monitoring networks

Region	Total Monitoring Wells	+ Loggers	+ Telemetry
Alinytjara Wilurara	50	38	19
Eastern Mount Lofty Ranges	582	25	2
Eyre	241	16	17
Kangaroo Island	141	28	0
Murray-Mallee	1757	42	0
Northern & Yorke	440	55	3
South East	1156	112	17
South Australia Arid Lands	197	20	0
<b>Total</b>	<b>4564</b>	<b>336</b>	<b>58</b>

### 3.3.3 Meteorology

The majority of meteorological information within South Australia is collected by the Bureau, although some Named Persons supplement this with their own focused meteorologic monitoring activities. These records may be limited by comparison to the Bureau meteorological data parameters. Indeed the data parameters collected between jurisdictional organisations varies, for example the EPA measure ambient temperature, barometric pressure, wind speed and direction, solar radiation, dew point and relative humidity, whereas the majority of DFW sites mainly collect rainfall.

State meteorological data is transferred to the Bureau as a single repository. There is very limited formal coordination in the establishment of new sites and closure of existing sites. Added to this agencies may use different station numbers to describe data from the same site as there is no common station numbering system. This has generated some uncertainty about the exact number of meteorological sites controlled by Named Persons as some appear to be shared between the Bureau, the MDBA and other Named Persons. A coordinated and collaborative approach to addressing these issues needs to be initiated as a priority to find a solution to this problem.

Of the known state meteorological monitoring sites, the majority are stored within the Hydstra database while the EPA and ForestrySA also maintain their own unique and (currently) unlinked repositories.

The approximate number of state-owned meteorological monitoring sites is detailed in Table 6 (p. 29). The current investments in meteorological data and technology are summarised in Table 7 (p. 30).

## Section C – Analysis of gaps in data and systems

## 4 Section C – Analysis of gaps in data and systems

## 4.1 Gaps in data and systems

## 4.1.1 Existing gaps

## 4.1.1.1 Connecting to national information systems

**Gap/Issue:** Current jurisdictional information systems are not always capable of connecting to national information systems such as AWRIS or of directly connecting across the state.

**Opportunity:** There is a state level opportunity to coordinate improvement of legacy information acquisition and management practices, business processes and systems. Investigate the integration of these systems into one portal and method of delivery to assist the state in delivering data not only to the national information systems, but also to the public in general.

**Action:** Identify areas where similar systems and requirements are being delivered separately to Commonwealth agencies.

## 4.1.1.2 Supporting market trading of water access rights

**Gap/Issue:** Current jurisdictional information systems and processes do not provide full information support for an unbundled water access rights and market trading regime.

**Opportunity:** With the increasing importance of water management in this state and across the nation there is an opportunity to leverage political and financial incentives to progress the development of a state registry system that complies with national requirements.

**Action:** The South Australian component of a National Water Market System project is being progressed. This will go some way to address the above gap but the DFW will be required to modify existing systems to cater for these changes. DFW is cooperating with the national water trading information initiative to investigate options for a Common Registry System to support integration of trading data across national borders.

## 4.1.1.3 Telemetry and Data Communication

**Gap/Issue:** There is increasing demand for access to current data and information for critical resources. The significance of field costs relative to other information costs makes telemetry attractive as a data communication technology since it offers fast and frequent access to monitoring data at significantly lower cost than manual retrieval. Current telemetry systems are predominantly mobile network based and circuit switched, an approach that is likely to be unsupported by telecommunications providers in the near future. Moving to packet switched, or Internet Protocol [IP] based telemetry will potentially alleviate this issue, resulting in a reduction in telemetry costs and allow for more frequent polling.

## Section C – Analysis of gaps in data and systems

**Opportunity:** Leverage state and Commonwealth investment to improve the state's telemetered water monitoring network.

**Action:** South Australia has already leveraged state and Commonwealth funding (e.g. M&E funding) to establish a telemetry network for a number of surface water and groundwater sites and to trial IP-based telemetry. Additional strategic sites are being identified and co-investment progressed on the basis of funding and priority. Transition of sites to IP telemetry is well advanced and is meeting all targets.

#### 4.1.1.4 Monitoring Density and NRM

**Gap/Issue:** Regional NRM organisations have a need for targeted local monitoring to complement the information available from state organisations. However, not all NRM Boards have completed their information requirements planning and hence have not fully resolved the supplementary regional information that they will need to collect. Those that have completed this work are incrementally seeking to expand their monitoring and to establish information handling solutions.

**Opportunity:** There is an opportunity to resolve these needs, in a coordinated way. The DENR is undertaking this work through its NRM integration project identifying all organisations that could benefit from an integrated approach to monitoring; in terms of the physical equipment and the dissemination of information and data being collected. Activities such as the State Water Monitoring Network Optimisation Project are leveraging these opportunities.

**Action:** The DFW distils regional monitoring density requirements through ongoing consultation with NRM. Investigate the need to form a working group, reporting to SAWIP Board.

#### 4.1.1.5 Clarifying state and local responsibilities for data supply

**Gap/Issue:** Currently responsibilities between Named Persons with regard to data supply arrangements are not clear. In some instances, this lack of clarity extends to arrangements for delivery of specified data items to the Bureau, in line with the Water Regulations.

NRM Regional Plans are often developed at different rates and with different levels of maturity. Some boards assume that state agencies will collect and provide relevant data, while others accept that they have a separate business requirement to collect and manage data that is otherwise unavailable.

**Opportunity:** Define data provision services through collaboration with Named Persons when developing the technical and business platforms for the collection, storage and dissemination of water information. Establish a working committee under the SAWI Program to ensure that roles and responsibilities are established for the dissemination of water information, collection and supply.

**Action:** Create binding agreements with Named Persons for the state-wide provision of these services.

## Section C – Analysis of gaps in data and systems

## 4.1.1.6 Modelling data

**Gap/Issue:** Water monitoring data constitutes a very rich information resource for all parties and there is a need to value-add to this information and establish persistent modelling over identified sensitive high priority areas.

Modelling is generally undertaken on a project basis to address catchment or region-specific issues. Models are typically detailed and require larger than national scale geofabric data (e.g. Great Artesian Basin).

Monitoring effort needs to be reviewed periodically to ensure it continues to realise maximum information value for the resources expended.

From a data perspective, modelled project data and metadata is not usually managed and distributed as freely as direct measurement data.

**Opportunity:** By making modelling data more generally accessible, additional value may be generated. There is a need to develop procedures for incorporation of modelled parameter data into the general water information stream, accompanied by appropriate metadata to detail its difference from measurement data.

**Action:** Review the modelling data that is available and assess the potential value of making qualified modelling data more accessible, and identify the type of metadata that needs to accompany such information. This is in part being addressed through the State Water Monitoring Network Optimisation Project.

## 4.1.1.7 Quality of rating curves and bathymetric tables

**Gap/Issue:** Length of time for the calculation and calibration of key stage height/flow and stage height/volume relationships. If past relationships are no longer reliable, their continued use to derive flow and volume parameters can lead to significant error.

Decisions about environmental water needs and sustainable water use are critically reliant on these relationships.

The state has recognised the need for key surface water, groundwater and storage relationships to be systematically reviewed.

**Opportunity:** Opportunity currently exists to progress a systematic review of key stage height/flow and stage height/volume relationships and improve currency of rating curves and bathymetric tables. This will allow the state to better estimate the storage capacity of weirs along the River Murray.

**Action:** Undertake an activity to:

- methodically review all relationships used for deriving flow and volume
- develop a methodology for assigning quality coding codes to such relationship curves and tables.

## Section C – Analysis of gaps in data and systems

## 4.1.1.8 Metadata

**Gap/Issue:** Metadata for most regulations water data held in the state is generated by data management systems or primarily designed to assist data management functions. The metadata required to improve data discovery and access has generally not been identified, and programs for its systematic maintenance are not in place. This limits the total value able to be obtained by data managing organisations as well as that of third parties seeking to repurpose the data. In addition, the Bureau has signalled its intention update the Water Regulations. This will impact the domain and scope of the state's current approach to metadata.

**Opportunity:** Work with the Bureau's data standards project to identify the best metadata to maintain and develop in light of the metadata changes in the Regulations.

**Action:** Once metadata options have been assessed, establish work practices to capture the most useful metadata and systematically manage this in conjunction with the data it details. Establish arrangements and ICT capability which facilitate access to metadata to support users in accessing and making independent assessments of the fitness of individual data items to their purposes.

## 4.1.1.9 Understanding water accounting/water balance

**Gap/Issue:** The availability of standardised jurisdictional water information suitable for water accounting purposes has not been fully identified.

**Opportunity:** Identify the areas that have not had a water account delivered and ensure that information that provided the foundation for the water account for provided areas is available for use.

With this knowledge the state would be able to position itself to ensure adequate measurement, monitoring and reporting systems are in place to support public and investor confidence in the amount of water being traded, extracted for consumptive use and recovered for environmental and other public benefit outcomes.

**Action:** Define the data and the method of delivery required to support the production of national, state and regional water accounts.

Identify where business and systems processes require change in order to support repeatable water accounting reports.

Position the state in respect to the national picture to effectively inform water planning (sharing) processes, water markets, investment decisions, and environmental management.

## 4.1.1.10 Appropriateness of geographic coverage of monitoring sites

**Gap/Issue:** South Australia's spatial coverage in terms of monitoring sites has historically been focussed on priority areas of interest, such as population centres, prescribed areas and primary agricultural regions. This leaves large areas of the state, particularly in some of the more remote NRM regions, with poor spatial coverage of water resource information.



## Section C – Analysis of gaps in data and systems

Over time, the consistency of water monitoring has been negatively affected by factors including the short term nature of project funding, and budget pressures leading to incapacity to meet operational costs of maintaining sites.

**Opportunity:** Use outcomes of stakeholder engagement undertaken in South Australia to identify water monitoring gaps and use this information to establish a plan to align spatial and temporal coverage of monitoring sites with regional water monitoring needs.

**Action:** Collaboratively identify sites of greatest value to the state and invest in improved spatial coverage (in part addressed through State Water Monitoring Network Optimisation Project). Investigate opportunities to support/automate community data collection and harvest long standing private records to improve temporal coverage. In collaboration with other jurisdictions, investigate the possibility of establishing a persistent funding model to address coverage issues.

#### 4.1.1.11 Inconsistency of attribution of spatial information

**Gap/Issue:** There is inconsistency in the jurisdiction's attribution of hydrological geospatial data. Metadata is not consistent between Named Persons and varies over time within and between organisations.

**Opportunity:** Stakeholder engagement has enabled the condition of hydrological geospatial metadata to be better known providing an opportunity to develop a plan to improve the consistency and quality of that metadata. Leverage the work being undertaken on the South Australia Geofabric project as a model for collaboration and management of integrated spatial data.

**Action:** Review/analyse spatial data information acquired from stakeholders and develop a plan to:

- develop/select an appropriate metadata standard (one that supports data discovery)
- support the establishment of consistent business processes for the ongoing creation and storage of metadata
- improve the consistency and quality of existing metadata.

#### 4.1.1.12 Ensure cross-agency coordination in ICT investment

**Gap/Issue:** Duplication of ICT infrastructure/architecture between agencies increases the cost of maintaining water information. A lack of integration between and agility of data management systems negatively impacts on the state's ability to deliver water data and information effectively. There is a need to more effectively utilise existing systems that can or will integrate across agencies allowing them to manage their own data in line with their business requirements and make it available to others.

**Opportunity:** Leverage existing ICT infrastructure to better integrate and deliver water information and data in line with the state's ICT strategy, *Ask Just Once* and its Cabinet-endorsed principles "Information is shared" and "Infrastructure is an asset".

## Section C – Analysis of gaps in data and systems

**Action:** Identify and document requirements to:

- build capability for the state by leveraging and extending existing agency investment to other agencies and water data providers
- develop business and data models that facilitate the improved management and delivery of hydrological and contextual data
- leverage state and Commonwealth investment in “joined-up” strategic water data and information systems
- develop systems that provide the capability to deliver integrated data in the appropriate format, at the appropriate frequency, to the Bureau.

#### 4.1.1.13 Integrated modelling

**Gap/Issue:** One of the most commonly identified issues is that agencies do not have sufficient data to model. Impacting on their ability to understand the relationship between rainfall and groundwater recharge, other interactions between surface and groundwater, and what constitutes sustainable use. However, agencies need to have an in-depth understanding of the broader goals, requirements and targets of any models before production is initiated.

**Opportunity:** Develop opportunities for collaborative projects at the NRM and state level, as well as with a national focus. Collaboration with universities and research organisations may be an ‘untapped’ source of data, information and innovation in the creation, development and implementation of models.

**Action:** Invest in aligning meteorological and water monitoring site locations to determine relationships between rainfall and recharge:

- identify priority areas for investigation for the state, and identify funding sources and collaborations for investigation
- invest in extending the state’s water monitoring network to provide better coverage in more remote regions of the state where planned economic development is dependent upon and is likely to have an impact on water resources
- negotiate enduring access to Bureau-held meteorological site location and data
- in collaboration with other agencies and the Bureau develop a data model that integrates ground and surface water data and information in line with the NGIS prototype full data model
- undertake a review of the current knowledge in this area to identify gaps and current models that would support a greater understanding of rainfall/recharge and surface/ground water relationships
- develop an authoritative spatially-enabled dataset within the state government for geofabric data, including water monitoring and meteorological sites (state and the Bureau owned sites) to inform coordinated decision making and investment.

#### 4.1.2 Common reporting elements

A requirement of the *2011 SWIMP* is that common reporting elements be included to allow easy comparison, using standard frameworks, between states. The following graphs and tables outline where all rounds of M&E funding has been distributed, and the extent to which gaps have been addressed. This reporting has aligned all projects from all rounds of M&E funding to the gaps outlined in the *2010 SWIMP*. The reporting has also utilised the Round 4 M&E Themes from the funding guidelines.

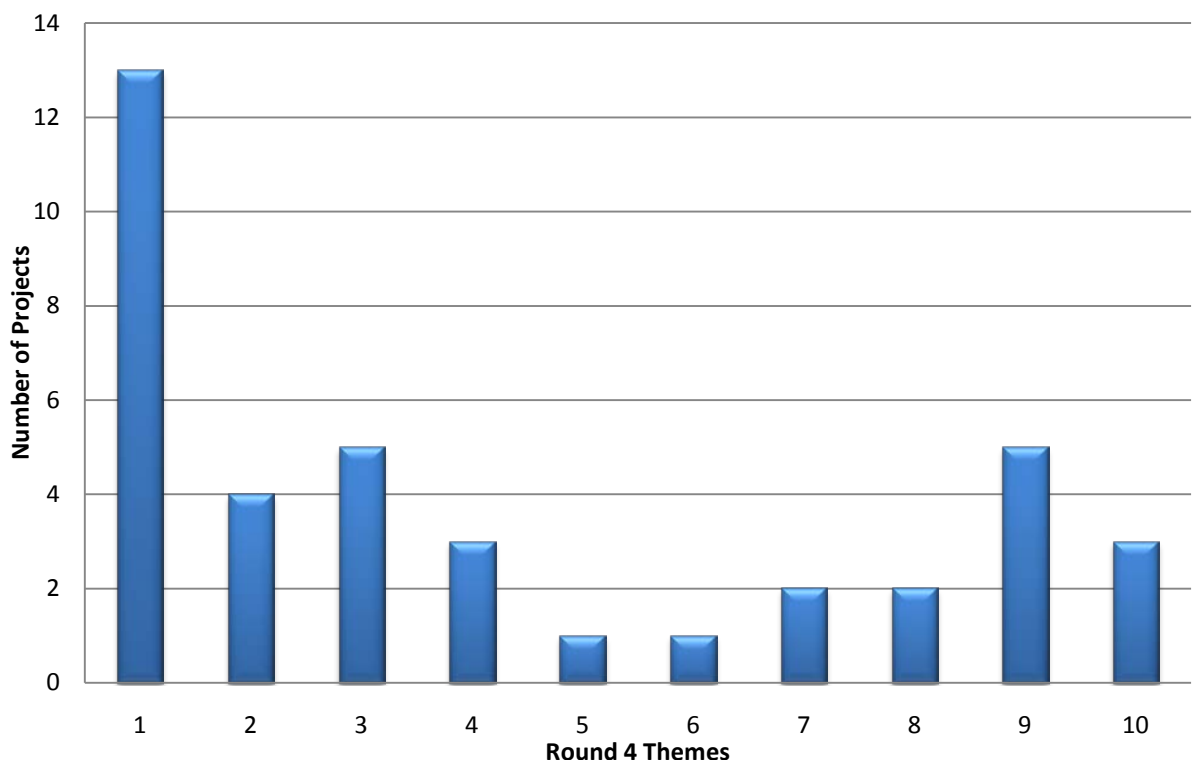
## Section C – Analysis of gaps in data and systems

The alignment of rounds 1-4 of M&E funding to gaps and themes used in the 2010 SWIMP has presented a number of issues for the Named Persons in South Australia. As the gaps identified in previous SWIMPs are very broad the challenge has been to align the projects to specific gaps, which may not wholly encompass the true gap the project is attempting to address.

Figure 4 demonstrates that the majority of M&E funding for South Australia has been targeted at Theme 1; Improving the accuracy of existing water storage measurement, stream flow, groundwater, meteorological and water quality networks. Thirteen projects across eight Named Persons, including NRM Boards and the LWA were funded under this theme alone.

Improving the accuracy of monitoring networks has been a priority for the state and moving forward the need to telemeter these stations to improve access to the data will be a priority. Theme 5 and 6 have only received funding for one project each, in the case of Theme 6, this project has been done in collaboration with state agencies that are not Named Persons at this time. The use of external expertise has fostered ongoing relationships and cemented efforts for this type of work to occur in the future. The rescue or recovery of water information (Theme 5) has not been prioritised by the state at this time, but as legacy systems are replaced this issue of migrating information may need to be addressed.

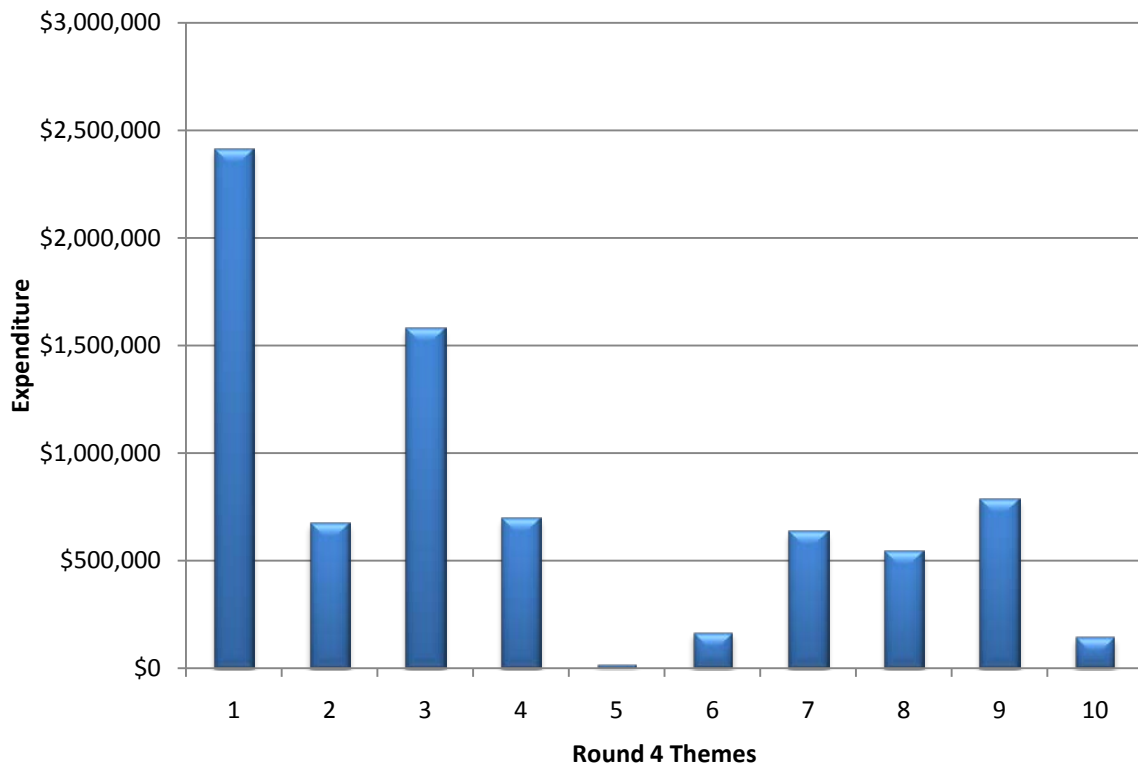
Figure 4: Number of M&E funded projects by Round 4 Theme



## Section C – Analysis of gaps in data and systems

The following graph (Figure 5) demonstrates that the majority of expenditure has been in Theme 1, as the majority of the project applications have targeted this Theme. As a general observation the number of projects in order does not correlate with the amount of expenditure in Theme 4 and Theme 2. Theme 4 has received slightly more funding (approximately \$25,000) than Theme 2, with one less project being approved. It is noted that funding is not proportional to the number of applications received. However, the importance of improving water data management procedures is a priority for the Bureau, as is evident with this example.

