BASIN SALINITY MANAGEMENT STRATEGY - SOUTH AUSTRALIA'S ANNUAL REPORT 2011-12

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- South Australian Research and Development Institute;
- SA Water;
- Future Farm Industries Cooperative Research Centre; and
- other divisions within the Department of Environment, Water and Natural Resources.

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LIST OF ABBREVIATIONS

ABIMZ	Angas Bremer Irrigation Management Zone
ABWMC	Angas Bremer Water Management Committee
ADCP	Acoustic Doppler Current Profiler
AHD	Australian Height Datum
BSMS	Basin Salinity Management Strategy
CLLMM	Coorong, Lower Lakes and Murray Mouth
CDS	Comprehensive Drainage Scheme
CEWH	Commonwealth Environmental Water Holder
COAG	Council of Australian Governments
CMC	Catchment Management Consulting
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DENR	Department of Environment and Natural Resources
DEWNR	Department of Environment, Water and Natural Resources
DFW	Department for Water
EC	Electrical Conductivity - µS cm^{-1} EC
FFI CRC	Future Farm Industries Cooperative Research Centre
GL	Gigalitre (1 000 000 000 litres)
IAG	Independent Audit Group
IIEP	Improving Irrigation Efficiency Project
IRES	Irrigation Recording Evaluation System
LAPs	Local Action Planning Associations
LWMP	Land and Water Management Plan
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
ML	Megalitre (1 000 000 litres)
NRM	Natural Resources Management
OFIEP	On-Farm Irrigation Efficiency Program
SA MDB	South Australian Murray-Darling Basin

SA MDB NRM Board	South Australian Murray-Darling Basin Natural Resources Management Board
SARMSS	South Australian River Murray Salinity Strategy
SARDI	South Australian Research and Development Institute
SASP	South Australia's Strategic Plan
SIS	Salt Interception Scheme
SKM	Sinclair Knight Mertz
t	Tonne
TDS	Total Dissolved Solids
TLM	The Living Murray
WAP	Water Allocation Plan
WUE	Water Use Efficiency

1. EXECUTIVE SUMMARY

Management of River Murray salinity remains a key priority for South Australia. This is due to the State's location on the lower reach of the River Murray, the natural geological structure of the Murray-Darling Basin (MDB) in which the River Murray acts as a drain for salt out of the landscape, and the influence of human development in mobilising salt to the River. Ultimately, elevated salinity has implications in terms of water quality for all uses, including critical human water needs and environmental assets.

This report documents South Australia's accountability and delivery against the Murray-Darling Basin Authority (MDBA) Basin Salinity Management Strategy (BSMS) and Schedule B of the Murray-Darling Basin Agreement (Schedule 1 of the *Water Act 2007* (Cth)).

The report is structured around a standard Table of Contents agreed to in 2008 by jurisdictions for BSMS reporting, as noted at Basin Salinity Management Advisory Panel Meeting #13, 16 July 2012.

Chapter three describes work undertaken in 2011-12, grouped against each of the nine elements of the BSMS, with an indication given to priority areas of focus for the coming year and beyond.

Chapter four provides a summary of flow and salinity observations and predictions at key locations within South Australia.

Chapter five summarises South Australia's response to the recommendations of the Independent Audit Group – Salinity from their most recent report.

Key current salinity management issues for South Australia include establishing appropriate salinity management provisions in the Murray-Darling Basin Authority (MDBA) proposed Basin Plan that build on the strength of the existing BSMS. Managing and accounting for the potential salinity impacts of environmental water use is also a key outstanding focus and South Australia is keen to work with the MDBA to finalise the accounting framework in 2012-13.

This report has been compiled by the Department of Environment, Water and Natural Resources (incorporating the former Department for Water and the former Department of Environment and Natural Resources) with significant contributions from other agencies and organisations. This reflects that management of salinity in the South Australian Murray-Darling Basin (see Figure 1) involves a partnership approach across the community, State agencies, the MDBA and other jurisdictions.

Key Achievements

Key salinity management achievements in 2011-12 include:

- South Australia's balance on the BSMS Salinity Registers remains in positive credit, following endorsement of the Salinity Registers by Murray-Darling Basin (MDB) Ministerial Council, 29 June 2012;
- Analysis and provision of advice on the Water Quality and Salinity chapter of the proposed Basin Plan, including considerable work to support the inclusion of salinity

operational targets to aid in flow management decision, and a salt export objective to aid in adequate flushing of salt to sea;

- Delivery of South Australia's obligations under Schedule B to the Murray-Darling Basin Agreement, including annual report to the BSMS, update of BSMS Salinity Registers entries and participation in the annual audit by the Independent Audit Group – Salinity (IAG);
- Groundwater modelling to support annual update of entries on the BSMS Salinity Registers, including completion of peer review of a number of South Australia's models with MDBA, enabling accreditation of the models and further update of BSMS Salinity Registers entries by November 2012;
- Continued progress on the construction of the Murtho Salt Interception Scheme (SIS) (due for commissioning in the final quarter of 2012);
- Completion of the salinity assessment of operation of the Chowilla environmental regulator; and
- Development of a pilot irrigation Annual Water Use report to understand current patterns in irrigation water use and hence future salinity impacts.

Significant Work

Significant effort was directed to:

- Engagement with the MDBA and the Commonwealth Environmental Water Holder (CEWH) to develop policy guidelines for accounting for salinity impacts of environmental watering; and to ensure that operational plans for environmental regulators are established cognisant of salinity impacts and contain appropriate management responses;
- Development of appropriate salinity provisions for inclusion in the revised version of the River Murray Water Allocation Plan (WAP);
- Updating the South Australian River Murray Salinity Zoning Policy (to ensure the policy is consistent with the unbundled water licensing regime);
- Finalising a simplified salinity assessment process for assessing the salinity impact of irrigation actions;
- Incorporation of salinity data requirements within the new Common Registry System;
- Finalising the 5-year review of the Morgan to Waikerie numerical groundwater model;
- The development of a proposal for a cross South Australian agency approach to crop data collection to support irrigation salinity assessments (currently undergoing internal review); and
- Commencement of a project undertaking a high level salinity assessment of proposed environmental works at Pike and Katarapko floodplains.

Future Work

The forthcoming Water Quality and Salinity Management Plan (WQSMP) within the Basin Plan will continue to be a major focus for 2012-13. At June 2012, South Australia was involved in inter governmental consultation on the Proposed Basin Plan including Chapter 8 – the water quality and salinity chapter. It will be especially important for the Water Quality and Salinity Management Plan to build on the strength of the BSMS successes and for effort to be directed to building an appropriate interface between the Basin Plan and the existing strategy.

In 2012-13, significant effort will also be directed towards:

- Delivering Schedule B reporting requirements (BSMS Annual Report, updates to Salinity Registers entries and Audit) and providing significant input to the mandated review of Schedule B;
- Working with the Murray-Darling Basin Authority to develop the accounting framework for BSMS salinity registers assessment of the salinity impacts of environmental watering actions;
- Exploring options for efficiencies in operation of salt interception scheme infrastructure;
- Working with the environmental watering program to ensure that operational plans for environmental regulators are established that are cognisant of salinity impacts and contain appropriate options for operational responses;
- Provision of policy input to the revision of the WAP for the River Murray Prescribed Watercourse;
- Finalising the updates to the South Australian River Murray Salinity Zoning Policy;
- Working with the Murray-Darling Basin Authority to explore options for the BSMS beyond the current 2015 expiry date; and
- Commencing the 5-year review of the Woolpunda numerical groundwater model to support further updates to data entries on the BSMS Salinity Registers.

Completion of these tasks in 2012-13 will ensure South Australia can continue to address the highest salinity risks to the River Murray system, meet its salinity management obligations under Schedule B, and be well placed to manage against any new targets and objectives in the Basin Plan.

2. INTRODUCTION

South Australia is committed to delivering salinity management obligations under the Murray-Darling Basin Authority (MDBA) Basin Salinity Management Strategy (BSMS) and Schedule B of the Murray-Darling Basin Agreement (Schedule 1 of the *Water Act, 2007* (Cth)). South Australia also recognises the importance of salinity management through key State level strategies and plans. These include:

- Water for Good (Action 56): Maintain a positive balance on the MDBA's Salinity Register, and continue to implement strategies and actions to ensure the real time management of salinity in the lower reaches of the River Murray so that water quality remains at levels suitable for human consumption;
- South Australia's Strategic Plan (SASP) Target (T.77): River Murray Salinity – South Australia maintains a positive balance on the MDBA's Salinity Register;
- 'Our Place Our Future' State Natural Resources Management Plan, South Australia 2012-2017, guiding Target 6 maintain the productive capacity of our natural resources;
- Objectives in the *River Murray Act 2003*; and
- Management Action Targets in the South Australian Murray-Darling Basin Natural Resources Management Plan.