Figure 5: Amount of M&amp;E funding invested per theme



Only one gap (Gap 1.02) from the 2010 SWIMP has not received any M&E funding at this stage, as shown in figure 6. Gap 1.02, Supporting market trading of water access rights, will be addressed within other projects currently being undertaken outside of M&E funding. The majority of funding has been attributed to Gap 1.10 and 1.04. The need to address the geographic coverage of the state's monitoring network is a priority for all Named Persons. In particular, the coverage of meteorological stations has led to an increase in funding of monitoring networks in the South East Natural Resources Management Region. The Named Persons within this region have submitted a number of projects to address this particular gap.

In parallel with the geographic coverage (Gap 1.10), monitoring density and NRM (Gap 1.04) has had similar priority. There has been significant co-investment in addressing this gap has occurred. The alignment of monitoring and NRM is strengthening within South Australia and will continue to increase moving into the future.

## Section C – Analysis of gaps in data and systems

Connection to national information systems (Gap 1.01), although only having a relatively small amount of funding thus far, is being addressed through the current round of M&E funding, with proposals being submitted to address this gap further. Similarly, Gap 1.11 (Inconsistency of attribution of spatial information) is being addressed through the geofabric project, and will provide a pilot methodology and process for the integration of spatial data across agencies. It is envisaged that this data will be integrated within state agencies, as well as NRM Boards, so that a common attribution system is established.

Figure 6: Amount of M&amp;E funding invested per theme

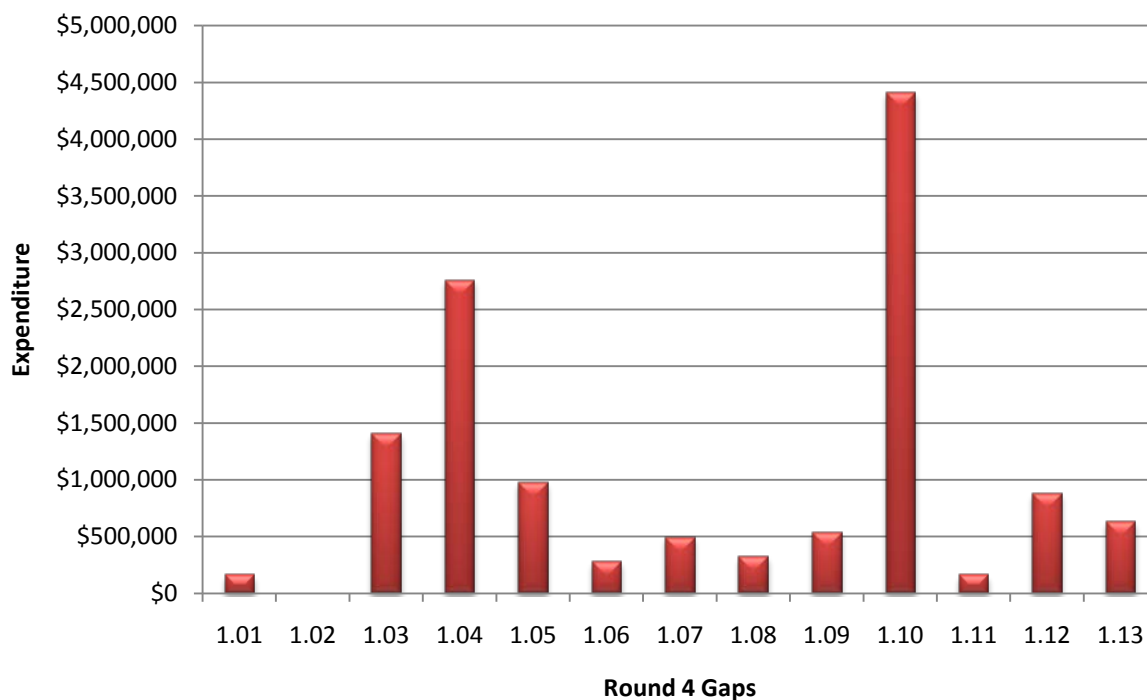


Table 9 (next page) outlines the extents to which gaps have been addressed through M&E funding. The exercise of aligning projects to gaps has been difficult for some Named Persons, as the current gaps had not been identified at the time of project submission. This reverse engineering of gap alignment means that the 'picture' of gap closure is not as simple as first thought. The nature of investment from these projects and the alignment of the Bureau's needs to that of the states, means that although gaps may have been closed fully in one portion of the state, the requirements for reporting on a state level mean that the gap is still less than 50% closed.

This is particularly true for the DFW, in that it has focussed some of its efforts in improving the reporting and monitoring of a specific region, such as telemetry in the remote NRM Regions, while not telemetering the same type of gauging stations in more accessible regions. This targeting of telemetry means that the gap being less than 50% addressed is reflective only at the state scale, and not for the remote regions where telemetry is increasingly important.

The following table (Table 10 pp.47-52) identifies the number of projects and their gap closure status identified from the 2010 SWIMP, by Round 4 funding theme. The tables also outline the number of projects, both funded and non-funded, that has been submitted under each funding theme.

## Section C – Analysis of gaps in data and systems

Table 9: Number of gaps addressed by Named Person, and the extent to which they have been closed by M&amp;E investment

Person Category	Organisation Name	Number of Gaps addressed through M&E Funding																																											
		Number of Gaps, 100% Addressed										Number of Gaps, 75% Addressed										Number of Gaps, 50% Addressed										Number of Gaps, <50% Addressed													
		1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10				
A	Department for Water											1	2																																
B	Department of Primary Industries and Resources South Australia																																												
	Environment Protection Authority	1	2	3	4							1	2																																
	ForestrySA																																												
C																																													
D	Department for Water												1	2																															
	Department of Primary Industries and Resources	1																																											
	SA Water Corporation											1	2																																
	Environment Protection Authority																																												
E	Central Irrigation Trust																																												
F	SA Water Corporation																																												
G	Adelaide & Mount Lofty Ranges NRM Board																																												
	Alinytjara Wilurara NRM Board																																												
	City of Salisbury																																												
	Eyre Peninsula NRM Board																																												
	Kangaroo Island NRM Board																																												
	Northern and Yorke NRM Board																																												
	South Australian Arid Lands NRM Board																																												
	South Australian Murray-Darling Basin NRM Board	1										1																																	
	South Eastern Water Conservation and Drainage Board	1	2	3																																									
	South East NRM Board																																												
H	City of Salisbury											1																																	
	SA Water Corporation																																												

## Section C – Analysis of gaps in data and systems

Table 10: Summary of project completion by gap and theme

Theme 1: Improving the accuracy of existing water storage measurement, stream flow, groundwater, meteorological, and water quality networks																																													
Gap Number	Gap	Total Number of Funded Projects	Total number of project applications submitted	Number of M&E Funded Projects																																									
				Number of projects which fully addressed gap for the funded organisation(s), i.e. 100% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), 75% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), 50% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), <50% closed											
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		
1.01	Connection to national information systems																																												
1.02	Supporting market trading of water access rights																																												
1.03	Telemetry and Data Communication	7	7																																										
1.04	Monitoring Density and NRM	2	2																																										
1.05	Clarifying state and local responsibilities for data																																												
1.06	Monitoring to support modelling	3	3																																										
1.07	Quality of rating curves and bathymetric tables																																												
1.08	Metadata																																												
1.09	Understanding water accounting/water balance																																												
1.10	Appropriateness of geographic coverage of monitoring sites	4	4																																										
1.11	Inconsistency of attribution of spatial information																																												
1.12	Ensure cross-agency coordination in ICT investment																																												
1.13	Integrated modelling																																												

Theme 2: Installation of telemetry																																														
Gap Number	Gap	Total Number of Funded Projects	Total number of project applications submitted	Number of M&E Funded Projects																																										
				Number of projects which fully addressed gap for the funded organisation(s), i.e. 100% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), 75% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), 50% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), <50% closed												
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10			
1.01	Connection to national information systems																																													
1.02	Supporting market trading of water access rights																																													
1.03	Telemetry and Data Communication	6	6																																											
1.04	Monitoring Density and NRM	1	1																																											
1.05	Clarifying state and local responsibilities for data																																													
1.06	Monitoring to support modelling																																													
1.07	Quality of rating curves and bathymetric tables	1	1																																											
1.08	Metadata																																													
1.09	Understanding water accounting/water balance																																													
1.10	Appropriateness of geographic coverage of monitoring sites																																													
1.11	Inconsistency of attribution of spatial information																																													
1.12	Ensure cross-agency coordination in ICT investment																																													
1.13	Integrated modelling																																													

## Section C – Analysis of gaps in data and systems

**Theme 3:** Extending the coverage of the monitoring network to address critical information gaps

[illegible]



## Section C – Analysis of gaps in data and systems

**Theme 4:** Improving the water data (and metadata) management procedures

[illegible]

**Theme 5:** Recovery or rescue of water information, including metadata

[illegible]

## Section C – Analysis of gaps in data and systems

**Theme 6:** Improving the Australian Hydrologic Geospatial Fabric's (AHGF) national foundation groundwater data set

[illegible]

**Theme 7:** Improving the Australian Hydrologic Geospatial Fabric's (AHGF) national foundation groundwater data set

[illegible]

## Section C – Analysis of gaps in data and systems

**Theme 8:** Participating in the cooperative planning and production of the National Water Account (NWA)

Gap Number	Gap	Total Number of Funded Projects	Total number of project applications submitted	Number of M&E Funded Projects																																									
				Number of projects which fully addressed gap for the funded organisation(s), i.e. 100% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), 75% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), 50% closed										Number of projects which <b>part</b> addressed gap for the funded organisation(s), <50% closed											
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		
1.01	Connection to national information systems																																												
1.02	Supporting market trading of water access rights																																												
1.03	Telemetry and Data Communication																																												
1.04	Monitoring Density and NRM																																												
1.05	Clarifying state and local responsibilities for data																																												
1.06	Monitoring to support modelling																																												
1.07	Quality of rating curves and bathymetric tables																																												
1.08	Metadata	1	1																																										
1.09	Understanding water accounting/water balance	2	2																																										
1.10	Appropriateness of geographic coverage of monitoring sites																																												
1.11	Inconsistency of attribution of spatial information																																												
1.12	Ensure cross-agency coordination in ICT investment	1	1																																										
1.13	Integrated modelling																																												

**Theme 9:** Engagement of Strategic Water Information Coordinators

Gap Number	Gap	Total Number of Funded Projects	Total number of project applications submitted	Number of M&E Funded Projects																																									
				Number of projects which fully addressed gap for the funded organisation(s), i.e. 100% closed										Number of projects which part addressed gap for the funded organisation(s), 75% closed										Number of projects which part addressed gap for the funded organisation(s), 50% closed										Number of projects which part addressed gap for the funded organisation(s), <50% closed											
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		
1.01	Connection to national information systems																																												
1.02	Supporting market trading of water access rights																																												
1.03	Telemetry and Data Communication																																												
1.04	Monitoring Density and NRM																																												
1.05	Clarifying state and local responsibilities for data	4	4																																										
1.06	Monitoring to support modelling																																												
1.07	Quality of rating curves and bathymetric tables																																												
1.08	Metadata																																												
1.09	Understanding water accounting/water balance																																												
1.10	Appropriateness of geographic coverage of monitoring sites																																												
1.11	Inconsistency of attribution of spatial information																																												
1.12	Ensure cross-agency coordination in ICT investment																																												
1.13	Integrated modelling																																												

## Section C – Analysis of gaps in data and systems

Theme 10: Development and application of best practice guides or standards for the collection, monitoring, measurement and storage of water information and metadata

Theme 10: Development and application of best practice guides or standards for the collection, monitoring, measurement and storage of water information and metadata																																												
Gap Number	Gap	Total Number of Funded Projects	Total number of project applications submitted	Number of M&E Funded Projects																																								
				Number of projects which fully addressed gap for the funded organisation(s), i.e. 100% closed										Number of projects which part addressed gap for the funded organisation(s), 75% closed										Number of projects which part addressed gap for the funded organisation(s), 50% closed										Number of projects which part addressed gap for the funded organisation(s), <50% closed										
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	
1.01	Connection to national information systems	3	3	■	■																																							
1.02	Supporting market trading of water access rights																																											
1.03	Telemetry and Data Communication																																											
1.04	Monitoring Density and NRM																																											
1.05	Clarifying state and local responsibilities for data																																											
1.06	Monitoring to support modelling																																											
1.07	Quality of rating curves and bathymetric tables		1																																									
1.08	Metadata																																											
1.09	Understanding water accounting/water balance																																											
1.10	Appropriateness of geographic coverage of monitoring sites																																											
1.11	Inconsistency of attribution of spatial information																																											
1.12	Ensure cross-agency coordination in ICT investment	1	1	■																																								
1.13	Integrated modelling																																											

## Section C – Analysis of gaps in data and systems

## 4.1.3 Gap and opportunity review process

In February 2011, a state water information priority setting exercise was commissioned by the Board and managed by the state's Strategic Water Information Coordinator [SWIC]. A series of interviews, surveys and a workshop were used to capture the existing information resources and requirements of state organisations with a responsibility for information / water resource management. The process engaged individuals from various tiers across state government and Named Persons to ensure the comprehensive coverage of information requirements.

The primary deliverable of this activity was a Board-level report detailing the gaps in South Australia's current water information infrastructure, including the resultant issues, opportunities, risks and impacts.

Developed through an open, interactive and inclusive approach, the report is a key input to the development of the *2011 SWIMP*, as well as, the *Strategic Water Information Coordination Implementation Plan 2011 – 2014*.

One hundred and fourteen (114) stakeholders were approached to take part from operational, management and executive level across state government. There were 10 face to face interviews, 11 telephone interviews and 53 responses to the online survey (93 were sent out). Organisations that were invited to take part included:

- Environment Protection Agency
- Department of Environment and Natural Resources
- Department for Water
- ForestrySA
- Primary Industries and Resources SA
- SA Water Corporation
- Department of the Premier and Cabinet
- Adelaide and Mount Lofty Ranges NRM Board
- Alinytjara Wilurara NRM Board
- Eyre Peninsula NRM B
- Kangaroo Island NRM Board
- Northern and Yorke NRM Board
- South Australian Arid Lands NRM Board
- South Australian-Murray-Darling Basin NRM Board
- South East NRM Board
- South Eastern Water Conservation and Drainage Board

The survey consisted of 37 questions in total. There were a total of 52 respondents who completed the survey.

Results for the interviews and the survey were used as a basis for a half-day facilitated workshop with 25 South Australia Government water information stakeholders, many of whom had responded to the survey. The initial findings from the interviews and survey were tested in the workshop, and an opportunity provided to explore issues and priorities further. This accumulated information served as the basis for the report.

## Section C – Analysis of gaps in data and systems

## 4.1.4 Further issues

Through consultation with Named Persons in South Australia the SWIC has been able to extend some of the identified gaps from previous SWIMPs with specific issues. This process has been conducted independently from the above mentioned WIIPSA review. The issues will allow for reporting and review of progress in closing the previous gaps in the future. These issues have been aligned to the gaps and will form the foundation of a reporting system. This is not a complete and exhaustive list and not all original gaps have had further issues related to them, e.g. Gap 1.2 '*Supporting market trading of water access rights*'. Over time as more issues evolve, and others are resolved the list will expand and contract. It is expected that the collection of gaps and issues will be an ongoing activity.

The following table (Table 11) contains responses from Named Persons identifying issues with water information and monitoring. It seeks to extend and supplement the gaps that have been identified in previous SWIMPs so that in the future it is easier to identify and target funding opportunities.

Table 11: Extended issues aligned to previous gaps in SWIMP

1.01	<b>Connection to national information systems</b>
1.01.1	In the GAB there is an issue regarding linking up across the NSW and QLD borders in regard to rainfall, flow, discharge, and recharge. (No data integration and understanding)
1.01.2	WDTF adoption is not being driven internally to the extent that it needs to be.
1.01.3	There is an issue linking up with NSW and QLD to access data such as rainfall, flow and discharge. There needs to be better integration to improve understanding. Data is captured and stored but access is an issue even when they are the owners.
1.01.4	Information sharing in regard to cross border water flows could be better.
1.03	<b>Telemetry and Data Communication</b>
1.03.1	Unreliability of 3G network is an issue.
1.03.2	Unreliability of monitoring instruments – maintenance is an issue.
1.03.3	Some weather stations are telemetered and occasionally some sites drop off due to sporadic coverage, although no data is lost.
1.03.4	Ideally there would be at least one telemetered site within each water region "bucket". Need to ensure that there is sufficient coverage of the groundwater monitoring network. This will help to assess the relationship between surface water/groundwater. With declines in groundwater, adequate monitoring of groundwater is essential. The impediment is assumed to be insufficient money and staff.
1.04	<b>Monitoring Density and NRM</b>
1.04.1	There are significant holes in the monitoring of groundwater
1.04.2	While the coverage of monitoring within prescribed areas is considered sufficient, outside of prescribed areas is insufficient.
1.04.3	Monitoring of the GAB relies on mining and exploration companies – and yet a key pressure is water allocation for mining
1.04.4	Access to DFW sites can be difficult due to remoteness and even if it was more accessible the high turnover of staff means expertise is lost and the ability to interpret is limited.

## Section C – Analysis of gaps in data and systems

1.04.5	Board have 30 telemetered surface water sites all available online. May have reached saturation point and not necessarily looking for additional sites unless ongoing funding is included.
1.04.6	Working with DFW to put in 14 new GW sites but they are only second order importance.
1.04.7	Priority of monitoring sites changes based upon type of reporting e.g. regional management plans versus Water Allocation plans.
1.04.8	No monitoring is done at all by the Board and very little is done by others. Only something like 20 bores in the region.
1.04.9	Large extractions are carried out by BHP within the GAB but insufficient monitoring of that extraction is carried out – being done 5 yearly instead of every 2 years.
1.05	<b>Clarifying state and local responsibilities for data</b>
1.05.1	There is a need to have greater transparency in dissemination of water information and data to the public
1.05.2	It is unclear whose responsibility it is to monitor the state's water (NRM vs. DFW vs. SA Water) the state NRM plan needs to make it 'crystal clear'.
1.05.3	Eyre NRM has an obligation to investigate Local Council discharge of storm water to the environment and yet NRM has no authority to monitor.
1.05.4	DFW is rolling out more monitoring sites – no detail has been made available.
1.05.5	Simply do not know how much ground water there is - little info on rate of flow, discharge, recharge
1.05.6	Can't get access to information on who has water licenses in the region from DFW.
1.05.7	Insufficient information about ASR e.g. system capacity, inflows and outflows, current situation. Regularly questioned by political interests and answers are either too slow or too inaccurate.
1.05.8	SA Water monitors on behalf of DFW and are responsible for the infrastructure. A real problem with having multiple users working in the water space.
1.05.9	The state's NRM plan is not very clear about whose responsibility it is to monitor water resources.
1.05.10	There is some overlap between SA Water and DFW monitoring along the River Murray.
1.05.11	Would like to see some clearer definition about what is expected around water security and safety issues from South Australia Govt.
1.05.12	Monitoring is conducted by other groups including community, DFW, EPA, University sector, mining industry etc. but there is no coordination of effort.
1.05.13	Concern at the level of granularity/details for data between commonwealth needs (data on AWRIS) and MDBA NRM and the State.
1.05.14	There may be issues/sensitivities re the publishing of data provided by some data providers - e.g. farmers.
1.05.15	Need the SWIMP to align with their regional plan which includes reporting targets.
1.05.16	Would like some clarification about who actually owns the water resource.

## Section C – Analysis of gaps in data and systems

1.05.17	The water quality monitoring budget has been halved from about \$600K to \$300K which has necessitated a review of the program and redesign of all groundwater, surface inland and coastal monitoring in the state. As part of the review, for example, analysis of monthly water quality data from a range of water types has shown that it is impossible to show meaningful trends to assist management actions due to the high variability in the data over time. This has led to the abandonment of regular monitoring at most fixed sites because we see no defensible way to show meaningful trends in most individual water quality parameters over time. The new focus will be tailored towards condition assessments based on biological measures of condition, with supporting risk data being collected that will include some of the more normal water quality parameters (e.g. total nutrients, salinity, etc.). Trends in the overall condition of sites over time will be reported not trends in individual water parameters.
1.05.18	Permissions for use of data internally. Some data is not owned by SA Water and cannot be shared among the various branches.
1.05.19	DFW is extending the monitoring network in the GAB but no information has been passed to the Board.
1.06	<b>Modelling data</b>
1.06.1	Monitoring not looking at water quality and yet this is an important need.
1.06.2	Almost nothing is known about surface water and groundwater interactions. How is the rock holes fed?
1.06.3	Would really like to see an Automatic Weather Station at Uley South. Some sites do exist but there is some doubt about how representative of regional rainfall those sites are.
1.06.4	Big lack of knowledge about the extent of the groundwater water resources, flow rate, discharge, recharge etc. and therefore can't establish reliable extraction rates.
1.06.5	There is a need to understand more about the nature of soils e.g. moisture absorption and holding capability.
1.08	<b>Metadata</b>
1.08.1	Data and associated metadata has been collected however it needs to be collated and managed.
1.08.2	Data and metadata has been collected but needs to be collated and managed better. Some monitoring sites exist which have not been used. Gaps in knowledge have been identified but no plan has been designed to fill the information gaps.
1.08.3	Metadata is a significant gap. There are multiple standards used and would like to see a clear choice from the Bureau about a preferred standard.
1.09	<b>Understanding water accounting/water balance</b>
1.09.1	Need to identify groundwater capacity – driven by declining rainfall.
1.09.2	Even with the best monitoring infrastructure/network it is difficult to say at any one time how much ground water is available for use due to natural leakage
1.09.3	Water use and recharge by forestry is a big unknown.
1.09.4	Very little is known about the water resources in the region. No prescribed water resource and is considered to be unmanaged. Reviews are carried out by SA Water on a 5 year basis. Licences are granted for cattle but nothing is known about numbers or volume.
1.09.5	Future mining is going to be a big issue. Approximately 98% of the region is covered by exploration licences. Considered to be the biggest threat to the water resource.
1.09.6	Community sustainability of water use will be an issue. Water is being trucked to some communities e.g. Oak Valley.



## Section C – Analysis of gaps in data and systems

1.09.7	There is a big gap in knowing what a sustainable level of use is.
1.09.8	There is a need to determine how much water there is, where it is, who is using it. This need exists both inside and outside the designated areas.
1.09.9	Lack of information about non-prescribed water resources used for urban supply
1.09.10	The key issue is managing sustainable allocation of water resources for mining.
1.09.11	South Australian Arid Lands Board covers approximately 50% of the State but is the second largest contributor to GDP. Despite this, there is still very low investment in understanding the resources in the region.
1.09.12	Consciousness of water issues is a relatively new thing on KI as water had always been plentiful prior to 2006.
1.10	<b>Appropriateness of geographic coverage of monitoring sites</b>
1.10.1	Adequate coverage is essential however the staffing required to manage the data is DFW's responsibility.
1.10.2	Need more comprehensive evapo-transpiration rates – currently calculated by weather stations on a daily basis however it is limited in range/coverage. There is a need for extension of the network to improve regional knowledge.
1.10.3	Monitoring needs to be related to land use. The general network is ok, but needs to be more flexible which will support better decision making.
1.11	<b>Inconsistency of attribution of spatial information</b>
1.11.1	Connectivity between water bodies needs to be identified (surface and groundwater – only ad hoc activities)
1.11.2	Water boundaries are defined by administrative boundaries (Hundred boundaries don't relate to water boundaries which makes it difficult to focus expertise and business). Water boundaries based on rainfall, surface and groundwater required.
1.11.3	A consistent stratigraphic model needs to be built for the state
1.12	<b>Ensure cross-agency coordination in ICT investment</b>
1.12.1	Project based information gathered by stakeholders is hard to access (in general storage of captured data and access to it is an issue).
1.12.2	Had to build their own surface water archive. There was no common platform, no common language, Couldn't find the data, there were errors and now there is difficulty getting it back to DFW.
1.12.3	Difficulties in identifying and discovering common authoritative versions of datasets.
1.12.4	EDMS is an old database that was being managed and maintained by a single resource that has since left the department. EDMS was set up to manage just ambient quality data but it didn't do it particularly well and is difficult to import data into, has no remote access or web reporting capabilities. The EPA is heading towards adopting a new, user friendly database called EnviroSys that will require less support to maintain. Current funding from within the EPA is expected to be able to cover this cost.
1.12.5	No capacity to manage telemetered data in-house.
1.12.6	If more monitoring or other water information gathering systems were set up there would be no capacity to maintain and analyse it. (Info is coming in from various sources including DFW however, there is no database to store it and no HR capacity to manage) Data held on hard drives and CD's.
1.12.7	Board is looking to automate as much reporting as possible.

## Section C – Analysis of gaps in data and systems

1.12.8	Very limited understanding of groundwater/surface water interactions. Suspects that DFW should be the lead agency. More monitoring required to understand the interaction. A platform is required to handle rainfall, surface water and groundwater all together in the same format. Better relationship between SAGeodata and HYDSTRA. Data still sitting around in spread sheets and Access databases. The wetland monitoring in the Upper South East is a good example.
1.13	<b>Integrated modelling</b>
1.13.1	No capacity to link rainfall to water flow –this is an important relationship that needs to be understood.
1.13.2	Almost nothing is known about surface water and groundwater interactions. How is the rock holes fed?
1.13.3	Key issue about how the water data is analysed and reported – needs to be more effective.
1.13.4	Need a different approach to modelling for stormwater harvesting.
1.14	<b>Resourcing</b>
1.14.1	Human resources to enable the ongoing maintenance of Water Information activities (collection management analysis and reporting) are an issue. Currently activities are ad hoc.
1.14.2	Need additional resourcing to maintain their water information network.
1.14.3	Water monitoring and analysis can only be funded through projects – these are short term opportunistic not long term
1.14.4	Relationship between the regions contribution to GDP and investment in NRM is low (South Australian Arid Lands NRM = 55% of States area and 2nd highest contributor to GDP)
1.14.5	Access to DEH wetland info (includes water flows) is also difficult.
1.14.6	Much of the data used for writing WAPs is out of date or different from what was needed when the plan was last updated. What is the extent of the resource, impacts of climate change, what are the environmental needs, what is the capacity of the resource? Multiple sources of information such as different types of modelling and different databases containing information. What are the information gaps?
1.14.7	Issues are mainly around relationships, evaluation, reporting etc. rather than great gaping holes in monitoring or science. Gaps in evaluation and report were discussed at length. Re relationships; this was touched upon only briefly. There is a desire to work collaboratively between agencies but this will always be difficult due to the culture, values and different aspiration of the various agencies; classic resource managers vs. water retailers.
1.14.8	Extra telemetry would be good to improve the network and associated information however there are no resource (HR and \$) to collate analyse and maintain/support - expectation that DFW would have a bigger role here if ongoing funding could not be sourced from the C/wealth for this function.
1.14.9	Data collection is done on a project by project basis – would like to see ongoing, consistent monitoring.

## 5 Section D – Priorities for Investment

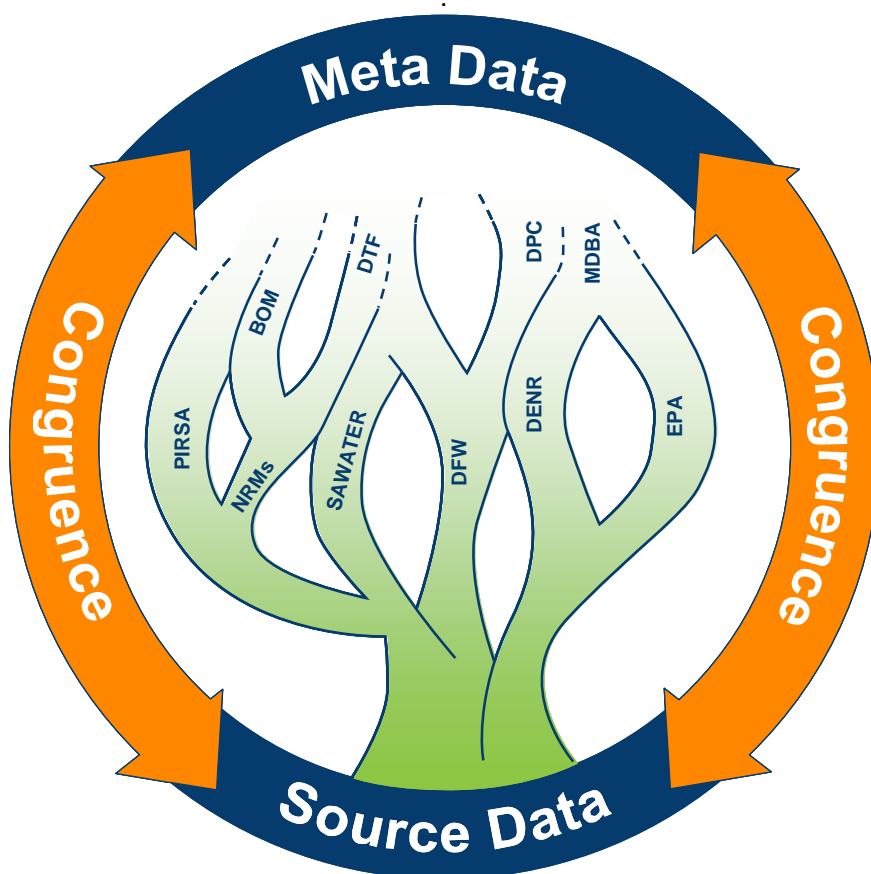
### 5.1 Early priorities (1-2 years)

#### **Establishing a web-based ‘realm’ for the water information community in government**

The overriding theme through the consultation was a desire for more integrated and water information management systems, centralised to some degree through the use of a web-based platform or portals. All recognise that they have different uses for the data, but that many of their sources overlapped. Many seek common agreement across government about what data is reliable and relevant, and many argue also for a consensus on how that data should be contextualised, aggregated and, to some degree, interpreted.

These ideas were expressed in several ways but often gravitated between the notion of having a ‘single source of truth’ to agreeing on the ‘metadata’ to both (that is, the idea that the start and end point should be the same, allowing for rich and varied analysis ‘in-between’). This has been encapsulated below (figure 7).

Figure 7 – An ideal: congruence between shared source data and overarching metadata



## Section D – Priorities for Investment

The general view appears to be that South Australia does not need one single data warehouse, but rather a shared point of access into a site that in turn links to the most commonly accessed databases. This can be conceived as a shared ‘realm’, or water information ‘neighbourhood’ for a community of users in South Australian Government.

The value from such a realm would be in part about having exposure to data sets that others are using, but more enduring and cumulative benefits could derive from creating an environment where people could share their reports, graphs, analysis and cross-reference them.

Taking the concept a step further, having created this environment that caters to a diversity of needs but which nevertheless creates a sense of community, the potential exists for users to develop common protocols for using datasets, share expertise on how to present data in different forms, and enter into a dialogue on issues that they encounter. This could be done using common tools such as creating a ‘wiki’ on the site and/or posting ideas or questions on a ‘wall’.

Ultimately, part of this data realm could be made accessible to the public, both for entry of data and information, and for viewing data or reports. (This is discussed more below.)

There will be some governance and system issues to work through initially, but the basic structures of the Water Security Council, the SAWIP Board, Strategic Water Information Coordinator and the water information community<sup>2</sup> (and possibly a Head of Profession) are in place.

Particular challenges will include:

- having someone ‘curate’ the site on an ongoing basis (to use a term that gained currency at the workshop)
- designing rules of ‘entry’ to and use of data on the site
- developing a professional culture among users that promotes information sharing, peer support, quality assurance and capability development
- empowering the user community to adopt the site as the definitive source of the truth.

These resources – particularly the water information community and its members – can be leveraged in future by the SAWIP Board to receive regular updates on data and information priorities, reducing the necessity for frequent stakeholder engagement exercises.

### **Invest in improvements to groundwater monitoring and analysis**

That a state-wide forum should be constituted for monitoring agencies as a matter of priority under the direction of the SAWIP Board so that issues identified in this and previous reports can be acted upon, particularly those issues related to funding of sites. In this way sites will not “fall through the cracks” and monitoring requirements to meet multiple needs will be identified and recorded, and budgeted for.

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<sup>2</sup> Note that the Government Agencies Statistical Committee might be thought of as a stakeholder group who could lend expertise to developing the ‘realm’.

## Section D – Priorities for Investment

This will help to ensure that the information content of collected data is maximised and that clear lines of responsibility exist for; collection, analysis, reporting, processing and storage.

There is a state-wide interest in understanding South Australia's aquifers and how they relate to surface water and to other groundwater stores. It is recognised that groundwater is inherently difficult to measure, but it most definitely a concern to many stakeholders to obtain more and better data on the Great Artesian Basin especially, as well as groundwater in the South East and Eyre Peninsula.

#### **Establishing a baseline related to current and potential resource sector operations**

Related to this is the desire for more comprehensive data, both to inform investment decisions by minerals and energy companies and to monitoring the 'take' from South Australia's water resources to ensure that it is managed sustainably.

#### **Investing in a successor to WILMA**

WILMA is a crucial application for the DFW and other agencies. However, its architecture and underlying platform are becoming increasingly out of date and less able to be integrated with other technologies and systems. At present, the department is scoping an activity to stabilise (and upgrade) its underlying IT platform. This will extend the life of the current version of WILMA. As a subsequent and separate activity, the department is working with the Commonwealth to develop a Common Registry Solution (CRS) involving six participating States and Territories, which due for delivery in 2014. The CRS will replace WILMA. In addition, the Department is evaluating the suitability of the Victorian Water Registry System as a possible alternative to the approach being taken by Commonwealth CRS and as a contingency should the CRS project not deliver.

There is the opportunity with a replacement system to improve its functionality, and increase its ability to integrate with existing systems and value add to business information delivery should funding and needs become present.

### **5.2 Medium term priorities (2-3 years)**

The Board will have its own views about relative priorities, but those listed here seem to be ones that would warrant attention within the next few years.

#### **Investigate the value of 'Super Sites'**

Even a cursory review of the networks across the different types of monitoring throughout the state reveals that there are considerable overlaps in monitoring conducted by different agencies for different purposes at varying temporal and spatial scales. This is particularly true for ecological assets that have been identified as being of significant value where project-based monitoring across a range of parameters is often conducted.

In terms of state and condition monitoring, sites where all parameters are monitored ('Super Sites') may prove to be an effective method of delivering good quality, consistent, and relevant data. By developing integrated monitoring points, or 'Super Site', where information is collected intensively across a suite of parameters such as flow, recharge, rainfall-runoff, water quality and climate alongside ecological

## Section D – Priorities for Investment

monitoring, ground water levels and groundwater quality, the capacity to identify the health of the natural resources is greatly increased. In addition, there is a need to investigate any financial implications of consolidating data collection either manually or via automatic collection and/or telemetry at a ‘Super Site’.

Within a catchment or board region a network of super sites could effectively operate as a state and condition monitoring network.’ Super Sites’ would be selected by examining each of the sampling networks for the greatest number of spatially coincident sampling points across parameters. Where parameter data gaps exist, it may be necessary to install new sample points and/or infrastructure. In some cases the value of the ecological asset may dictate establishing entirely new ‘Super Sites’.

#### **Invest in paperless process for sharing market information**

Undeniably water trading will become more frequent and widespread. As an important indicator of relative supply and demand, and a vital input into commercial and government decision-making, more timely data on price and location and volumes of trades would carry great benefits.

On the face of it, the challenge appears to be to a move from a paper-based workflow to an electronic one, so it should not be overly complicated. The irrigation trust at Loxton is already using an online system for trades. The more brokers that move to a paperless system, the easier it should be to distribute and aggregate data.

#### **Engage with local government and universities and industry**

There is some interest in extending stakeholder engagement about water information needs into the wider community. As a starting point, it would seem valuable in the medium term to engage with universities and similar institutions (locally and nationally) about the data they rely on and the extent to which there is a commonality of interest and opportunities for better collaboration and/or efficiency around data collection and analysis.

Similarly, local government holds data on stormwater and recycled wastewater that could be more widely shared and value-added.

In the commercial sector, mining companies, irrigators, foresters are all providers and users of water data and information now. Bringing them into the discussion about what data is available, what more is needed and how better it can be used would be of great mutual value.

### **5.3 Longer term priorities (4-5 years)**

#### **Moving from engagement to ‘co-production’**

Having consulted a wider stakeholder group and engaged with them on water information needs and priorities, the next step is to integrate them more as ‘co-producers’ of an integrated source of water information (albeit with some internal firewalls and protections as appropriate) that can be used more widely. That is, the goal would be to create the conditions whereby holders of useful data are prepared to provide it directly to a central repository (the ‘realm’). In return they get access to related information that can inform their own decision-making, actions or simply their understanding of the state and condition of South Australia’s water resources.

## Section D – Priorities for Investment

There will be anxiety about quality control and misuse of the data, so the ‘curator’ role and data community governance will be important. As Wikipedia has shown, however, open source peer review and ‘inter-subjectivity’ can lead to robust and more complete information set.

**A real-time data ‘dashboard’**

An aspiration of many is to have ready access to live data showing the current situation by region and state-wide in way that allows interaction and application of different overlays. Potential uses include managing River Murray operations from a single location. This is not a new idea and realistically would take several years to achieve. But it is, in a sense, the culmination of much of what has gone before – providing the combination of ‘real time’ comprehensive data presented spatially, that can be scaled up or down according to the issue at hand on the day.

It would function as a decision support tool and system that would allow users to quickly identify areas at risk, or in need of further management.

## Appendix 1 – Acronym list

**ABS** – Australian Bureau of Statistics  
**AMLR**– Adelaide & Mount Lofty Ranges  
**ANU** – Australian National University  
**Bureau** – Bureau of Meteorology  
**COAG** – Council of Australian Governments  
**CSIRO** – Australian Commonwealth Scientific and Research Organisation  
**DENR** – Department for Environment and Natural Resources  
**DFW** – Department for Water  
**EPA** – Environment Protection Authority  
**ESCOSA** – Essentials Services Commission for South Australia  
**FTP** – File Transfer Protocol  
**GAB** – Great Artesian Basin  
**GILF** – Government Information Licensing Framework  
**GIS** – Geospatial Information System  
**NGIS** – National Groundwater Information System  
**ICT** – Information Communications Technology  
**JRGWI** – Jurisdictional Reference Group for Water Information  
**MDBA** – Murray-Darling Basin Authority  
**M&E** – Modernisation and Extension of Hydrologic Monitoring Systems  
**NRM** – Natural Resources Management  
**PIRSA** – Primary Industry Resources South Australia  
**SEWCDB** – South Eastern Water Conservation and Drainage Board  
**SAWIP Board** – South Australian Water Information Program Board  
**SCADA** – Data Control and Data Acquisition System  
**SE** – South East  
**SWIC** – Strategic Water Information Coordinator  
**SWIMP** – Strategic Water Information and Monitoring Plan  
**WAP** – Water Allocation Plan  
**WDTF** – Water Data Transfer Format  
**WILMA** – Water Information and Licensing Management Application  
**WIIPSA** – Water Information Investment Priority Setting Activity



## Appendix 2 – Department for Water mini-SWIMP

### Section A – organisation and drivers

#### The Organisation

The Department for Water [DFW] was established in 2010 with an objective to ensure that there is always sufficient and sustainable water resources in SA for the health, economy, environment and lifestyle of South Australians. The government, through the DFW, has the responsibility to ensure that water is managed in a way that is socially and economically beneficial and environmentally sustainable.

The DFW is the lead water agency for South Australia and is required to meet the legislative and policy requirements of the *Water Act 2007* (Cwlth), the *Natural Resources Management Act 2004* and the *River Murray Act 2003*.

The DFW collects data from groundwater and surface water monitoring stations across the South Australia and has responsibility for the licensing of prescribed water resources and the provision of advice to the Minister on the prescription of key water resources. The DFW maintains this data, along with data from other state, federal and private agencies in the state's key water data repositories. In addition, the agency employs scientists from the fields of hydrology, hydrogeology and aquatic ecology to interpret, analyse and model future scenarios based on collected monitoring data.

Discharging the responsibility for water access entitlement and water allocation management is dependent on the maintenance of accurate water access entitlement and water allocation data in the Water Register.

The department's priorities are focussed on addressing:

- water for our communities, including a healthy River Murray, managing sustainable surface and groundwater resources and developing sustainable water sources
- water for our environment including ensuring the health of water dependant ecosystems and transparency through water accounting
- water for our economy ensuring competitive and innovative water markets
- water reform covering legislation, policy and pricing of water and wastewater services
- science, policy and technology to increase knowledge, understanding and management of our water resources.

### **Water information drivers**

The DFW has responsibilities under both state and federal legislation to report on the state, condition and capacity of South Australia's water resources. The agency has leadership responsibilities for providing and exchanging information on a daily basis with the Commonwealth, NRM Boards and other external stakeholders and is required to meet the legislative and policy requirements of the *Water Act 2007* (Cwlth) and the *Natural Resources Management Act 2004*. In addition, DFW has a responsibility to provide the Government with evidence-based policy advice. The collection and management of reliable data and information is key to the development of sound policy advice.

#### ***Water Act 2007 (Cwlth)***

The Water Act 2007 (Cwlth) is an Act to make provision for the management of the water resources of the Murray-Darling Basin, and to make provision for other matters of national interest in relation to water and water information, and for related purposes. A number of objectives of the Water Act drive the collection of water information. Specifically:

- to achieve efficient and cost effective water management and administrative practices in relation to Basin water resources
- to provide for the collection, collation, analysis and dissemination of information about:
  - Australia's water resources
  - the use and management of water in Australia.

#### ***Natural Resources Management Act 2004 (State)***

From a water resource perspective this Act calls for the Minister to:

- keep the status and condition of the water resources of the state under review
- conduct and support research into the preservation, protection, management, enhancement, restoration or rehabilitation of the state's water resources
- compile, maintain and update information in relation to the state's water resources;
- promote public awareness of the importance of the state's water resources and to encourage the conservation of those resources
- maintain and make available for public inspection a register of water management authorisations and permits granted under the Act.