Additionally, on 14 February 2012, the Governor's speech to South Australian Parliament outlined seven strategic priority areas for the State Government. Effective River Murray salinity management is particularly relevant to the first of these priority areas "Premium Food and Wine from our Clean Environment" by contributing to the sustainability of food production from a healthy working River Murray.

Salinity management will require continued investment in South Australia to manage the risk of increased salt loads to the River Murray into the future, partly due to past actions (the legacy of history) and continued irrigation development, but also due to increased mobilisation of salt that may result from higher flows and environmental watering.

The Department of Environment, Water and Natural Resources (DEWNR) continues to work across programs internally and collaborate with key external stakeholders including the MDBA to maximise the value of investment across programs to continue to manage salinity within the Murray-Darling Basin.

Context for 2011-12

Higher flows in the River Murray were again the dominant factor affecting salinity and salt loads in South Australia during 2011-12. Following the high flows detailed in the 2010-11 report, flows to South Australia dropped to 10 000 ML/day by November 2011 and then rose again to approximately 60 000 ML/day by April 2012. Flows again receded to under 20 000 ML/day by June 2012.

Salinities at the South Australian border remained low, in the 200 to 250 EC range, with a subsequent maximum at Morgan of 450 EC. Approximately 1.5 million tonnes of salt passed

Morgan. Flow rates enabled the barrages to be opened, facilitating flushing of salt to sea. The maximum salt load at Morgan in this period was approximately 250 000 t/month in May 2012.

Salinity levels in Lake Albert remained higher. The average salinity in Lake Albert was 3700 EC at the end of June 2012. This represents a reduction from July 2011 when the average salinity level was 6400 EC. Lake level cycling will continue in 2012-13 to facilitate further salinity reductions.

Figure 1 is a map outlining the key geographic features of the MDB in South Australia.