***River Murray Act 2003 (State)***

The River Murray Act (2003) aims to protect the River Murray system through ensuring that development and other activities with an effect on the River are ecologically sustainable, and undertaken in a way that does not harm the River. The Act also aims to restore and enhance the health of the River Murray by promoting a healthy working River Murray system, sustaining communities and preserving the unique values of the system.

From a water information perspective the Act requires the Minister to:

- undertake monitoring programs to collect data on the state of the River Murray and other relevant information, and to assess and apply other information relevant to the River Murray obtained from other programs or sources
- conduct or promote research and public education in relation to the protection, improvement or enhancement of the River Murray
- keep the state of the River Murray under review.

***Water for Good***

*Water for Good* is a State plan with the aim to ensure water supplies in South Australia are:

- secure, safe, diverse and reliable
- can sustain population and economic growth.

The plan details 94 actions focussed around water recycling, desalination, conservation, water markets and trading, scientific research, community education and information provision. The implementation of the plan is the responsibility of DFW.

Under the plan, the Minister will produce an annual statement that will:

- ...provide demand-supply status for each region
- Identify and analyse impacts of any emerging issues.

The successful completion of these actions, and the plan's reporting requirements, will be underpinned by quality data and information.

***Water for the Future***

*Water for the Future* is a ten year Federal Government program to invest in improved water management and water policy reform. Within this program there is a major emphasis on the collection and provision of data and information via the Bureau of Meteorology to address water management questions at the Federal level and for the development of National Water Accounts.

## **Other State Programs**

### **SA Strategic Plan**

SASP T3.9 - sustainable water supply

### **Water Allocation Planning**

Assisting NRM Boards with the development of Water Allocation Plans for prescribed water resources.

### **Groundwater Program**

Groundwater is a key water resource throughout South Australia. Approximately 65% of all irrigation water is sourced from groundwater supplies. Many communities in the arid regions, Eyre Peninsula and the South East are groundwater dependent. The DFW's Groundwater Program aims to increase the technical information base about South Australia's groundwater resources to support planning and management capabilities within the state. Included within this is the optimisation of the state's monitoring networks to efficiently provide the information required for assessment of the sustainability of water resources. A priority initiative of the project is also improved communication and information management.

### **Other drivers**

The DFW is the agency designated as the Flood Hazard Leader within State Government and therefore has responsibility for assessing flood risk and proposing mitigation strategies. In addition, the DFW has responsibility for flood warning along the River Murray. Flow monitoring along the River Murray and modelling of flood behaviour are the key activities for these functions. The DFW also has responsibility for the management of the Patawalonga lakes system, with telemetered monitoring both upstream of, and within the system, critical functions for this role. Finally, the DFW collects water information for short term projects that seek to answer specific water management questions, and in relation to other Commonwealth and international agreements.

### **Questions our organisation seeks to answer and steps taken to answer**

In collecting water information, the DFW seeks to understand the current state and condition of the state's water resources and the response of the water resources to both seasonal and long term climate variation. This requires the compilation of a long term dataset of resource behaviour across the state, with monitoring sites established at the end of catchments or key locations across groundwater resources. In areas of high value water resources, such as those where there is a significant demand for water, increased monitoring is required to produce a more comprehensive picture of the response of the resource to usage and to assist in decisions made about the allocation of resources.

Other questions the DFW seeks to answer include:

- What are the sustainable yields for a particular water resource?
- What are the requirements of water-dependant ecosystems?
- What is the extent of available stormwater and wastewater for recycling programs?
- What are the natural characteristics of surface water catchments and groundwater aquifers?
- What is the degree of interaction between surface water and groundwater resources, in particular how does this impact the groundwater recharge processes?
- What is the measurable impact of drought and climate change on water resources?
- What is the impact of management practices on water resources – particularly for groundwater dependant communities?
- What is the effectiveness of water conservation measures?
- Have water resources been over allocated?
- What alternate water sources are available for use (e.g. stormwater, recycled water)?

## **Section B - outline of water information assets**

### **Water resource monitoring network**

The DFW spends approximately \$2.88 million per year operating and maintaining a network of stations to monitor surface water, groundwater and dry land salinity. These sites, in combination with a smaller number of sites operated by other agencies, provide the information required to formulate the evidence base that supports the DFW's policy development and water resource assessment, management and reporting activities.

### **Groundwater**

The DFW maintains 4564 observation wells in 146 monitoring networks. In addition, the department has an interest in 7540 private and other government department wells from a monitoring data perspective. Monitoring is generally for either salinity or water level; however both parameters are measured at some wells. There are 24 sites connected to the DFW's telemetry network, providing near real-time data, while approximately 336 sites have stand-alone data loggers. In addition to the telemetered and standalone data monitoring network the DFW maintains the water supply process control infrastructure in the APY lands and other Aboriginal communities and records operational and regional water level and water quality data at these sites. Thirty four of these sites are connected to a SCADA network to allow remote monitoring and control of these critical water supply sites. As part of the water allocation planning process in a number of NRM Board areas, a number of licensed wells in prescribed areas are monitored either yearly or twice yearly for water quality parameters including salinity and pH. This data is maintained in the state groundwater archive.

### **Surface Water**

The DFW maintains 146 surface water monitoring sites established to monitor the state and condition of water resources, for River Murray operations, and to manage and report on the effectiveness of the salt interception schemes. A further 36 sites are maintained for rainfall and climate data. Data is also received from 33 sites maintained by the South East Water Conservation and Drainage Board and a small number of sites maintained by other government agencies, Santos or SA Water. Approximately 174 surface water monitoring sites (including rainfall and climate sites) maintained by The DFW is connected to the telemetry network, with standardised data loggers and modems. The majority of the other sites have a variety of models of stand-alone loggers which are progressively being moved to a standardised platform where possible. The primary parameters collected are level, flow, salinity and rainfall, with a limited number of other water quality and meteorological parameters at some sites including turbidity, pH, redox, and wind.

## Telemetry Network

In addition to the sites mentioned above, there are approximately 50 additional surface water sites that are owned and maintained by external agencies that are also included in the DFW's telemetry system. A dial-up, or circuit switched, telemetry system is used for most sites using Next G mobile, satellite and standard PSTN connections. The DFW is currently implementing an IP, or packet switched, telemetry system using Telstra's Next G mobile internet network. This BoM funded project will migrate a minimum of 116 sites from dial-up telemetry to IP telemetry by June 30th 2011. It is anticipated that all remaining non-satellite dial-up telemetry sites will be migrated to IP telemetry during the 11/12 financial year. This project has also developed an application to report on exceptions, failures and performance issues within the telemetry system to systems administrators. This will enhance the reliability of the telemetry system and the data made available on the DFW's telemetry websites.

## Water register

Water management authorisations granted under the *Natural Resources Management Act 2004* include water licences endorsed with water access entitlements, water allocations, water resources works approvals and site use approvals. The effective management of prescribed water resources across the state is dependent on the maintenance of accurate water access entitlement and water allocation data. The accuracy and availability of water access entitlements and water allocation data assists in the development of competitive and innovative water markets. The quantity of water allocation remaining available to be taken is informed by accurate and timely water usage data.

## Data management systems

The DFW has five state archival water databases:

- Hydstra – a time series database that manages the storage, analysis and distribution of surface water data. Hydstra is very efficient at storing large amounts of time series data and includes a useful set of reporting and analysis tools specific to time series data, however, the core technology behind the system is over 25 years old and as a result the database is difficult to integrate with modern systems and applications.
- SAGeodata - manages the storage, analysis and distribution of groundwater data. It is a custom database developed and maintained by DFW and Primary Industries and Resources SA on an Oracle platform. Time series data is stored in SAGeodata, but the database is not structured for optimal management or analysis of time-series data. Data is presented through the DES and OBSWELL applications. An upgrade to the data logger module in SAGeodata is presently underway to enable archiving of both standalone and telemetered time series logged data.
- Water licensing data is managed in WILMA (Water Information and Licensing Management Application), also a custom application developed on an Oracle platform. WILMA is the source of truth for water access entitlement, water allocation and water taken (usage) data for prescribed groundwater and surface water resources across the state.

Appendix 2 – Department for Water mini-SWIMP

- AMIS – manages asset information across the DFW including information about monitoring sites and associated monitoring assets. AMIS is an SQL Server-based application and therefore integrates readily with the DFW's web systems.
- Spatial data related to water information is stored and maintained in an enterprise GIS system on an ESRI platform.

The preferred method for the delivery of water data is via web systems developed and maintained within the DFW. Hydstra, SAGEodata and WILMA do not integrate with the majority these systems, so it has been necessary to develop the DataMart. This is a set of three SQL Server databases that duplicate selected tables from the archival databases to provide the web systems with access to the data.

With assistance from the BoM, the DFW is participating in a national project to implement an instance of the National Groundwater Information System [NGIS]. The NGIS is a data model for the integration of spatial and textual (non-spatial) into a single spatial geodatabase for groundwater data. The implementation of a geodatabase based on this data model facilitates sharing of data across agencies and jurisdictions and also gives users access to much of the state's key groundwater data within desktop GIS. Currently hydrostratigraphic data for over 13,000 wells is being migrated from SAGEodata into the NGIS geodatabase.

Finally there are a number of smaller databases/data management systems which may be stand-alone or may feed into the larger archival systems. These include, but are not limited to:

- ecological monitoring databases
- Meter Data Management System – a prototype system used in part for meter data from the South East
- risk assessment tool for water dependant ecosystems
- surface water and groundwater modelling data.

## Metadata

There are very few structured metadata documents that describe the context and use of water information datasets. There are significant resources available to provide information about monitoring sites, site histories and the data collected, however these are often not readily accessible nor maintained in a structured system. This data is distributed across all data management systems (e.g., SAGEodata contains a substantial dataset on well construction and purpose) but within these systems the data is not stored in such a way as to make it readily accessible in a structured format. In addition, the lack of integration between the different systems further restricts ease of access.



## Section C – system component assessment/review

The following gaps, issues and aspirational opportunities, subject to resource availability, exist in the water information area within the DFW:

1. On behalf of the DFW, Australian Groundwater Technologies has recently completed a review of monitoring activities in six NRM regions. The opportunity exists to optimise the state's monitoring network within these regions based on the findings of this review.
2. There is an opportunity to integrate the five data management systems through the development of a single system for managing water information within DFW (Hydstra, SAGeodata, WILMA, AMIS, GIS), to assist in the reporting, analysis, assessment and appropriate allocation of water resources.
3. The compilation of metadata relating to monitoring sites and data into central searchable system would significantly improve access to critical data.
4. Improve standardisation of site, parameter and quality codes attached to water data to a single format that aligns with BoM's WDTF.
5. Communities in the regional SA are often entirely groundwater dependent. The DFW should continue to develop and promote opportunities to assess water resources in non-prescribed areas to support sustainable economic development. Improving the information available for groundwater dependent regional communities would significantly improve the ability to manage groundwater resources.
6. Arid areas hydrology would benefit from a broader information base to support evidence based policy and management decisions. This has implications not only for water supply but also infrastructure (e.g., mining, roads, telecommunications and rail).
7. Opportunity to utilise technology (e.g., telemetry) to improve the consistency and frequency of the capture of water resource usage data to assist in water resource management and water allocation management.
8. Water resource usage data is currently stored and managed in a number of systems and applications (e.g., spreadsheets). Rationalising these into a single data management system would greatly facilitate the management and accessibility of this data.
9. Increased quantity and frequency of water use data collection would improve DFW's capability to more fully assess and report on the capacity and sustainability of the state's water resources.
10. Improving the understanding, quality and utility of the state's water accounting and water balance will improve the integrity of analysis, assessment and evaluation of decisions made in the planning and allocation of water resources.
11. In some regions, aquatic ecosystems are at risk because of gaps in understanding of the nature of the systems.

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### Appendix 2 – Department for Water mini-SWIMP

12. Clarify roles and responsibilities for monitoring and reporting of ecological data within State government agencies. This includes arrangements for collecting, managing and sharing data.
13. The DFW's IP telemetry system has far greater network capacity than the DFW can use at this time. Pursuing opportunities to share this capacity with other agencies using telemetry could reduce costs for all agencies. This system also has capacity to support significant capture of water use data should electronic capture of this data be implemented within the DFW.

## Section D – priority areas for investment

The following is a list of aspirational priority areas for investment in water information within the DFW subject to resource availability:

- Operational funding to support efficient capture and management of water information
- Monitoring infrastructure – in particular site infrastructure and telemetry infrastructure including a greater time series of data in a format that can be accessed for analysis- to assess impact of climate variations
- Water licensing systems development to deliver enhanced management and reporting on water licenses, access entitlements, permits, allocations and usage that support interoperability with national systems
- Information technology Infrastructure, including improved data management systems that allow for systems integration and integrated modelling and analysis of data
- Improved understanding of water resources in non-prescribed areas, with a particular focus on areas identified as possible regions for future development that could have a significant impact on regional water resources(e.g. mining)
- Improved metadata to enable improved search and retrieval of data
- Improved data sharing between agencies, both within SA and at a national level, to provide easier access to other data sources
- Improved quality assurance and quality control of data
- Improved processes that enable reporting on the state and condition of South Australia's water resources
- Improved tools and inquiry capability for graphical presentation of data to aid analysis and reporting to the public
- Improved collaboration across the sector particularly with regard to geofabric data
- Improved asset management systems and procedures to enable efficient investment into monitoring assets
- Improved property level water usage data collection, storage and management that supports water accounting.

## Appendix 3 – SA Water Corporation mini-SWIMP

### Section A - organisation and drivers

#### The organisation

##### Core business

To deliver drinking water, recycled water and wastewater services using assets we own and operate.

Core functions include:

- water and wastewater quality, transport and treatment
- constructing, managing, maintaining and operating water ,wastewater and recycled water networks
- water quality research and development
- asset management
- customer service
- information systems.

Our stakeholders include:

- our customers – residential, commercial, non-commercial, agricultural and industrial
- the Government of South Australia, the Treasurer, the Honourable Jack Snelling MP
- the Minister for Water, the Honourable Paul Caica MP and government agencies
- metropolitan, rural and remote communities of South Australia
- our employees
- contractors and suppliers
- Natural Resources Management Boards.

#### Water information drivers

##### Our organisation

SA Water is wholly owned by the Government of South Australia.

Established by the *South Australian Water Corporation Act 1994*, SA Water came into being on 1 July 1995. Our history can be traced back to 1856 just 20 years after the European settlement of South Australia when the Waterworks and Drainage Commission was established. This later became the Engineering and Water Supply Department (E&WS), then SA Water. With our contractors we now provide water and wastewater services to approximately 1.5 million people across South Australia.

SA Water is responsible to the Minister for Water, the Honourable Paul Caica MP.

The Minister appoints the members of the Board and an independent observer may attend all Board meetings. The current independent observer is Linda Hart from the Department of Treasury and Finance. We have relationships with a number of agencies of government and work most closely with:

- Department of the Premier and Cabinet
- Department of Treasury and Finance
- Department for Water
- Department for Environment and Heritage
- Department of Health
- Environment Protection Authority.

### **Critical public assets**

SA Water owns, operates and maintains more than \$9 billion worth of assets including:

- more than 26,200km of water mains
- more than 8,600km of wastewater mains
- 30 water treatment plants
- 25 wastewater treatment plants.

### **Our vision**

Water for growth, development and quality of life for all South Australians.

### **Our reports**

We publish an Annual Report incorporating our Sustainability Report in line with statutory requirements and in accordance with reporting guidelines from the South Australian Department of the Premier and Cabinet. We also publish a Drinking Water Quality Report detailing performance against the Australian Drinking Water Guidelines. This adjunct report focuses specifically on our performance in the management and delivery of drinking water to our customers.

To ensure our reports are relevant to our stakeholders, we refer to numerous sources including:

- South Australia's Strategic Plan – [www.stateplan.sa.gov.au](http://www.stateplan.sa.gov.au)
- SA Water's Strategic Map 2009-14
- SA Water's Corporate Environmental Management Plan and our ISO14001 certified Environmental Management System
- SA Water Sustainability Policy suite
- feedback and content of past reports
- industry and utility reports
- *Water for Good Plan*.

## Relevant Legislation

### ***Public Corporations Act***

Subject to this Act, SA Water is a commercial entity providing services in accord with prudent commercial principles and striving to provide a commercial return to Government. Non-commercial operations may be carried out, but must be provided in an efficient and effective manner. The *Public Corporations Act* requires SA Water to:

- operate within the Parliament's and Government's intentions for the nature and scope of Corporation activities as expressed by the *South Australian Water Corporation Act 1994* and the SA Water Charter
- act in accord with the control and direction of the Minister for Water
- publish in its annual report any direction issued by the Minister.

### ***South Australian Water Corporation Act 1994***

Establishes SA Water and makes it subject to the *Public Corporations Act*. SA Water's functions are set out in Section 7 of the Act. The Corporation's primary functions are to provide services for the:

- supply of water by means of reticulated systems
- storage, treatment and supply of bulk water
- removal and treatment of wastewater by means of sewerage systems.

Under the Act, SA Water has the following further functions:

- to carry out research and works to improve water quality and wastewater disposal and treatment methods
- to provide consultancy and other services within its areas of expertise
- to commercially develop and market products, processes and intellectual property produced or created in the course of its operations
- to advise users of water in the efficient and effective use of water
- to encourage and facilitate private or public sector investment and participation, whether from within or outside the State, in the provision of water and wastewater services and facilities
- any other function conferred on the Corporation by this Act, any other Act or the Minister, or delegated to the Corporation by the Minister.

### ***Sewerage Act 1929***

Empowers SA Water to construct and operate sewerage systems.

### ***Waterworks Act 1932***

Empowers SA Water to construct and operate water supply systems.

***Metropolitan Drainage Act 1935***

Provides for flood mitigation works on the River Torrens, Sturt River, and the Brownhill and Keswick Creeks. SA Water administers this Act on behalf of the Minister for Water.

***Rates and Land Tax Remission Act 1986***

Provides for rates concessions for various rates to be granted to eligible pensioners. The remission scheme is funded by the Government but administered by SA Water.

**Other legislation/Legislative review**

More than 120 other Acts have a direct impact on the activities of SA Water. In June 2009 the Government released Water for Good in which it committed to a comprehensive review of the legislation covering the water industry to provide a more contemporary legislative framework for the provision of water and wastewater services in South Australia. SA Water welcomes this review which is being coordinated through the newly formed Department for Water.

**Issued water licences**

The South Australian Government has issued water licences to the Corporation under the *Natural Resources Management (NRM) Act 2004*. The licences have conditions attached which restrict the use of the allocations endorsed thereon. The details of these water licences are as follows:

Rights other than those relating to the River Murray are:

- Various South East Region licences.
- Various Murray Mallee Area licences.
- Various Eyre Peninsula Region licences.
- Licence 4484 McLaren Vale Licence for the Aldinga Wastewater Treatment Plant.
- Licence 5706 Northern Adelaide Plains Licence for the Bolivar Wastewater Treatment Plant.

River Murray water rights are conferred via multiple instruments:

- Licence 2333 River Murray Licence for Metropolitan Adelaide.
- Licence 2334 River Murray Licence for Country Adelaide.
- Various other River Murray licences that can be used for Adelaide, Country or other purposes.
- In addition, SA Water also owns water rights held under the *Victorian Water Act 1989*. The rights held are:
  - WEE043798, high Reliability Goulburn Zone 1A water share.
  - WEE047878 high Reliability Murray Zone 7 water share.

The allocations made to these water shares are able to be transferred for use in South Australia.

**Water rights. - Permanent**

The Corporation has purchased a series of tradable water rights. The rights are perpetual and are accumulated as Water Access Entitlements onto licences held by the Corporation issued by the South Australian Government under the *NRM Act 2007*, and as Water Shares issued by the Victorian Government under the *Water Act 1989*.

**Seasonal water allocations - temporary**

In addition to the permanent water allocations above, during 2008-09 and 2009-10 the Government granted approval for SA Water to purchase seasonal water allocations to be used for critical human needs in 2009-10 and 2010-11. SA Water also purchased water allocations for operational needs. These purchases have been treated as other assets in the accounts and will be expensed as the water is used. At 30 June 2010 the Government have approved the carry forward of unused water allocations to the following year in 2010-11.



## **Section B - outline of water information assets**

### **SCADA system**

SA Water uses SCADA (Supervisory Control and Data Acquisition) system to monitor its network of reservoirs, pumping stations, pipelines, water treatment plants, wastewater treatment plants and other telemetered systems. This system acquires and stores operational data from an extensive telemetry network. While the SCADA system does store some historic operational data, it is not generally used to store long term historic data. The ODS (Operational Data Store) has been created for this purpose. In terms of water data, the primary focus of the SCADA system is to accurately collect and store data, which is then transferred to the ODS for storage and accessibility for other users. Water data collected by the SCADA system includes flow rates in pumps, pipes and rivers, water levels in dams, rivers and reticulation reservoirs.

### **ODS**

The ODS (Operational Data Store) is a recently implemented SA Water system. This system will enable warehousing for all corporate time stamped operational data and will allow trending and analytical analysis of the performance across multiple measures. To date some SCADA data has been made available to users of this system. However more information will be made available as the system is expanded.