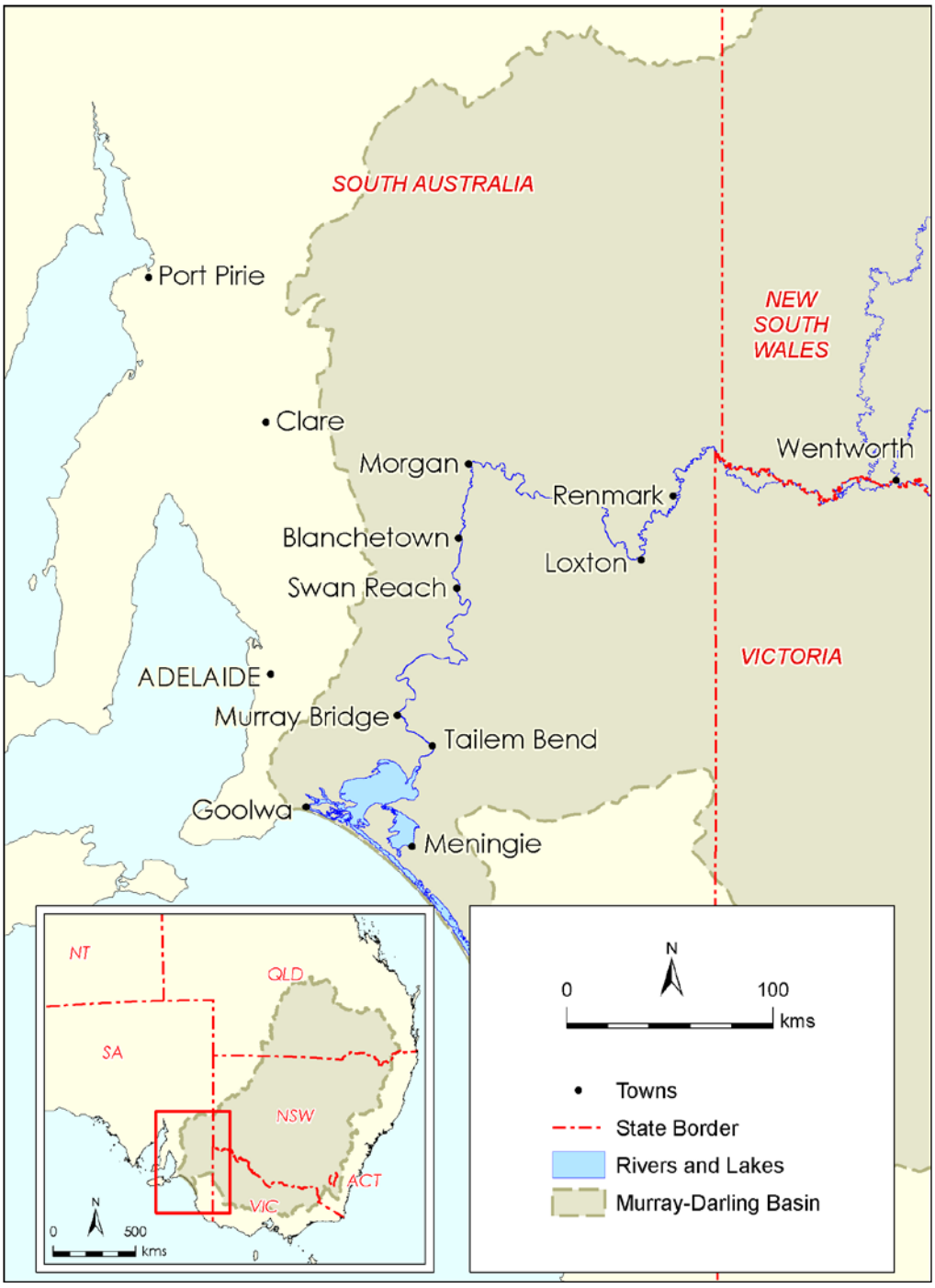

Figure 1 - South Australian Murray-Darling Basin

3. NINE ELEMENTS OF THE BASIN SALINITY MANAGEMENT STRATEGY

The following sections highlight actions taken within South Australia in 2011-12 to implement each of the nine elements of the BSMS:

1. ***Developing capacity to implement the Strategy***
2. ***Identifying values and assets at risk***
3. ***Setting salinity targets***
4. ***Managing trade-offs with the available within-valley options***
5. ***Implementing salinity and catchment management plans***
6. ***Redesigning farming systems***
7. ***Targeting reforestation and vegetation management***
8. ***Constructing salt interception works***
9. ***Ensuring Basin-wide accountability: monitoring, evaluating and reporting***

3.1. DEVELOPING CAPACITY TO IMPLEMENT THE STRATEGY

The Commission and partner Governments will administer a comprehensive 'knowledge generation' program to support Basin and within valley planning and implementation.

The partner Governments will assist catchment communities to implement national, Basin and State initiatives by improving access to and use of the knowledge and decision tools generated by investigations and salinity research and development. This process will be supported by further capacity building for catchment planning, including communication and education. *(BSMS 2001–2015)*

Various initiatives are undertaken in South Australia to develop and maintain capacity to implement the BSMS. Developing capacity occurs at different levels including within local communities and groups focussed towards on ground actions, within South Australian government agencies, and in terms of the ongoing interface between South Australia, Commonwealth agencies such as the MDBA and other jurisdictions that are party to the Murray-Darling Basin Agreement.

3.1.1. Irrigator Annual Reporting

Irrigator Annual Reporting for the River Murray Irrigation Management Zone

Irrigation Annual Reporting is recognised as being an important component of programs to manage the salinity impact of irrigation. The capacity to develop irrigation annual reports was maintained through the annual collection of irrigation data and maintenance of relevant databases and datasets.

Collection of this data enables analysis of:

- crop types and areas;
- annual water use compared to site use approval volumes;
- irrigation intensity - including at a crop type level; and
- water use efficiency - based on estimates of crop water use and annual water use and precipitation.

South Australia has produced a draft pilot River Murray annual water use report based on this data. Such analysis enables future irrigation water drainage risks to be assessed; this facilitates the development of priorities for the Land and Water Management planning. This analysis will also underpin a risk assessment approach required for development of the new River Murray Water Allocation Plan, including identifying key risks to water resources and ecosystems as a result of salinity. It is anticipated that another iteration of the River Murray annual water use report can be developed in 2012-13 to allow for the comparison of water use and efficiency data between water use years.

Irrigator Reporting for the Angas Bremer Irrigation Management Zone

The 2010-11 Irrigation Annual Report for the Angas Bremer Irrigation Management Zone (ABIMZ) was prepared during 2011-12 and is available at: http://angasbremerwater.org.au/annual_reporting.php

The 2010-11 Angas Bremer Irrigation Annual Report indicated that the average water use across the districts 6 678ha of irrigated crops was 2.0ML/ha compared with 2.47ML/ha in the 2009-10 irrigation season. The reduction in district water consumption is likely due to the wetter than average conditions experienced in 2010-11, particularly during the active irrigation season.

Active Managed Aquifer Recharge (MAR) continued in the district with 4 825ML recharged in 2010-2011, which was slightly lower than the record levels achieved in 2010-11. The availability of improved water quality sourced from the River Murray at Jervois and supplied via the Creeks Pipeline Company is one of the key drivers of active MAR practice in the Angas Bremer region.

3.1.2. IrriEYE

IrriEYE is a prototype Irrigation Advisory Service based on near-real time high resolution satellite data. IRRI-EYE provides farmers and water managers with real-time irrigation water data needs from field and irrigation unit to district and river basin scale. The prototype, initially developed and then consolidated in Italy and Spain, has been adapted to Australian tree crops in the irrigation district of Bookpurnong. In 2011-12 the SA MDB NRM Board collaborated with the University of Naples (Italy) to conduct an IrriEYE trial in the Bookpurnong-Lock 4 irrigation district to assess the effectiveness of satellite based remote sensing input to inform agricultural water management.

The water requirements of five irrigated properties in the Bookpurnong district were analysed using satellite based techniques to determine the efficiency of irrigation management practices.

The IrriEYE trial will continue during the 2012-13 irrigation season with the methodology to be further refined and additional system calibration works to be undertaken.

3.1.3. Case Study Groups

Land and Water Management Planning (LWMP) activities continued during 2011-12 in the Bookpurnong-Lock 4, Taylorville North, Pyap-Kingston on Murray and Angas Bremer irrigation districts.

Sustainability Reports were prepared for both the Bookpurnong-Lock 4 and Taylorville North LWMP regions which included detailed assessments of district irrigation efficiency levels. Updates to irrigation footprint data for the Bookpurnong-Lock 4 and Taylorville LWMP districts was undertaken as part of the project with selected outputs presented in Figure 2 and Figure 3. Figure 2 shows proportions of irrigation system used in this district. Figure 3 summarises proportions of crop types.

Positioning LWMPs to have close interaction with the implementation of the MDBA Basin Plan will be a focus of 2012-13 LWMP work activities.