### **LIMS**

LabWare LIMS (Laboratory Information Management System) primary purpose is to schedule water sampling, record water quality parameter results, and associated water quality sampling sites and their metadata. Water quality results are transferred to an in-house built system called WaterScope. Data is obtained for both SA Water (as its own internal customer) as well as other external customers including the EPA and SA Water contractors.

### **WaterScope**

WaterScope is an in-house built system for long term storage of water quality results for both SA Water and the SA Water laboratories (Australian Water Quality Centre) customers. It contains both water quality results and some associated metadata for sampling sites and analysis information.

### **AquaMap / GIS (Geographic Information System)**

AquaMap is SA Water's web based mapping application. AquaMap is an enterprise information portal, an application enabling access to information stored in a variety of corporate information systems from a single map-orientated interface. AquaMap uses web technology and has been developed using standard IT tools and methods and provides a range of query and reporting functions supporting a wide range of business processes.

### **Hydraulic Modelling**

SA Water uses WaterGEMS for water network modelling and InfoWorks for wastewater network modelling. These applications are used by specialised engineers to model scenarios for growth and the impact on the existing reticulation network.

### **Enterprise Data Warehouse (currently in development)**

The Enterprise Data Warehouse aims to be a centralised store of information providing services for all of SA Water. The warehouse will contain a large repository of historic and current data specifically targeted to assist in business decision making activities. The Enterprise Data Warehouse will be scalable across several dimensions within the organisation, and have the ability to handle the growth of data over time, as well as the growing complexities of processes associated with the evolution of new and improved business processes.

### **DamSmart**

DamSmart is a database of dam information used by SA Water's Dam Surveillance Unit to store and monitor dam safety requirements in accordance with ANCOLD (Australian National Committee on Large Dams) guidelines.

We currently use DamSmart to store data received from instrumentation on our dams, earth bank storages and River Murray structures.

Such instrumentation includes:

- piezometers in dam walls
- inclinometers in dam walls
- surveyed movements in dam walls, both level surveys and transverse surveys
- reservoir levels.

DamSmart also stores attributes of dams, earth bank storages owned by SA Water and River Murray locks, weirs and Lake Victoria maintained and operated for MDBA (Murray-Darling Basin Authority).

**Maximo**

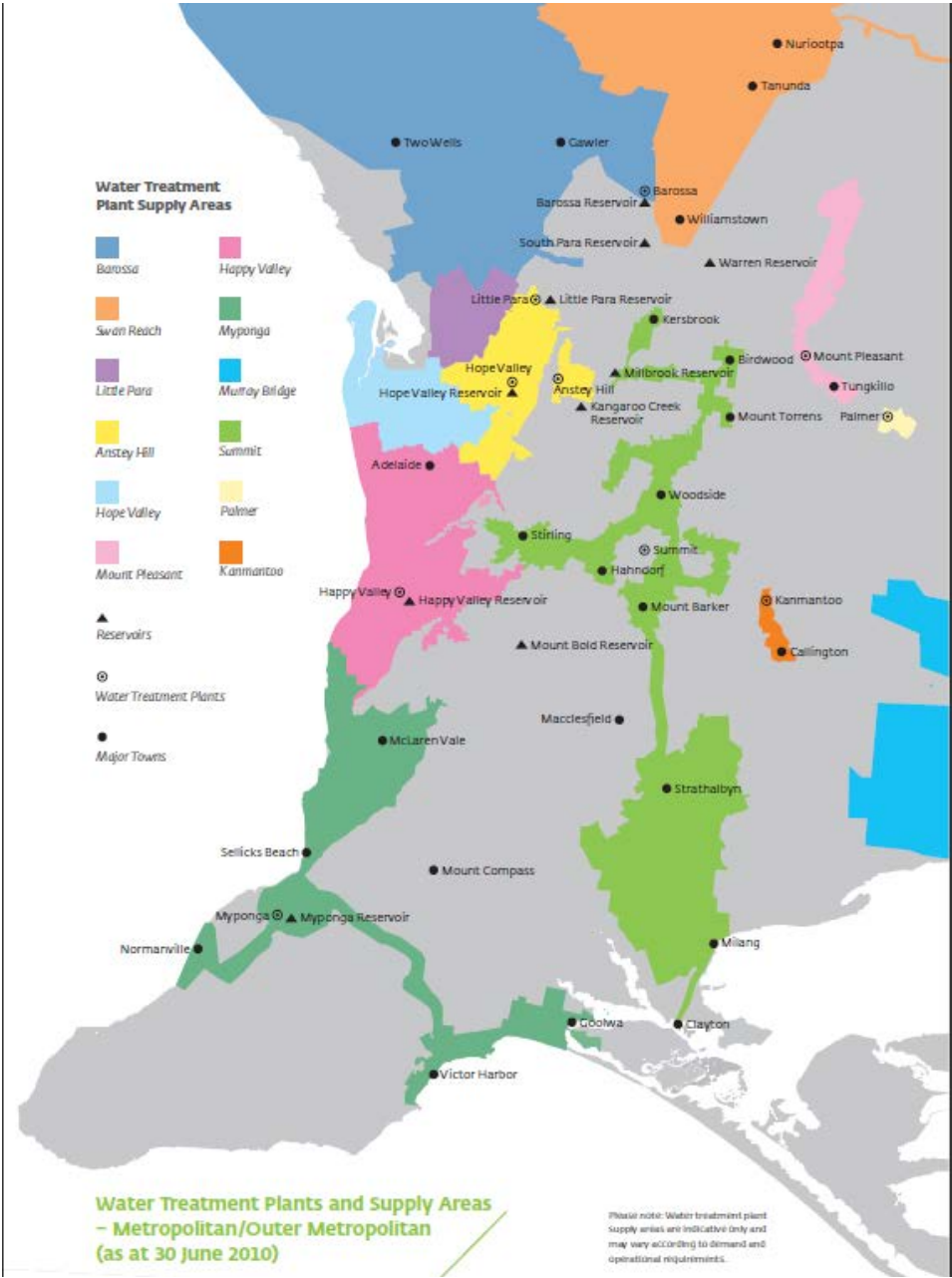
Maximo is SA Water's choice of enterprise works and asset management software for the management of its network assets and field work force. This system aims to deliver services to meet customer and operational charter requirements effectively and efficiently. It is used to provide information for long and short-term asset planning, to plan and schedule preventive, reactive and condition-based maintenance, optimise resource utilisation, and measure key customer and operational charter performance indicators.

## Appendix 3 – SA Water Corporation mini-SWIMP

## Description of water networks



Appendix 3 – SA Water Corporation mini-SWIMP



## Section C – system component assessment/review

Note these items are not necessarily meant to imply all areas of SA Water's investment only ones that align significantly with water information pertaining to quality and quantity.

### **Enterprise Data Warehouse (currently in development)**

SA Water is progressing the EDW project. A conceptual model for the Electronic Data Warehouse Technology platform has been produced. A pilot has been conducted where a number of lessons learnt have been used to define the path forward. Recommendations for an effective way forward have been proposed. Business drivers to leverage from this project include:

- asset management
- North South Interconnection Project
- economic Regulation
- Regional Operations - KPI reporting
- O&M Alliance Metropolitan Operations KPI reporting.

### **Various MS (Microsoft) Excel Spreadsheets**

SA Water has identified several instances of data being measured and stored within MS Excel spreadsheets. We are reviewing this data to assess if it's suitable to be entered into a corporate database such as the ODS previously mentioned in section B or a planned future system called the Data Warehouse.

### **South AustraliaQUADAT historic water quality data**

SA Water is also investigating migration of some historic water quality data into its water quality repository (WaterScope). This data is pre-1997 water quality data and extends back for a period of time.

### **WDTF formatting of data investigating OSI Soft options of module**

As a result of our obligations to deliver data to the Bureau of Meteorology, SA Water is investigating the viability of an externally produced module to assist with the delivery and formatting of data to BoM's desired requirement.

## Section D – priority areas for investment

### **Enterprise Data Warehouse (currently in development)**

SA Water is progressing the EDW project. A conceptual model for the Electronic Data Warehouse Technology platform has been produced. A pilot has been conducted where a number of lessons learnt have been used to define the path forward. Recommendations for an effective way forward have been proposed. Business drivers to leverage from this project include:

- North South Interconnection Project
- economic Regulation
- Regional Operations - KPI reporting
- O&M Alliance Metropolitan Operations KPI reporting.

### **Various MS (Microsoft) Excel Spreadsheets**

As explained in section C, SA Water has several MS Excel spreadsheets that contain some water information. The long term storage of this data is a priority for SA Water.

### **WDTF formatting of data investigating OSI Soft options of module**

SA Water is continuing to investigate this option during the 2011 / 2012 financial year.

## Appendix 4 – Forestry South Australia mini-SWIMP

### Section A - organisation and drivers

ForestrySA is a state government corporation which manages both native forest reserves and commercial pine plantations across the higher rainfall regions of South Australia. Established in 1876 as the Woods and Forests Department, the agency has a long history of climate measurement at district headquarters in the southern Flinders Ranges, Mount Lofty Ranges and south east South Australia. The existence of commercial plantation forestry is predicated on the requirement for a minimum 600mm annual rainfall, the vagaries of climate at different time scales, and the requirement to adapt and respond to climate signals.

Rainfall is viewed as the main driver of forest growth, and understanding of regional variation is critical for management of plantations under changing climatic conditions. Records of rainfall and temperature (max, min, 0900 and 1500 DB and WB) have historically been taken at forest district headquarters by foresters and clerks, however many forest reserves have been amalgamated over time and daily readings discontinued. Data has been supplied to BOM at monthly / annual scales, although some observation stations have reported readings at 0600, 0900 and 1500 during the fire season.

As the major forest plantation owner in South Australia, ForestrySA is acutely aware of the need for accurate and timely rainfall data to estimate soil and fuel moisture levels (and forest / grassland fire danger levels) over the summer months. The higher rainfall areas are among the most productive and economically important parts of South Australia, and support large primary and secondary industries, infrastructure and rural populations.

ForestrySA has only modest water information requirements at this stage. Most organisational need have been met by climatic observations (rainfall / temperature) rather than hydrologic measurements of water yield and quality.

ForestrySA has a formal agreement with EPA to provide monitoring of herbicide concentrations in streamflow at exit points from forest catchments in proclaimed water catchment in the Mount Lofty Ranges over the first few years of each rotation. Most streams are ephemeral, no measurements of flow are undertaken, and samples are usually taken after any significant winter rainfall events.

The potential for forestry plantations to be licensed under water allocation plans in the SE region has placed greater emphasis on the need for water data. However there are only limited surface water resources in the SE region and extensive groundwater resources which cannot be seen (monitored from bores as point sources). Scaling of plot based estimates of plantation water use to a regional basis remains a significant issue to the entire forest industry as water management zones are based on cadastral boundaries rather than hydro-geological (catchment) zones and current estimates of plantation water use lead to overallocation issues.



## **Section B - outline of water information assets**

ForestrySA has very limited monitoring networks at present. With Round 2 BOM funding, a pluviometer network was established across the higher rainfall regions of South Australia using sites with either long term rainfall records or adjacent bores or weirs with dataloggers measuring changes in water levels (in conjunction with the DFW / SECWDB funding application for the SE region). This will expand the temporal and spatial resolution of available data, allowing calculation of rainfall intensity and sub daily totals, and a better understanding of meteorological inputs and outputs.

ForestrySA also has one main catchment study at Knott Hill in the Mount Lofty Ranges, maintained by Water Data Services (Appendix 1). A second catchment was previously gauged, however after failure of the Starflow logger, measurements were discontinued.

It is envisioned that pluviometer data download from loggers will occur every two – three months, validated and delivered via DFW HYDSTRA to BOM. Hydrologic data from the Knott Hill catchment is supplied to BOM directly by Water Data Services.

## **Section C – system component assessment/review**

The pluviometer network could be expanded to other parts of the forest estate in South Australia in co-operation with other forestry companies, but any expansion really needs to be integrated with other regional hydrologic networks (DFW / SECWDB / SE NRM Board) to maximise regional benefits.

The loss of CSIRO Forestry staff and equipment from the SE region has reduced the capability to undertake precise measurements of tree water use (using sapflow technology / soil evaporation/ soil neutron moisture monitoring).

Further catchment studies in the Mount Lofty Ranges would assist in closing the water balance of forested catchments, and allow calculation of tree water use without the need for expensive plot based measurements using sapflow technology (and attendant scaling issues).

## **Section D – priority areas for investment**

There is probably a greater need for low cost AWS with telemetry to assist with monitoring of soil and fuel moisture levels (and forest / grassland fire danger levels) over the summer months. This is of particular value during fire fighting operations where data from sites close to the fire would be of maximum value, particularly wind speed and direction (influencing flame height and rates of spread).

## Appendix 5 – Northern & Yorke NRM Board mini-SWIMP

### Section A - organisation and drivers

#### **Water information drivers**

1. Clare and Baroota Prescribed Water Resources Areas Water Allocation Planning Process.
2. Implementation of actions to meet the targets of the Regional and State NRM Plans.
3. State of Environment Assessment requirements for reporting to the public and the State.
4. Accurate information to increase community awareness and acceptance of water resource usage or impact restrictions
5. Community concern over extraction levels and the health of the system

#### **Questions your organisation seeks to answer and steps taken to answer**

1. Extent and condition of the regions current water resources.
2. Level of change in the extent and condition of the regions water resources over time.
3. Sustainable extraction levels linked to climatic trends
4. Demands on water resources; current and potential uses and rates of extraction.
5. Condition of the region's water dependant ecosystems and threats to their future condition.

## **Section B - outline of water information assets**

The Northern and Yorke NRM Board is predominantly reliant upon monitoring that is conducted by the Department for Water, the Environmental Protection Agency, SA Water and the Bureau of Meteorology. NRM staff have commenced a monitoring program for permanent pools in priority surface water areas. Annual irrigation reporting surveys of the Clare PWRA Imported water users to be incorporated on Clare Valley website being developed by the Department for Water. The Northern and Yorke information system is now functional, water data and information collection functions will be added in future versions.

## **Section C – system component assessment/review**

River Management Plans previously written by Department of Water, Land and Biodiversity Conservation to be used to inform creation of catchment scale riparian projects in priority surface water areas.

Appendix 1: Excerpt: DWLBC (DFW) Report 2006/15: Northern and Yorke Natural Resources Management Region Water Monitoring Review, Sally Roberts.  
Tables 4 – 29.

## **Section D – priority areas for investment**

Appendix 2: Northern and Yorke NRM Region Water Monitoring Proposal May 2009, Ruth Coates.

## Appendix 6 – Kangaroo Island NRM Board mini-SWIMP

### Section A - Organisation and Drivers

The Kangaroo Island Natural Resources Management Board (KI NRM Board) is responsible for setting the strategic direction for natural resources management, including water, on Kangaroo Island.

The KI NRM Board has developed the Kangaroo Island Natural Resources Management Plan (The Plan) which was adopted by the Honourable Jay Weatherill, Minister for Environment and Conservation on 2 September 2009.

The Plan describes the current state of natural resources, including water on Kangaroo Island, identifies goals for managing natural resources and a scheme for implementing natural resources management programs and policies. The Plan also contains an operational plan for monitoring, evaluating, reporting, learning and improving Natural Resource Management.

In relation to water management, the plan identifies the following Regional Targets and Board Targets that will contribute the Regional Targets;

**Regional Target RT 1.6 – By 2018 water quality in the Cygnet River at Bark Hut Road meets NWQMS (National Water Quality Management Strategy) targets for lowland rivers at least 95% of the time.**

#### **Contributing Board Targets**

**BT 1.8** – By 2013 all targeted watercourse management and rehabilitation works for Cygnet River catchment are completed

**BT 1.12** – By 2013 a targeted water monitoring program is developed

**Regional Target RT 1.7 – By 2018 at least 50% of all targeted riparian zones have a high QHER (Quantifying the Health of Ephemeral Rivers) score.**

#### **Contributing Board Targets**

**BT 1.9** – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value riparian zones

**BT 1.30** – By 2013 at least 75% of landholders are implementing best practice native vegetation management

**Regional Target RT 1.8 – By 2018 there is no change in the status of wetlands meeting ANZECC wetlands criteria as assessed in 2002.**

#### **Contributing Board Targets**

**BT 1.10** – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value wetlands

**BT 1.11** – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value coastal zones

**BT 1.13** – By 2013 investigations into surface and groundwater resources for priority catchments are completed

**BT 1.14** – By 2009 initial water resources management policies are put into effect

**BT 1.15** – By 2013 water quality targets have been identified using the NWQMS method

**Regional Target RT 1.9 – By 2018 no aquatic species are at conservation risk due to changed flow regime.**

**Contributing Board Targets**

**BT 1.11** – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value coastal zones

**BT 1.13** – By 2013 investigations into surface and groundwater resources for priority catchments are completed

**BT 1.14** – By 2009 initial water resources management policies are put into effect

**BT 1.15** – By 2013 water quality targets have been identified using the NWQMS method

**BT 1.16** – By 2013 water resources policies incorporate updated climate change risk assessments

**Regional Target RT 1.10 – By 2018 ecologically appropriate environmental flow regimes exist in all monitored rivers.**

**Contributing Board Targets**

**BT 1.13** – By 2013 investigations into surface and groundwater resources for priority catchments are completed

**BT 1.14** – By 2009 initial water resources management policies are put into effect

**BT 1.16** – By 2013 water resources policies incorporate updated climate change risk assessments

**Regional Target RT 1.11 – By 2018 key water quality parameters for aquatic ecosystems are below NWQMS (National Water Quality Management Strategy) thresholds in monitored rivers for at least 90% of the time.**

**Contributing Board Targets**

**BT 1.8** – By 2013 all targeted watercourse management and rehabilitation works for Cygnet River catchment are completed

**BT 1.9** – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value riparian zones

**BT 1.15** – By 2013 water quality targets have been identified using the NWQMS method

**Regional Target RT 1.19 – By 2028 there is no net loss of functional connectivity in aquatic ecosystems compared with 2009.**

**Contributing Board Targets**



**BT 1.11** – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value coastal zones

**BT 1.13** – By 2013 investigations into surface and groundwater resources for priority catchments are completed

**BT 1.14** – By 2009 initial water resources management policies are put into effect

**BT 1.16** – By 2013 water resources policies incorporate updated climate change risk assessments

**By 2028 the rate of increase in mean groundwater level in priority groundwater recharge areas declines**

**Contributing Board Targets**

**BT 1.2** - By 2013 there is at least a 10% increase in the priority groundwater recharge area with perennial vegetation cover compared with 2009

**BT 1.3** - By 2013 a fully costed plan is developed for managing salinity impacts on key biodiversity assets

**By 2028 the mean groundwater level under the most significant & defensible biodiversity assets is below the threshold identified in the 2012 plan**

**Contributing Board Targets**

**BT 1.2** - By 2013 there is at least a 10% increase in the priority groundwater recharge area with perennial vegetation cover compared with 2009

**BT 1.3** - By 2013 a fully costed plan is developed for managing salinity impacts on key biodiversity assets

**BT 1.13** – By 2013 investigations into surface and groundwater resources for priority catchments are completed

**Quantifying Water Resources and their Use**

The Kangaroo Island Region does not have any prescribed water resource areas. As such there is currently no restriction to who can access water and no trading of water occurring.

In developing the The Plan the Board has endeavoured to quantify the amount of surface water available based on modelling of rainfall/run off relationships across the region. There is insufficient regional data to determine volumes with any precision. In addition the Board has undertaken a preliminary assessment of water development (dams, forestry) across the region and the volumes of water intercepted for these purposes. Again these assessments have relied on models to predict water capture and use. This information is presented in The Plan.

The Plan stipulates Sustainable Use Limits (SUL) for catchments and subcatchments across the Kangaroo Island region using different methods depending on the average rainfall.

In subcatchments that have an average rainfall greater than or equal to 600mm/annum, with the exception of the Middle River catchment, the SUL is determined as being the existing average surface water runoff generated across the

subcatchment minus the surface water runoff that would have been generated if the entire subcatchment was covered with Native Vegetation. Thus the minimum amount of water that the environment should receive is the volume of surface water runoff that would have been generated if the entire subcatchment was covered with Native Vegetation. This method is currently being reviewed and may be changed in the future.

In subcatchments that have an average rainfall less than 600mm/annum and in the Middle River catchment, the SUL is determined as being 25% of the average surface runoff generated in the subcatchment. Thus the minimum amount of water that the environment should receive is 75% of the average surface runoff generated in the subcatchment.

It must be noted however that some subcatchments had already exceeded their limits prior to the introduction of SUL. In subcatchments that have exceeded their SUL, the volume of water available to the environment will be less than described above. In subcatchments that have not reached their SUL, the volume of water available to the environment will be greater than described above.

The volumes of water still available for development in each subcatchment across Kangaroo Island can be found on pages 55 – 65, Volume 3. of the Plan.