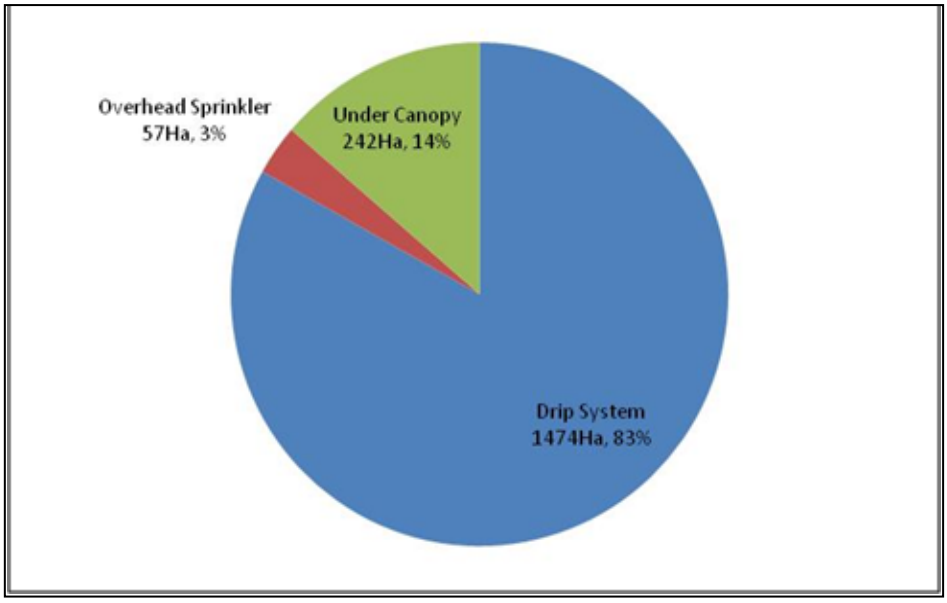

Figure 2 - System Type by planted area (ha) - Bookpurnong LWMP District 2011-12

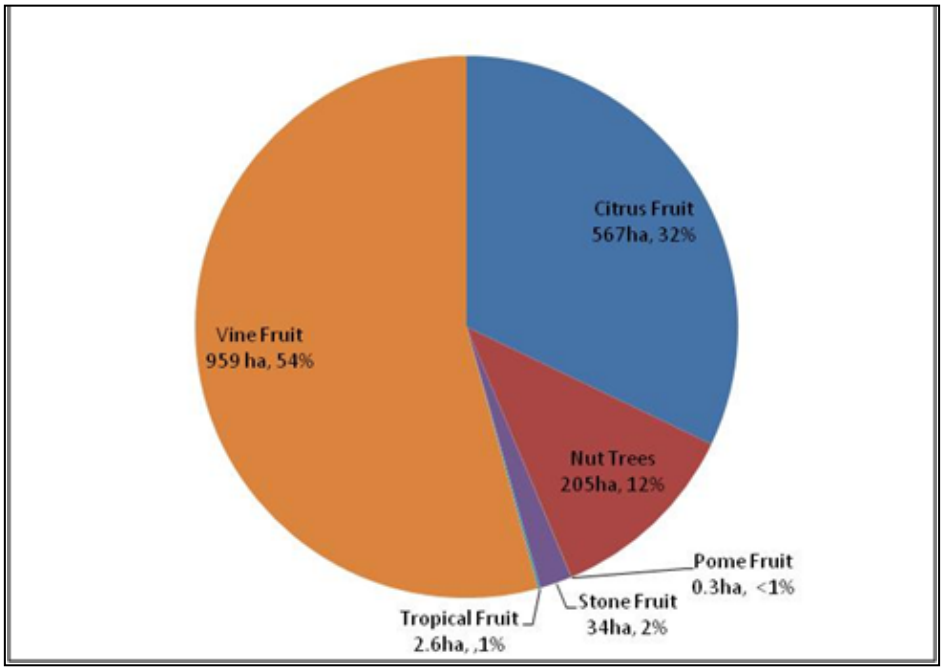

Figure 3 - Land Use by Crop Type (ha) - Bookpurnong LWMP District 2011-12

3.1.4. South Australian MDB Sustainable Irrigation Steering Committee

The cross government agency South Australian Murray-Darling Basin Sustainable Irrigation Steering Committee (SISC) was formed in 2010 and comprises representatives from the South Australian Murray-Darling Basin Natural Resources Management Board (SA MDB NRM Board), former Department for Water (DFW) and Primary Industries and Regions SA (PIRSA).

The broad role of the SISC is to provide effective coordination and collaboration across key state government agencies to deliver irrigation and salinity management programs.

The key issues discussed by the committee during 2011-12 included the collection and management of irrigation data, particularly the updating of crop area data and the specific interactions of this with Irrigation Annual Reporting processes.

3.1.5. Measuring Water Use Efficiency in the SA MDB

South Australia is working to develop appropriate indicators for monitoring the effects of irrigation efficiency policy for inclusion in future WAPs. Regulation and compliance policies under the WAP will be developed to support efficient management of irrigation water.

The South Australian Murray-Darling Basin NRM Board continues to facilitate investment in research and development to enable improvements in the efficient management of irrigation water. A particular focus in 2012-13 is investigating options to facilitate ongoing collection of core datasets used in measuring water use efficiency, including crop survey data.

3.1.6. Sustainable Irrigation Code of Practice

An Irrigation Code of Practice is an important potential risk mitigation tool for managing the future salinity risk/occurrence of deep drainage events. This is because it tackles the cause of the problem by minimising irrigation water drainage rather than the symptoms (such as the use of SIS to lower groundwater mounds).

A draft Irrigation Code of Practice has been developed that identifies key points or risks in the irrigation enterprise, and identifies and proposes control actions to minimise these risks.

The draft Code of Practice incorporates three levels of practice, from a minimum level of competency to a high level of competency. The code specifies management practice requirements and mandates standardised data collection at a property level, to inform both property and district scale performance. This includes a basic crop survey and computer based recording, scheduling and analysis.

The draft Code of Practice is currently being trialled through a phone based survey and field visits. The trial involves irrigators from the Young Irrigators Group and a representative sample of irrigators from elsewhere within the SA MDB. The trial provides an opportunity to benchmark irrigation standards, identify key risks to irrigation practice and support and enhance current levels of practice. This will help inform decision making regarding the most appropriate future policy strategies in the future River Murray Water Allocation Plan for the management of irrigation water use efficiency.

In addition to the development of a Code of Practice. a Water Stewardship Field Trial in the Murray-Darling Basin has been sponsored by the Murray-Darling Basin Authority. Water

Stewardship aims to develop a recognised standard for water use along the supply chain including protection of water quality and environmental values. The trial will include the development of a Water Stewardship Plan to identify the key risks to responsible water use and relevant actions that enterprises can take to ameliorate these risks. This approach links strategic goals to on-ground action. It engages irrigators through a voluntary approach and encourages and fosters partnerships and collaboration between irrigators, government and research bodies to manage the efficient use of irrigation water.

3.1.7. Future Farm Industries Cooperative Research Centre

In 2011-12, the Government of South Australia continued to be involved in the Future Farm Industries Cooperative Research Centre (FFI CRC) through South Australian Research and Development Institute (SARDI) and the former DENR, in collaboration with CSIRO and The University of Adelaide. The aim of the FFI CRC is to develop innovative farming systems and new regional industries through the incorporation and sustainable use of perennial plants for broad-acre farming in southern Australia. These perennial plants and farming systems can reduce salinity impacts and provide other natural resource management benefits for soil protection and supporting biodiversity, whilst at the same time providing production benefits compared to more traditional farming systems.

The Government of South Australia continued to support the FFI CRC development of profitable perennial shrubs in the Murray-Darling Basin through ongoing activities at DEWNR's Monarto Research Site. Recent activities included the establishment of an experimental trial of perennial shrub livestock grazing. (Figure 4 shows perennial shrubs after grazing in May 2010 and regrowth in November 2011). This trial will investigate whether a diverse mixture of shrubs, combined with grazing management based on animal behaviours, influences the intake of shrubs by livestock compared with a monoculture shrub (such as an Old Man Salt Bush stand) and conventional animal management. Results have shown that sheep could be introduced to novel shrub species and include these in their diet relatively quickly without compromising live weight.

These farming system options are being developed for the lower rainfall livestock/cropping zone of southern Australia such as the South Australian MDB region. Current research indicates that fodder shrubs, established on 20 percent of farm land, can increase whole farm profits by providing out of season feed (during summer and autumn) whilst reducing groundwater recharge rates. However, using a single shrub species is not considered the "silver bullet" solution but rather a mixture of shrub species provides the best nutrition and maximises natural resource management benefits.

Additionally, propagation trials at Waikerie continued to refine propagation techniques in order to be able to produce commercial quantities of seedlings that will be economical viable for landholders, and SARDI continued the delivery of dryland salinity information through the FFI CRC-funded Saltland Knowledge Exchange project, which is the last major national extension project addressing dryland salinity management. As part of its management of the Saltland Genie website the project has also continued to develop future training courses for Dryland Salinity management through its Saltland Skills courses.

Future Farm Industries CRC website: http://www.futurefarmonline.com.au/

Saltland Genie website: http://www.saltlandgenie.org.au/

Figure 4 – Perennial shrubs after grazing in May and regrowth in November

3.1.8. On-Farm Salinity Monitoring and Management Trials

During 2011-12 the SA MDB NRM Board continued its support of on-farm root zone salinity management trials in the lower reaches of the region. Active salinity management trials have been underway in the Langhorne Creek and Currency Creek irrigation areas for many seasons reflecting the importance of this issue for these regions.

The results of the trial work have reinforced the importance of implementing an active monitoring program to support informed decision making and encourage adaptive management solutions. It highlights that operational conditions are dynamic in nature and therefore farm management practices need to reflect this in order to support the adoption of long term sustainable practices.

The results of both the Langhorne Creek and Currency Creek salinity monitoring trials were presented at the Irrigation Australia Limited National Conference which was held at the Adelaide Convention Centre in June 2012.

3.1.9. Coping with Irrigation Drought

The majority of irrigated cropping in the South Australian MDB is permanent horticultural crops, in particular citrus, almond, other fruit trees and grape vines. In 2011-12, research into the impacts of reduced water allocation - due to several years of drought - on Riverland crops shifted from assessing crop survival to evaluating crop recovery on returning to full water allocation.

Trials and on farm monitoring programs have been used to collect data over the course of the recent drought, and during the subsequent return to full water allocation. Analysis of these datasets provided insight to the resilience of some of these crops to reduced water applications and salt build up in soil profiles.

Irrigation management and crop husbandry strategies have subsequently been prepared to assist growers in minimise salt accumulation in the soil profile and damage to permanent horticulture under circumstances of extreme water restrictions. For example, research for vines has shown that a rotational system of water reduction across the entire vineyard (rather than significant reductions contained to specific varieties) would be the best strategy to minimise long term impacts.