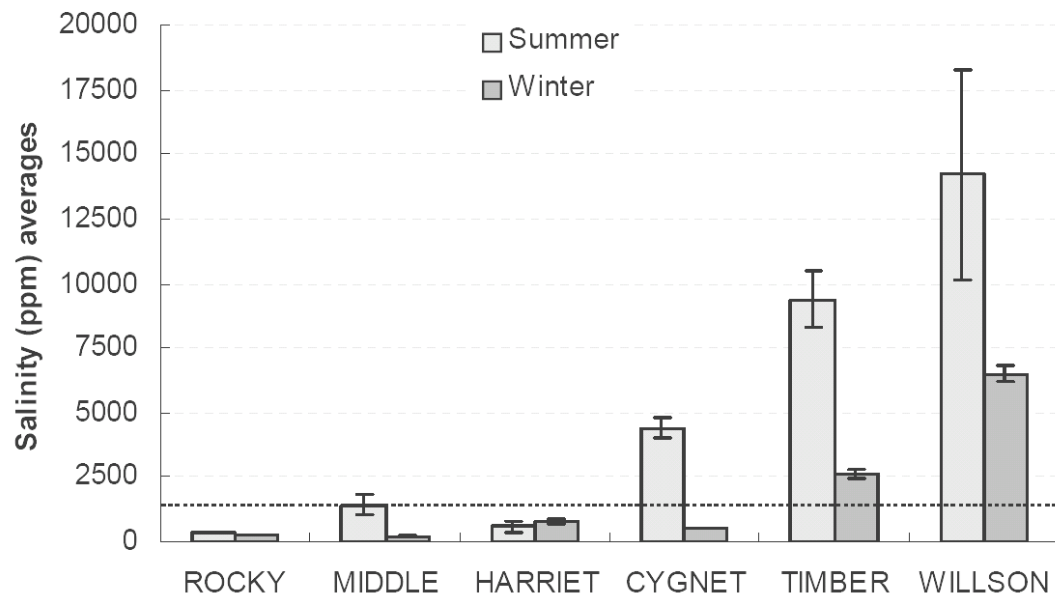
## Water Quality

### Surface water quality

The quality of surface waters is highly variable across the Island and is largely determined by the degree of catchment modification and land use. Data for the Rocky River effectively provides a baseline due to the almost complete cover of native vegetation. Monthly data for a wide range of parameters over the period June 1995–December 1997 show that water quality in the Rocky River was in general classified as good (Environment Protection Agency 1998). The notable exception was for soluble aluminium (Nilsen 2006), which appeared in high levels. Aluminium levels are probably naturally high in many streams across Kangaroo Island as many types of subsoil are rich in aluminium, which is leached out in acidic conditions.

In the Cygnet River catchment at least, the highest concentration of nutrients in streamflows come from the first and second order streams, and especially after 1–2 days of heavy rainfall in the order of 40–60 mm (Southgate 2005). Nutrient concentrations have also been found to be higher in streams flowing through agricultural land use than either forestry or native vegetation. Grazing/cropping land is the major source of nutrients, and farmland with poor riparian vegetation is the source of most nutrients (Southgate 2005). These results are consistent with research across southern Australia and would probably be similar in other catchments.

Increasing stream salinity resulting from dryland salinity is a major issue in parts of Kangaroo Island, especially in the Central Plains subregion. Typically, stream salinity varies across the year, peaking in late summer–autumn when saline groundwater baseflow is often the only input into streams. Stream salinity is typically at its lowest in late winter–spring, when a period of flow has flushed salt from the system. While this is typical for many streams it is not the case in all, for example the Harriet River



**Average stream salinity – summer and winter** (Source: Nilsen 2006)

Table 18. Surface water quality assessment 1996–2004

Parameter (threshold value)	Within environmental threshold limit?					
	Rocky River	Cygnat River	Bark Hut Road	Middle River*	Harriett River**	Timber Creek***
Conductivity (100–5000 $\mu\text{S cm}^{-1}$ )	Yes	Yes	50% of data	Yes	Mostly yes	No
pH (6.5–9.0)	Mostly yes	Yes	Yes	Yes	Yes	No
Turbidity (1–50 NTU)	Mostly yes	Yes	Yes	Mostly yes	Yes	Yes
Dissolved oxygen (%saturation >90%)	No	Yes	Yes	Yes	No	Mostly yes
Temperature (< 21°C)	Mostly yes	Mostly yes	Mostly yes	Yes	Yes	Yes
Total phosphorus (< 100 $\mu\text{g L}^{-1}$ )	Yes	Mostly yes	Yes	Yes	No	Inconclusive
Filterable reactive phosphorus (< 40 $\mu\text{g L}^{-1}$ )	Yes	Yes	Yes	Yes	(no data)	Yes
Total nitrogen (< 1000 $\mu\text{g L}^{-1}$ )	Mostly yes	Mostly yes	Yes	Yes	Yes	No
Oxidised nitrogen (< 100 $\mu\text{g L}^{-1}$ )	Yes	Mostly yes	50% of data	Yes	(no data)	No
Aluminium at pH > 6.5 (< 55 $\mu\text{g L}^{-1}$ )	No	No	No	No	(no data)	No
Copper (< 1.4 $\mu\text{g L}^{-1}$ )	50% of data	Mostly yes	Mostly yes	Mostly yes	(no data)	Mostly yes
Lead (< 3.4 $\mu\text{g L}^{-1}$ )	Mostly yes	Yes	Yes	Yes	(no data)	Mostly yes
Zinc (< 8 $\mu\text{g L}^{-1}$ )	50% of data	Yes	Yes	Mostly yes	(no data)	Yes

(Source: Nilsen 2006 – using EPA data except where indicated)

\* EPA data from 2003 &amp; 2004 only

\*\* nutrient data interpreted from combined River of Life, SW Landcare Group and EPA data and over 2004 only

\*\*\* Rivers of Life data 2004 only

## Groundwater

Groundwater is generally saline (> 2000 mg/L) and wells are very low yielding (< 1 L/s) (Barnett and Dodds 2000). There are limited and localised areas where fresh groundwater lenses occur (Mooney and Grinter 2001).

## Water information drivers

*The Natural Resources Management Act 2004*, and the *Kangaroo Island Natural Resources Management Plan 2009* are the KI NRM Boards water information drivers.

The Plan identifies the following water resources information gaps:

- flow, salinity and temperature data for more watercourses
- better understanding of groundwater–surface water interactions
- finer scale modelling of the impacts of interception activities and climate change on stream flows
- quantification of environmental water requirements
- comprehensive but targeted water monitoring program
- condition of, and risks to, riparian vegetation.

For information on the steps being taken to answer the questions, please refer to the Regional Targets and Board Targets listed in Section A - organisation and drivers.

## Section B - outline of water information assets

The KI NRM Board are not the custodians or owners of any water information assets.

Water information assets are currently owned and managed by other Government Departments and Agencies such as DFW and the EPA.

A search of our Metadata database has found the following list of water data stored in our system;

### **KI NRM Board Custodians**

Kangaroo Island runoff  
Kangaroo Island water course cross-sections  
Kangaroo Island groundwater chemical data  
Kangaroo Island surface water chemistry monitoring  
KI Drillholes

### **DFW Custodians**

Water erosion hazard  
Salinity of Shallowest Aquifer  
Yield of Shallowest Groundwater Aquifer  
Stream gauging station sites  
Surface water monitoring sites  
Groundwater networks  
Groundwater projects  
Groundwater salinity of South Australia from best available aquifers (shallow and deep).  
Ordered Streams - Kangaroo Island  
Water Catchment Boundaries  
Water Use Information

### **EPA Custodians**

Water quality in Nepean Bay

### **DEH Custodians**

Ambient water quality

### **PIRSouth Australia Custodians**

Kangaroo Island surface water salinity monitoring and salinity induced by watertable  
Kangaroo Island groundwater data - Naroonda focus catchment  
Kangaroo Island groundwater data - Eleanor River catchment  
Kangaroo Island groundwater data - Chain of Lagoons catchment  
Kangaroo Island groundwater data - other sites  
Kangaroo Island Electromagnetic (EM) data  
Profile Salt Storage: High Rainfall Areas on KI

Appendix 6 – Kangaroo Island NRM Board mini-SWIMP

**Department for Water Custodians**

Water Drillholes and Wells

**No Listed Custodians**

Water Infrastructure (1:50K)

Waterbodies

Waterbodies (1:50K)

## Section C – system component assessment/review

In the 2010/2011 financial year the KI NRM Board conducted an audit of all Government Agencies and Departments operating on Kangaroo Island.

The audit identified all the water related projects and monitoring programs that are currently being conducted on Kangaroo Island.

On completion of the audit it was determined that the current monitoring of groundwater resources was not sufficient to be able measure the regions achievements against the groundwater related targets identified in the Plan.

The audit also identified that the monitoring of surface water quality was not sufficient to be able measure the regions achievements against the targets identified in the Plan.

As a result of the audit, a monthly, baseline water quality monitoring program has been developed and commenced at all flow gauging stations in the KI Region in January 2011. Flow gauging stations are currently located at Harriet River, Cygnet River (Huxtable Forest and Koala Lodge), Rocky River, Stunsail Boom River and Timber Creek.

The Sonde Water Quality tester is being used to measure temperature, salinity, dissolved oxygen, total dissolved solids, turbidity and pH.

Water samples are also being collected which are sent to the AWQC in Adelaide for analysis of Total Nitrogen and Total Phosphorous.

The Huxtable forest and Koala Lodge flow gauging stations which are located on the Cygnet River are being upgraded with the installation of high flow meters and composite samplers in early 2011. Data collected by the high flow meters will be managed and stored by the Department for Water. The composite samplers being installed at these flow gauging stations will provide a weekly analysis of nutrient and sediment loads and concentrations passing the gauging stations. Data collected by the composite samplers will be stored and managed by the KI NRM Board.

An event based water quality monitoring program at all flow gauging stations is also being developed in conjunction with the Monthly (Baseline) water quality monitoring program.

Event based monitoring is particularly important when trying to estimate and model sediment and nutrient loads being transported by watercourses:

- as it allows analysis of the rapid changes in sediment and nutrient loads occurring during flood or high flow events
- enables more accurate modelling of annual sediment and nutrient loads being transported by watercourses.



Low cost automatic rising and falling stage siphon samplers are being constructed and will initially be installed in the Cygnet River Catchment alongside the more expensive mechanical composite samplers being installed at Koala Lodge and Huxtable Forest flow gauging stations.

Once the siphon samplers are shown to be working effectively, it is planned that more siphon samplers will be constructed and installed at the remaining flow gauging stations across the region.

Having siphon samplers located next to the mechanical composite samplers should help improve the modelling of nutrient and sediment loads passing gauging stations without mechanical samplers.

The data collected by the water quality monitoring program will initially be used to achieve BT 1.15 – *By 2013 water quality targets have been identified using the NWQMS method*

The National Water Quality Management Strategy method identifies water quality targets by:

- establishing current water quality in the region
- determining environmental values that the community desires for watercourses, rivers lakes etc in the region.
- setting water quality targets that will achieve the environmental values determined
- monitoring and reporting on progress towards achievement of water quality targets.

It is planned to develop and implement a groundwater monitoring program in conjunction with the Department for Water and PIRSouth Australia in the 2011/2012 financial year.

The capture of Aerial Imagery across KI was completed on the 5<sup>th</sup> of March 2011. The imagery has been captured by HyVista Corporation Pty Ltd, in 4 band colour (Red Green Blue and Infrared) using a Vexcel UltracamD camera with a 0.4 or less Ground Sample Distance and a horizontal and vertical accuracy of +/- 3.0m.

It is expected that the creation of the Aerial Digital Ortho-imagery will be completed and delivered in April 2011.

### **Why is the imagery needed?**

The most up-to-date dam's layer available for KI was produced in 2001 and the most recent aerial imagery available that covers the entire island was captured in 2006.

Both these pre-date the adoption of the Plan and result in a situation where we have a very poor and out-of-date understanding of current dam development on Kangaroo Island.

An up-to-date knowledge of current dam development is essential to:

- effectively manage water resources in the region
- to assess applications for new dams.

To determine the volume of water available for development in a catchment it is necessary to know how much water is already being captured by dams in the catchment.

In addition to this, the volumes of water available in catchments across KI that are listed in the Plan are based on the 2001 dam's layer. This means catchments and subcatchments are potentially listed as having water available for further development when in fact they have already exceeded their sustainable use limits.

Knowledge of current dam development is also needed for compliance purposes.

It is essential to know what dams already existed at the adoption of the Plan so that dams constructed after the adoption date of the Plan, without the required approvals can be identified. It is also essential to have imagery of the surface areas of dams at the time the Plan was adopted so that unauthorised enlargements of existing dams can be identified.

Following receipt of the Imagery, it is planned to get a Dams Layer created showing locations and surface areas of existing dams and also providing estimates of dam capacities based on their surface area.

## Section D – priority areas for investment

Regional Targets and Board Targets listed in Section A - organisation and drivers, dictate the priorities, strategies and recommended actions with regard to future investment in water monitoring.

As stated in Section C of this document, in the 2010/2011 financial year the KI NRM Board conducted an audit of all Government Agencies and Departments operating on Kangaroo Island.

The audit identified all the water related projects and monitoring programs that are currently being conducted on Kangaroo Island.

On completion of the audit it was determined that the current monitoring of groundwater resources was not sufficient to be able measure the regions achievements against the groundwater related targets identified in the Plan. This is a priority area for investment.

The audit also identified that the monitoring of surface water quality was not sufficient to be able measure the regions achievements against the targets identified in the Plan.

The monthly (baseline) water quality monitoring program has an estimated annual cost of between \$6662.67 - \$8443.74.

The cost of running the planned event based water quality monitoring program is dependent on the number of significant flow events that occur annually, thus an estimate of the annual cost of this program cannot be made with confidence. However sampling and analysing samples at a single flow gauging station would cost approximately \$400.00 per flow event.

The cost of installing the siphon samplers required for the event based monitoring program is approximately \$300.00 per site.

Both the event based and monthly (baseline) water quality monitoring programs are priority areas for investment.

Funding is also being sought for additional crump weir and composite sampler on the Gum Creek tributary of the Cygnet River and plans to integrate ground water monitoring with surface water monitoring in the Cygnet River catchment are being developed.

As stated in Section C of this document, aerial imagery of KI was been captured in the 2010/2011 financial year. Following receipt of the Imagery, it is planned to get a Dams Layer created showing locations and surface areas of existing dams and also providing estimates of dam capacities based on their surface area. This is also a high priority area for investment.

## UNCLASSIFIED

### Appendix 6 – Kangaroo Island NRM Board mini-SWIMP

Other funding priorities in the region will involve the commencement and/or continuing of work to ensure achievement of the following Board Targets:

- BT 1.9 – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value riparian zones
- BT 1.10 – By 2013 protection or rehabilitation plans are implemented for at least 50% of all high value wetlands
- BT 1.12 – By 2013 a targeted water monitoring program is developed
- BT 1.13 – By 2013 investigations into surface and groundwater resources for priority catchments are completed
- BT 1.15 – By 2013 water quality targets have been identified using the NWQMS method
- BT 1.16 – By 2013 water resources policies incorporate updated climate change risk assessments

## Appendix 7 – South Australia EPA mini-SWIMP/Issues document

### **EPA Issues List – 6/5/2011**

EDMS is an old database that was originally being managed and maintained by Peter Christy from the Water Quality Group, and who retired in 2010 but has subsequently been maintained in an ad hoc way by several staff. EDMS was set up to manage just ambient quality data but it didn't do it particularly well and is difficult to import data into, has no remote access or web reporting capabilities.

In response to this the EPA is currently in the process of transferring all data over to a new, user friendly database called EnviroSys that will require less support to maintain. This is being funded and developed using EPA funds and personnel.

The EPA is still in negotiations with other government departments in relation to the new reporting products that have been developed to report on water and ecosystem health results using data from 2008 to 2010 but started to release edited material for publication in the print media. Plans are underway to finalise the final products and publish on the EPA's website around the middle of 2011. In the interim, some data is being shared with DFW and negotiations are underway to have this publicly available on their web portal instead along with other hydrometric data.

The EPA is now collaborating with the Adelaide NRM in relation to stream monitoring and assessment work from at least 2011-2014 and seeks input from other NRMs when sampling in their regions. This will continue to be developed over coming years.

The groundwater monitoring program is still under review but work is proceeding with evaluating the merits of using biological measures of condition (microbes, stygofauna) to report on the health of different groundwater systems in the State. The vacant senior groundwater scientist position has also recently been filled so further development of the groundwater program is expected to be carried out from mid 2011 onwards.

## Appendix 8 – South East NRM Board mini-SWIMP

### Section A - organisation and drivers

#### The organisation

The South East Natural Resources Management (SE NRM) Board is a statutory organisation under the South Australian *Natural Resources Management Act 2004*. Board members appointed by the Minister for Environment and Conservation, and supported by state and local government representatives, make decisions about regional investment in NRM. SE NRM Board staff implement the strategic direction set out in the regional NRM plan, including development of water allocation plans for groundwater and surface water, and promotion of best practice irrigation efficiency to the region's irrigators.

The SE NRM Board was established in May 2005 and is responsible for the natural resources of an area that covers approximately 28,000 square kilometres bounded by the Victorian border to the east, the Southern Ocean to the south and the Coorong to the West. Its northern boundary adjoins the South Australia Murray-Darling Basin NRM region.

In 2009, enhanced regional meteorological coverage was facilitated by the SE NRM Board via the establishment of a network of thirteen Automatic Weather Stations (AWSs). The main driver for the network's establishment was to facilitate the generation of reference crop evapotranspiration (ET<sub>o</sub>) figures, to be utilised by the region's irrigators as a component of climate-based irrigation scheduling techniques. Appropriate (best practice) irrigation scheduling is an essential component in the optimal use of the region's groundwater assets.

In mid-2010, a funding arrangement with DAFF provided the opportunity to direct project budget funds towards a minor expansion of the AWS network. An additional DEH/DFW AWS was upgraded to the standard of the existing stations and incorporated into the Board's network. This AWS (named "Caroline") is located in the extreme southern part of our region adjacent to Piccaninnie Ponds. Additionally, network data is (or is planned on being) utilised for numerous purposes, including:

- Hydrological modelling of regional surface/ground water
- Soil temperature data used to determine optimal crop planting schedules
- Wind speed / direction and Delta-T data used to determine optimal agricultural spraying periods
- Leaf wetness information used to predict vine disease risk scenarios
- Degree day information used by regional orchardists

### **Water information drivers**

Regulation, under the *NRM Act 2004*, and asset management (regional groundwater resource) were both powerful drivers for the establishment of the AWS network, and are continual driver for the future expansion of the network.

#### **Regulation**

*NRM Act 2004*

#### **Asset Management**

Significant declines in the level of the regions groundwater resource have occurred since the 1990s. Appropriate management of this resource will be, in part, achieved through the utilisation of best practice irrigation techniques by the regions irrigators.

## Section B - outline of water information assets

### Automatic Weather Station network

The SE NRM Board owns and operates a network of thirteen AWSs (with a fourteenth AWS being incorporated into the network in mid-2010 as per Section A above), located in regions supporting significant areas of irrigation (and located away from areas covered by existing BoM meteorological sites).

Each weather station is built around a sturdy two metre aluminium tripod mast. The temperature and relative humidity sensor is mounted within a sensor shelter installed at a height of 1.2m above ground level. The wind speed and direction sensor is installed on a cross arm at a height of 2.0 metres and the solar radiation sensor at about 1.8 metres. A soil temperature sensor is buried under the tipping bucket rain gauge, which is located at ground level approximately 5 metres away from the mast. One AWS, located within a vineyard, has a leaf wetness sensor incorporated.

Sensors are connected to a data logger mounted within a steel enclosure mounted on the mast, which also houses sensor interfaces, battery and modem. Each AWS is powered by a rechargeable battery and solar panel, and is fully self-contained.

Sensor details are tabled below:

Phenomenon	Accuracy	Unit	Sensor
Air Temperature	± 0.2	°C	Vaisala HMP45-A
Relative Humidity	± 2 typ.	%	Vaisala HMP45-A
Radiation	± 10	W/m <sup>2</sup>	SK01-D pyranometer
Soil Temperature	± 0.2	°C	Buried thermistor
Wind Speed	± 0.3 / 2 %	m/s	Vaisala WMS301 wind sensor
Wind Direction	± 3	°	Vaisala WMS301 wind sensor
Rainfall	1% ± 0.2	mm	H.S. TB3-A tipping bucket rain gauge
Leaf Wetness	-	%	MEA2040 leaf wetness sensor

Calculated figures, utilising measured data, available from the nrmWEATHER website (see address below) include evapotranspiration (ET<sub>o</sub>), Delta-T, apparent temperature, dew point, degree days and hours of frost.

### Telemetry system

The SE NRM Board uses a wireless NextG telemetry system to transfer AWS data to Adelaide-based server on an hourly basis.

The data logger housed in the sensor enclosure has a memory capacity to record three months of data. NextG modems are used for data retrieval. Each AWS incorporates an MEA Packet Data Terminal, which works with the modem to automatically and regularly transfer data from the AWS to an ftp site. Magpie software manages the communications between the BoM-hosted computer server and the AWS (including remote access) and is used to display and analyse the weather data, including



evapotranspiration (Note: data transferred to a website is available for viewing without specialist software).

### **Monitoring network**

#### **Climate Data**

Measurement Engineering Australia Pty Ltd (MEA) design, build and maintain the AWSs that collect the data. The raw data is uploaded (by the stations) to the BoM FTP server, where it is processed by Magpie 2 software (MEA commercial software) and stored in dBase IV database format, running on Windows XP. Data is often exported to CSV (comma separated variable) format when data processing is required by other programs.

This information is stored on a private computer hosted by BoM, Kent Town. The data is made publicly available via a web site (<http://se.nrm.space.com.au/nrmweather>) which is maintained by MEA, in conjunction with SERIC (South East Resource Information Centre). Metadata exists in digital and hard copy, and is maintained internally by the SE NRM Board.

## Section C – system component assessment/review

### Automatic Weather Station network

The SE NRM Board's AWS network is a highly effective system for acquiring meteorological data, with the current sensor package providing high quality data since May 2009.

There is a high degree of flexibility regarding the type and number of sensors available for any particular AWS. Retrofitting existing AWSs with extra sensors (e.g. barometric pressure) is an option; as SE NRM Board or community demand requires.

### Telemetry system

The current NextG telemetry system is considered to be a fit for purpose mechanism for transferring data from AWS sites to the BoM-hosted server. Unidirectional high gain antennae were incorporated into the construction of each AWS, as the AWS sites are located in areas with variable (often poor) signal strength. Since network establishment, two sites have been upgraded to improve the signal strength, with Yagi 14dB antennae (on a 3.4 and 6 metre mast respectively) replacing those originally installed.

Due to the highly variable nature of the Telstra NextG network signal strength across the SE NRM Region, there remains a high probability that further antennae upgrades (as detailed above) will be required for a number of AWSs, in order to ensure hourly data downloads.

### Monitoring network

#### Climate Data

The SE NRM Board's AWS network provides very good quality data, with excellent temporal resolution, from a large area of the region. However, locations of existing AWSs remain biased towards localities containing significant areas of irrigation; an historic circumstance resultant from funding being made available to the SE NRM Board's Irrigation Efficiency Project (IEP) largely for the purpose of generating ETo figures for irrigation scheduling.

Expansion of the network into other parts of the region is a priority, in order to appropriately manage local natural assets such as ground/surface water and groundwater dependant ecosystems. Improving the availability of regional climatic data by filling the current "gaps" will greatly assist the SE NRM Board in their asset management endeavours.

Operation and maintenance of the network is an ongoing expense, currently being covered by the IEPs limited operating budget. Expansion of the network will necessarily involve an increased operation and maintenance budget.

## Section D – priority areas for investment

Priorities and strategies for improving SE NRM Board water information include:

1. Expansion of the current network to enhance regional coverage. Community input since network establishment has informed the SE NRM Board in determining locations of future AWS sites, with a further ten prospective sites identified. MEA would be contracted to supply and install any new AWSs (for consistency of network hardware/software). Following signing of Landholder Agreements, SERIC would be contracted to upgrade the nrmWEATHER website to incorporate data from the new AWSs.
2. Collation of past, current and future rainfall measurements captured by private entities (companies and individuals), with an emphasis on historical on-farm rainfall records. A widespread call for rainfall records (e.g. television and newspaper coverage) would be followed by directly targeting regional landholders through mailouts and personal contact. There would be a requirement to develop a database (with information publically available) in order to collate and store the data.
3. Value adding to current network by retrofitting extra sensors (e.g. barometric pressure sensors). There has been significant interest from regional agricultural industry groups in the potential to upgrade data provision from the existing stations. A widespread call to all regional stakeholders would inform the SE NRM Board as to which AWSs should be upgraded. SERIC would be contracted to upgrade the nrmWEATHER website to incorporate new sensor data.

## **Appendix 9 – South East Water Conservation and Drainage Board mini-SWIMP**

### **Section A - organisation and drivers**

#### **The organisation**

The South Eastern Water Conservation and Drainage Board is a statutory authority charged with the responsibility of managing surface water flows on rural lands in the South East of South Australia.

The Board maintains 1875 kms of drains within its drainage network in the Lower South East region. There is a further 640 kms of drains in the Upper South East Dryland Salinity and Flood Management Project area, for which the Board is responsible for the collection and verification of surface water and met data programs.

The Board is the largest collector of surface water data in the South East and operates a total of 171 monitoring hydrological sites. This includes 46 continuous recorder sites , of which 36 are telemetered and record stream flow level and water quality parameters. The remaining 125 sites are opportunistically gauged sites. The monitoring network has been established to inform the Board of catchment and flow conditions for use in flood warning management, information management and decision support for environmental flows.

#### **Hydstra System**

The Board is currently using Hydstra Version 9.6.0 to store data from monitoring sites. Information held within the system includes:

- time Series Data for water level
- time Series Data for Water Quality i.e. EC and Temperature generally
- rainfall and climate data
- rating tables
- metadata including Spatial Coordinates and site photographic information.

#### **Telemetry system**

The Board uses the Next-G mobile network to provide telemetered data from in-field monitoring equipment, this information is supplied directly to DFW on a daily basis, and provides information to personal from the Upper South East Dryland Salinity and Flood Management Program, in assisting with the regulating and directing flows to important ecological sites. The telemetry system is generally reliable, however some black spot areas exist in the system, where data collection is dependent upon good weather conditions.

### **Climate Data**

The Board currently operates a network of tipping bucket rain gauges along the South Australia/Victoria Border. Inflow from Western Victorian catchments is vital to the health and well being of many wetland sites within the South East. These include the Ramsar listed wetlands of Bool Lagoon and Hacks Lagoon.

Next G Telemetry has assisted the Board in planning and operating regulators with the information provided from these sites. There are several sites within the South East that, apart from collecting rainfall data also collect wind speed, wind direction, solar radiation, and soil moisture data, to assist ecologists in wetland studies.

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Appendix 9 – South East Water Conservation and Drainage Board mini-SWIMP

### **Section B - outline of water information assets**

- Nil response

### **Section C – system component assessment/review**

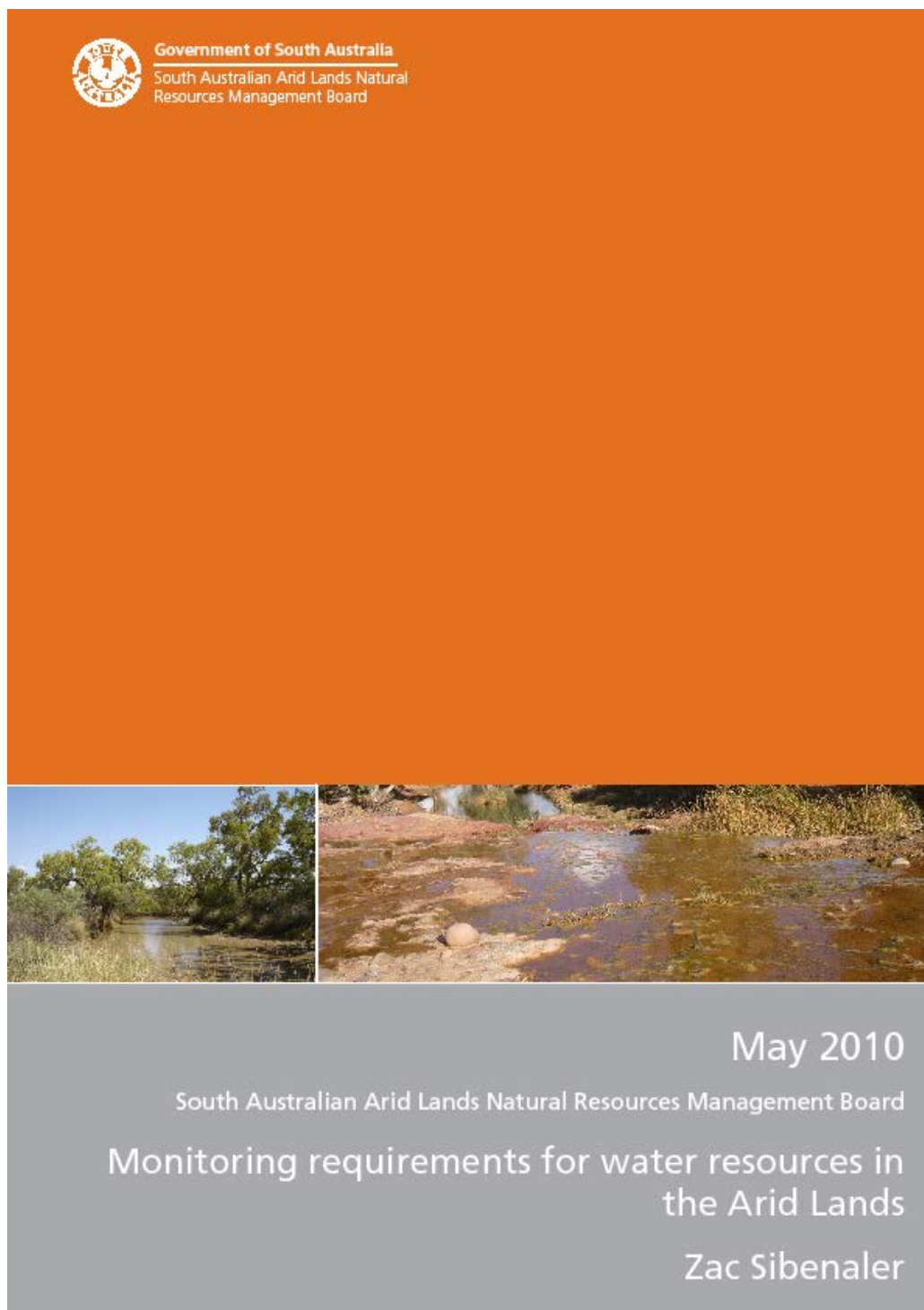
- Nil response

## **Section D – priority areas for investment**

Additional operational information is needed to provide real time pondage data to enable operational management of regulators. The Board is working with the Department for Water to implement an IP telemetry system additional funding will be required to implement this system. Following local flooding in Western Victoria during January 2011 it was highlighted for the need to improve flood forecasting for inflows to South Australia.

Additional improvements in stream gauging equipment (Doppler) will need to be addressed to improve the ability to cover the checking and verification of existing rating tables, given the large area that the Board covers. This will also help to provide a safer working environment under OH&S

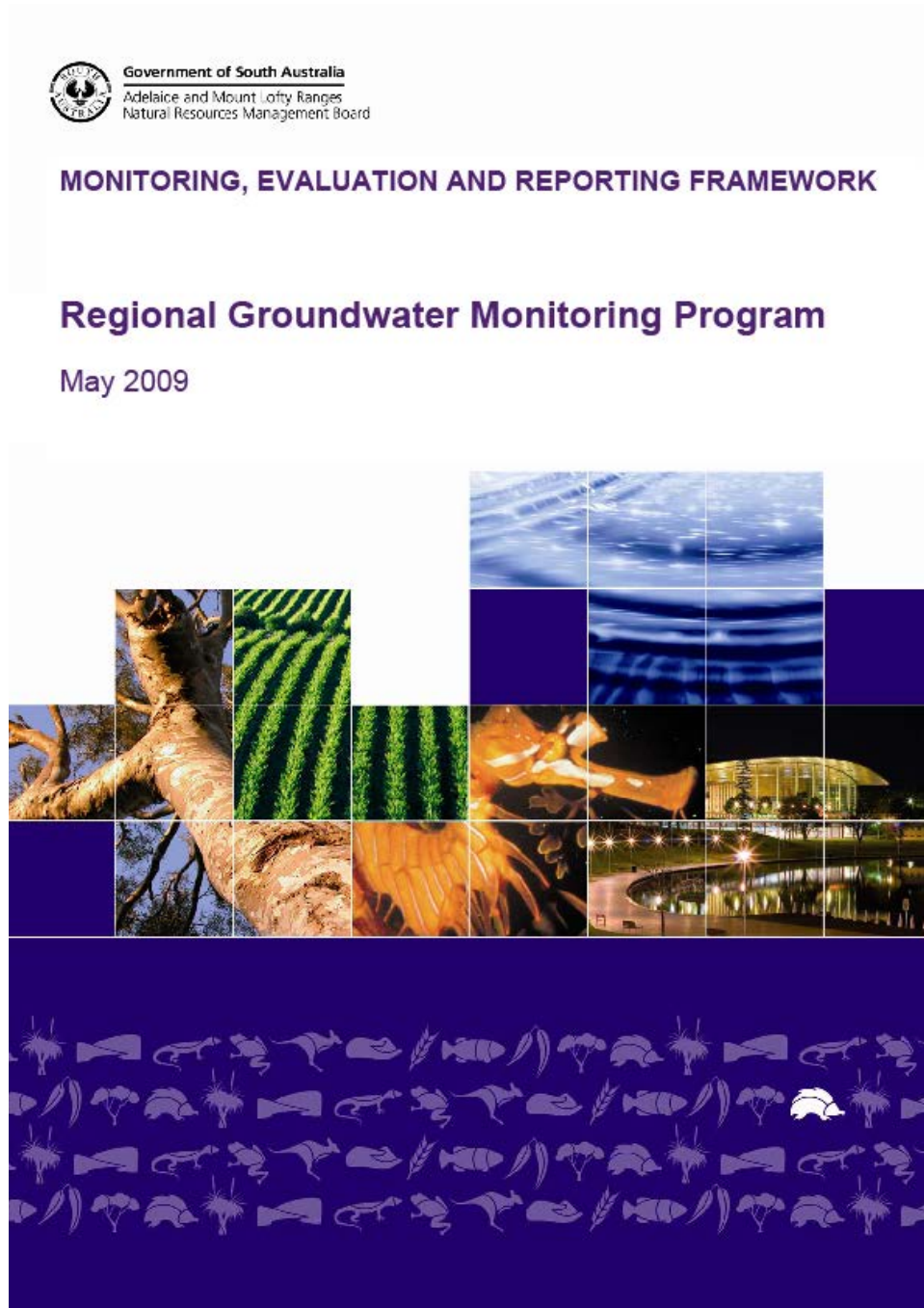
## Appendix 10 – South Australian Arid Lands NRM Board – Monitoring Requirements Document

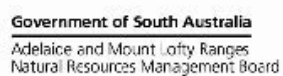


Note this document is 139 pages, and will be attached separately



## Appendix 11 – Adelaide and Mount Lofty Ranges NRM Board mini-SWIMP





## MONITORING, EVALUATION AND REPORTING FRAMEWORK

## Regional Surface Water Monitoring Program – Quality and Quantity

July 2008



These reports will be provided separately.

## Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

### Section A - organisation and drivers

#### Summary:

South Australian Murray-Darling Basin Natural Resources Management Board (SA MDB NRM Board) is one of eight boards responsible for the management of natural resources in South Australia.

The South Australian Murray-Darling Basin Natural Resources Management Plan (the regional NRM plan) builds upon previous plans and strategies and provides a plan to protect and improve the condition of the natural resources of the SA MDB NRM region. (See <http://www.samdbnrm.sa.gov.au/NRMPlan.aspx>)

River Murray is the most significant water resource in the South Australian Murray-Darling Basin Natural Resources Management (SA MDB NRM) Region and the principal water resource for the state of South Australia. Other groundwater and surface water resources of the Region are locally important to the ecology and economies of those areas. The water resources of the Region support significant aquatic habitats along the entire length of the River Murray, the Lower Lakes, Coorong and Murray Mouth and in other parts of the Region. The water resources of the River Murray support irrigation, agriculture and town supplies throughout the Region. Water exported from the Region supports irrigation and stock watering in areas as far removed as the Clare Valley, Barossa Valley, Port Pirie, Whyalla, Port Augusta, and Keith in the south-east of the state. In addition, River Murray water is a key supply for metropolitan Adelaide (on average around 40% although this can rise to 90% during drought).

Away from the River Murray corridor, water is captured and diverted from tributary streams including the Marne, Angas, Bremer and Finnis Rivers and Saunders, Tookayerta and Currency Creeks. In these areas, increasing water interception and storage interrupts the natural flow pattern and reduces the volume of water available for natural flows.

Groundwater is extracted from selected aquifers and is particularly important to agriculture in the Angas-Bremer plains and the Mallee regions for irrigation and stock and domestic uses. Both groundwater and surface water resources are used for stock and domestic purposes throughout the Mount Lofty Ranges and this remains a significant management issue as water use from some streams and aquifers has exceeded sustainable levels. This over-use has led to the degradation of natural resources that rely on the water. Impacts include the loss of environmental water, salinisation of land and water resources, and subsequent ecosystem decline.

The Murray-Darling Basin has been experiencing a period of extended drought which, when combined with high rates of past extraction, has greatly depleted water holdings throughout the entire system. With low inflows into the Lower Lakes and high evaporation rates, water levels have fallen dramatically. Salinity levels are rising and there has been a high risk of acid sulphate soils causing the lakes to acidify. The lakes and many important wetland and

## Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

floodplain systems along the course of the River Murray in South Australia are severely afflicted by lack of water as a consequence of the drought.

Source: SA MDB NRM Board (2008a) South Australian Murray-Darling Basin Natural Resources Management Board Regional NRM Plan: Volume 1 Strategic Plan 2009-2019, South Australian Murray-Darling Basin Natural Resources Management Board, South Australia.

Water resources and water quality of the River Murray channel is variable and subject to over the border flows, localised rainfall, extraction rates and seasonal factors. There are various locations at which water samples are taken with some analysis is undertaken to determine any trends evident.

The right to use water varies according to water resource. Some areas are prescribed (restricted use for irrigation) and some are not. For prescribed resources, individual licence holders generally have a licensed volume. Water is traded in the region and this process is handled by the Department for Water in South Australia.

The Board works toward achieving targets consistent with its plan and consistent with other state and federal priorities for water resource management.

Figure one outlines the water targets developed by the Board in consultation with the community. These long-term and intermediate targets are part of an integrated approach to natural resource management over five key assets of Land, Water, Biodiversity; People and Atmosphere.

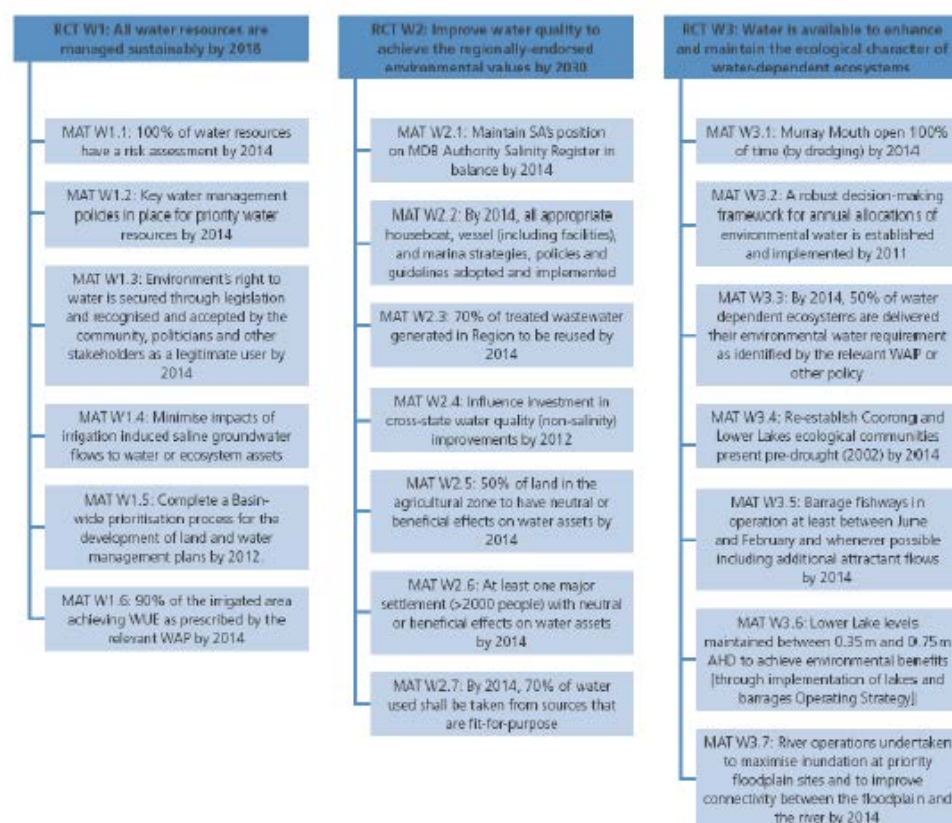


Figure 1 The long-term resource condition targets (RCTs) and intermediate management action targets (MATs) to be achieved to realize the Water asset vision

The regional NRM Plan came into full operation on 1 July 2009. As part of its proactive approach to management, the SA MDB NRM Board provides water information to the Bureau of Meteorology (BoM) through programs that:

- Undertakes environmental monitoring in the Eastern Mt Lofty Ranges
- Undertakes a Community Monitoring program
- Operates an Automatic Weather Monitoring Network (AWMN)

## **1 Water information drivers**

- 1.1 For Water Allocation purposes, water is monitored and this information used to inform and establish WAPs. WAP is a statutory responsibility for the SA MDB NRM Board.
- 1.2 For community engagement programs, water is monitored and this information used as information for natural resources management.
- 1.3 For the Sustainable Irrigation program purposes, automatic weather station information is used to inform farming practices, as well as to account for the efficiency and long term sustainability of current irrigation management practices

## **2 Questions the SA MDB NRM Board seeks to answer and steps taken**

- 2.1 For Water Allocation purposes, water is monitored to determine the condition of the resource over time in order to regulate sustainable use and ensure environmental needs are taken into account.
- 2.2 For community engagement programs, water is monitored for natural resources management.
- 2.3 Understand the resource condition and trend - what is sustainable?
- 2.4 Monitor local impacts and identify any saline incursions
- 2.5 Support other monitoring activities of groups

In order to do this, the community monitoring program engages with:

- NRM Board
  - Dept for Water
  - River Murray Councils
  - Regional NRM Project Officers
  - Land managers
  - General community
  - All Murray-Darling organisations
- 2.6 For the Sustainable Irrigation program purposes, the automatic weather monitoring network (AWMN) was established to encourage the incorporation of site and seasonally specific weather data into irrigation management practices. The AWMN significantly increased the density of meteorological monitoring sites in the SA MDB region which facilitated the increased use of local data into on-farm decision making.

The establishment of the AWMN involved working collaboratively with many agencies and groups to ensure that the network delivered appropriate information to as many stakeholders as possible. Partners in the project include:

- Australian Government Bureau of Meteorology
- Australian Government National Action Plan for Salinity and Water Quality
- Central Irrigation Trust
- Cooperative Research Centre – Irrigation Futures
- Local Action Planning Groups
- Regional Development Boards
- Mallee Water Resources Committee
- South Australian Research & Development Institute
- Rural Solutions SA
- Riverland & Langhorne Creek Wine Industry Councils



## Section B - outline of water information assets

Output: - a description of water monitoring networks and technologies, data management systems etc. in place.

### 1. For Water Allocation Planning

Various sites through the Eastern Mt Lofty Ranges

### 2. For community engagement programs

This program provides:

- Project Officer Support and training for groups
- Loan scheme for monitoring equipment

Community collected data is valued by the South Australian Murray-Darling Basin Natural Resources Management Board (SA MDB NRM Board), and is supported financially and technically across a number of Board programs. Community collected data is most powerful when it is integrated with broader monitoring, evaluation and communication at a regional, state or national level.

Community based monitoring groups collect a range parameters in the SA MDB NRM Region including water quality (salinity EC, nutrients, turbidity), bushland condition, bats, birds and soil. Most relevant to this mini-SWIMP the SA MDB NRM Board Community Monitoring Project Officer manages and facilitates the collection of water quality data supporting approximately 30 community groups collecting data from over 100 sites.

Key parameters collected include:

- Nitrates NO<sub>3</sub> expressed as Nitrogen (N) (in mg/l)
- Phosphates PO<sub>4</sub> expressed as Phosphorus (P) (in mg/l)
- pH
- Turbidity NTU
- Salinity in EC units or uS/cm
- Water Temperature
- Macroinvertebrates - Total Pollution Sensitivity and Total Species Diversity (at Phylum-Class-Order level)

Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

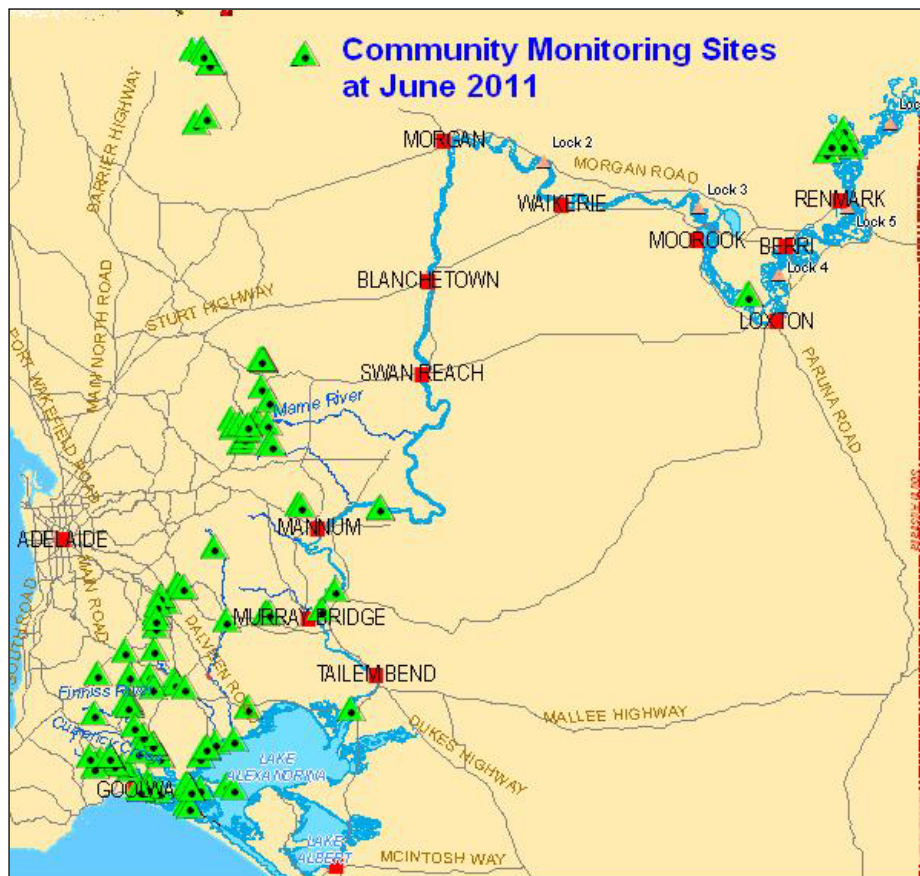


Figure 2: Community Monitoring Surface water Sites as at June 2011



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Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

## Metadata from Online Database

Available at: <http://www.samdbnrm.sa.gov.au/portals/9/CDMT/index.asp>

Category	Element	Metadata
Dataset	Identifier	SAMDBC08
	Title	Community Group Stream and Groundwater Monitoring Project
Custodian	Custodian	South Australian Murray-Darling Basin Natural Resources Management Board
	Jurisdiction	South Australia
Description	Abstract	Surface and groundwater quality data including Groundwater - depth to groundwater, Salinity (EC), Surface water - Salinity (EC), Nutrient, pH, Turbidity
	Search Word	Bureau of Rural Sciences, surface water, salinity, water quality, S.A. Murray-Darling Basin
	Geographic Extent Name	S.A. Murray-Darling Basin, South Australia
Data Currency	Beginning Date	July 2008
	Ending date	
Dataset Status	Progress	Identification of water quality trends
	Maintenance and Update Frequency	Quarterly and Event monitoring
Access	Stored Data Format	Microsoft Excel spreadsheets
	Available Format Type	Microsoft Excel spreadsheets
	Access Constraint	South Australian Murray-Darling Basin NRM Board; other parties by prior approval only
Data Quality	Lineage	Protocols consistent with data confidence plan
	Positional Accuracy	All locations recorded as GPS points on GDA94 with 5m accuracy
	Attribute Accuracy	EC: 10% accuracy. Nutrient analysis 100%; pH 1; Turbidity 20 NTU; Groundwater level.

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### Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

	Logical Consistency	Data entry into Microsoft Excel spreadsheets. QC process as per data confidence plan
	Completeness	Data being collected by volunteer community groups. Some monitoring times have been missed and data is incomplete.
Contact Information	Organisation	South Australian Murray-Darling Basin Natural Resources Management Board
	Contact	Greg Lundstrom - Phone: 8536 5622
	Position	Community Monitoring Project Officer
	Mail Address	6 Catherine Street, Strathalbyn, SA 5255
	Email Address	Greg.Lundstrom@samdbnrm.sa.gov.au
Metadata Date	Metadata Date	1 <sup>st</sup> January, 2010

### 3 Automatic Weather Monitoring Network

The key benefit that the network has delivered is a strategically positioned set of automatic weather monitoring sites that can be used to optimise regional irrigation management practices. As part of project additional educational resources such as Fact Sheets and Training Workshops have been developed to encourage the adoption of weather data into irrigation management practices. Monitoring of the website confirms that significant numbers are accessing data on-line.

The current data quality, collection and distribution system developed between the SA MDB NRM Board and the Bureau of Meteorology in South Australia is able to easily accommodate expansion of the current Automatic Weather Monitoring Network, or inclusion of new AWMNs by other NRM Boards. Inclusion of new networks from other NRM Boards will require bilateral negotiation and agreement with the Bureau of Meteorology in South Australia.

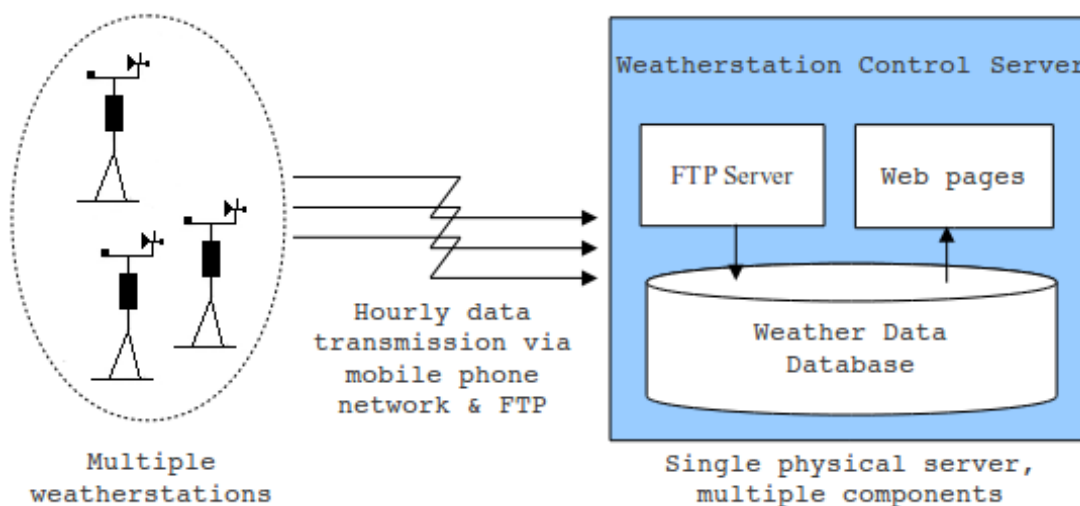


Figure 3: Automatic Weather Monitoring Network (AWMN) Structure

The Automatic Weather Monitoring Network can also deliver additional benefits to Bureau of Meteorology services by increasing the density of weather monitoring sites across regional South Australia. The data from this network can be made available for climate investigation and to assist with weather forecasting). Additional real time rainfall data will also contribute to the Bureau's new Strategic Radar Enhancement Project, which is funded to provide improved capabilities in numerical weather prediction.

## Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

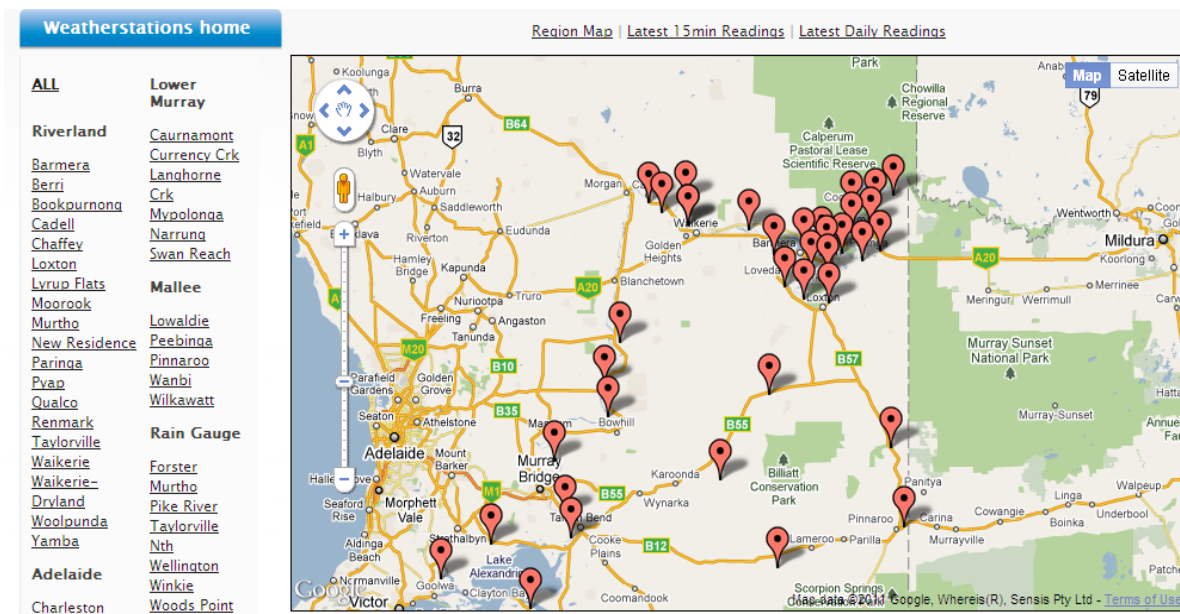


Figure 4: Regional Automatic Weather Monitoring Network – Website Homepage

## Section C – system component assessment/review

Output: - an assessment and statement of gaps, issues and opportunities in our existing organisational water information and monitoring investment and systems.

1. All Board programs are subject to monitoring, evaluation review and improvement (MERI). The Board utilises its MERI framework and implementation program that assesses the monitoring programs data collection and links back to the regional NRM plan. The MERI program is reviewed annually.
2. Community engagement programs

An independent evaluation of the Community Stream Sampling and Salinity Mapping Project in the South Australian Murray-Darling Basin NRM Region was conducted in September 2008 by interPART & Associates.

### Key Recommendations

1. That the fundamental role and benefits of community monitoring be actively promoted by the SA MDB NRM Board as a critical element in the achievement of NRM goals and objectives, both directly and indirectly, and supported accordingly
2. That community monitoring interests and motivations be regularly reviewed and incorporated into engagement, education and monitoring strategies
3. That mechanisms are strengthened to ensure a clear and common understanding across community members, and SAMDB NRM personnel and other stakeholders of the purpose and objectives of any community monitoring program
4. That the regional community monitoring program give attention to extending the current network in a strategic manner including targeting volunteers based on location so as to enhance data coverage
5. That data management systems involving community monitoring data be strengthened, including clarity on who receives what data, in what format, how it is stored, analysed, interpreted, displayed and accessed, custodial responsibilities, and links with other data sets.
6. That user-friendly web-based access for community and other stakeholders be established as soon as possible, with appropriate protocols and provision for it to be regularly maintained and updated.
7. That efforts to strengthen co-ordination with related programs and data, including other community, NRM, industry and research monitoring programs, be continued and conveyed amongst stakeholders as a key task.

Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

- 8 That there is greater recognition of the critical link between community engagement, motivations and data quality in developing and supporting community monitoring.
- 9 That mechanisms to recognise, capture and value community knowledge and observations be further explored and actively developed as part of a community monitoring program and processes.
- 10 That reporting and feedback mechanisms, especially with community stakeholders, be significantly strengthened, including stronger contextual analysis and interpretation of results and regular liaison.  
Most importantly is a need to demonstrate how community data is being used to inform policy and practice change.
- 11 That there is an ongoing multi-pronged capacity development plan operating to support (a) new and existing community volunteers in continuing to gather reliable data, and (b) associated organisational intentions and systems to facilitate this.
- 12 That opportunities to strengthen support to community volunteers be considered, including practical material assistance and collaborative links with other stakeholders and programs.

The Board is currently undertaking a Community Monitoring Framework Review due for completion in July 2011.

3. Automatic Weather Monitoring Network (AWMN)

Data Quality Issues:

All 29 of the original automatic weather station sites established as part of the Automatic Weather Monitoring Network have been surveyed and assigned World Meteorological Organisation (WMO) numbers.

Maintenance at each site is performed on a monthly basis and a standard checklist is completed and stored as metadata to validate the integrity of the network. Scheduled sensor calibrations are also performed with the assistance of contractor, Measurement Engineering Australia (MEA). A detailed fault log is also maintained by the Board and can be accessed by data consumers on the website.

In 2010 the Board was successful in gaining funding through R4 of the Modernisation and Extension of Hydrologic Monitoring Networks program to undertake a project titled 'Implementation of improved data QA procedures for the SA MDB NRM Board meteorological monitoring network'. This project has resulted in an automated data QA system being developed along with a significant upgrade of the public website. The project has also facilitated the transfer of the Board's meteorological data to BoM in WDTF compliant format as is required pursuant to the Commonwealth Water Regulations – see Figure 5 over page.

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  ...
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```

Figure 5: An example of WDTF for wind speed readings for the station at Cadell, RMPW12, for the 17/01/2011. The Board's BoM ID is w00208.

It is expected that the new data QA system will provide significant efficiencies to the operation and management of the network and ensure that a high quality meteorological data product is supplied to a broad range of end users.

The new data management system will also allow additional automated data transfers to occur between the Board and other state government agencies including the DFW and EPA to assist with their business needs.

## Section D – priority areas for investment

Output: - a description of priorities, strategies and recommended actions.

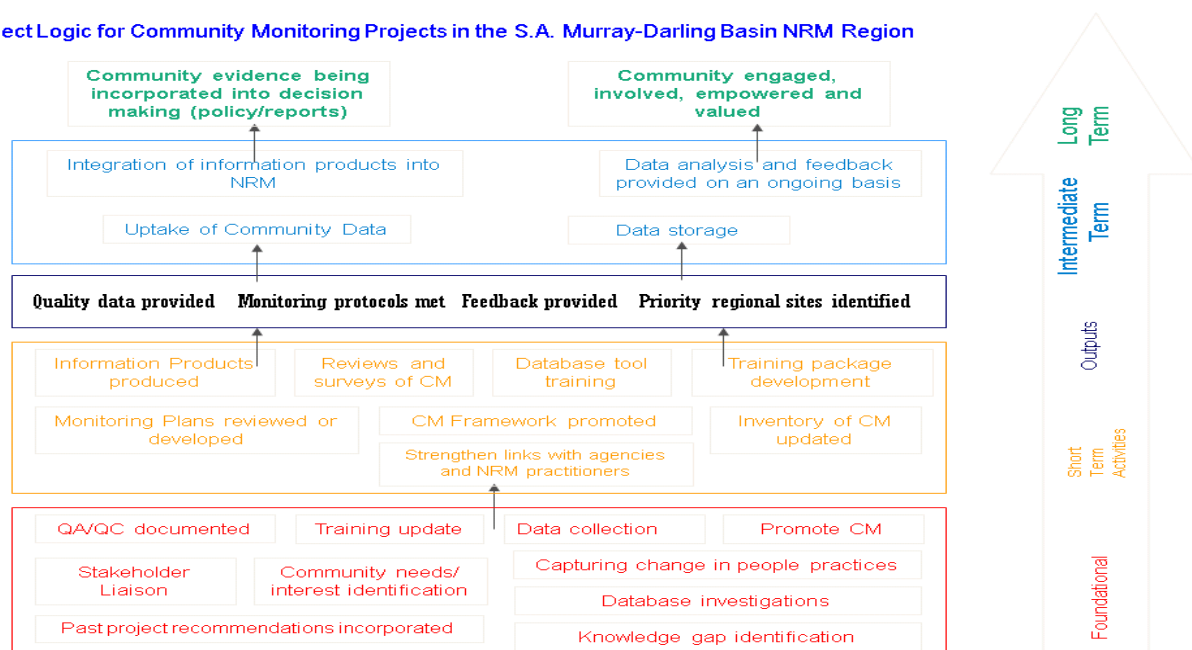
1. Priority investments are outlined in the Business Plan available at:  
(See <http://www.samdbnrm.sa.gov.au/NRMPlan.aspx>)
2. Community Monitoring Program

The Community Monitoring Program and in particular the Community Stream Sampling Program undergoes regional outcomes reporting to ensure alignment with both the Board's regional plan and the state strategic plan. The last review was May 2011.

For the community engagement programs, water is monitored for natural resources management and capacity building. Its priorities are:

- Understand the resource condition and trend - what is sustainable?
- Monitor local impacts and identify any saline incursions
- Support other monitoring activities of groups
- Community engagement

**Project Logic for Community Monitoring Projects in the S.A. Murray-Darling Basin NRM Region**



**Figure 6: Program Logic for Community Monitoring Projects in the SA MDB NRM Region**

3. Automatic Weather Monitoring Network (AWMN)

The expansion of the network into other parts of the Board's region e.g. Eastern Mt Lofty Ranges has been considered however the upfront capital costs together with the increased on-going monitoring costs has meant that any expansion has been only very limited. The



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### Appendix 12 – South Australian Murray-Darling Basin NRM Board mini-SWIMP

new data management system will provide the Board with an improved understanding of network data usage e.g. website hits which will be used to inform future discussions surrounding network expansion.

## **Appendix 13 – Non Supplied mini-SWIMPs**

- Department of Primary Industries and Resources South Australia
- Central Irrigation Trust
- Eyre Peninsula NRM Board
- City of Salisbury
- Alinytjara Wilurara NRM Board