Options for managing citrus trees include reducing canopy size through pruning, in order to reduce water demand, with water savings approximately in proportion to the percentage of canopy removed. The canopy will regrow over a few seasons, noting that regrowth will be moderated by the amount of water available.

Findings from research in almond crops (as shown in Figure 5) indicate that reductions in water applications result in direct reductions in yield. It was concluded that maintaining water availability, by leasing water allocations, was the best strategy for almonds.

Figure 5 – Reduced water application trial on almond production yield

3.1.10. Community Stream Sampling in the SA MDB NRM Board Region

Salinity remains the single most influential factor for healthy river systems in the South Australian MDB region. The Community Stream Sampling project supports more than 40 community groups across the South Australian MDB region, by providing them with the means to identify areas within their catchments that are at risk from salinity. The information obtained is used by groups to better understand their local water resources. In addition, this local-scale monitoring is used to enhance the regional water resource picture. Salinity monitoring forms part of a broader community water monitoring program that also captures the following water quality parameters; nutrient, turbidity, pH, supporting field observations and biological monitoring.

The community stream sampling program collects salinity readings from 143 sites over the South Australian MDB region. Some of these sites have been continually monitored since 1994, others are relatively recent, and some are inactive due to changes to the monitoring program. Collection of data by schools increased the number of sites (particularly Riverland sites) and has made inter-annual comparisons possible.

Analysis of the Community Stream sampling data for community groups and schools indicated that the highest salinity levels were recorded in the main channel and in-feed streams south of lock one. Ephemeral streams consistently exhibited the highest salinity readings.

Surface water salinity over the 2011-12 year ranged from 100 EC at Kingston-on-Murray to 121 000 EC at Long Gully Creek near Mannum (LGS-020). In comparison 2010-11 results

ranged from 80 EC at Kingston-on-Murray to 54 300 EC at the Long Gully Creek site. The median value of all sites was higher in 2011-12, although further analysis shows more sites recorded lower salinity values in 2011-12 (adjusted to account for extra number of sites). The greater number of low salinity sites in 2011-12 does point to improved salinity conditions across all sites.

Figure 6 provides a geographic representation of the extent of monitoring sites across the South Australian MDB.

Figure 6 – Combined community and schools stream sampling sites across the SA Murray-Darling Basin Natural Resources Management Board Region

An online community monitoring database now operative with an improved interface functionality and expanded data sets (with 90 sites added for a total of 233), and is available at http://www.samdbnrm.sa.gov.au/

The interface provides for:

- transfer of quality controlled datasets that have been 'released' via the community monitoring database;
- improved quality control through compliance with Bureau of Meteorology quality categories for water data;
- automated data capture that removes errors that can occur during manual data input;
- achievement of Bureau of Meteorology water information reporting requirements; and
- timely data set transfer.

Data sets are being analysed at a catchment and sub-catchment scale utilising database information to determine long term trends. This analysis is being fed back to the community volunteers involved.

The Board considers this model of community data collection and storage to be one that can be promoted to other NRM regions in Australia.

3.2. IDENTIFYING VALUES AND ASSETS AT RISK

The partner Governments will work with catchment communities to identify important values and assets throughout the Basin at risk of salinity, and the nature and timeframe of risk. This Strategy emphasises the triple-bottom-line approach, requiring a balance between economic, environmental and social values. It necessarily recognizes that living with salinity is the only choice in some situations.

(BSMS 2001–2015)

South Australia recognises that management of environmental watering at a Basin scale requires a coordinated whole-of-Basin approach. This is to take into account the need to meet environmental water requirements for system assets and remove salt from floodplains while maintaining river salinity within acceptable salinity levels for all water users, including other downstream assets such as the Coorong and Lower Lakes. In assessing which sites to water, the potential scale of the cumulative salinity impacts. in-stream flow and salinity conditions and availability of water for dilution need to be considered.

3.2.1. Floodplain and Wetland Watering

The native riparian vegetation on many parts of the floodplains of the Lower River Murray in South Australia is in severe decline. This is due to high soil salinity and lack of flooding. The Lower River Murray acts naturally as a drain for the highly saline regional groundwater systems of the Murray-Darling Basin, and much of the groundwater passes through these floodplains.

Prior to river regulation, salt was regularly mobilised out of the River Murray floodplain in response to frequent flood inundation of the adjacent floodplains. While the salt content of the Basin has not changed under river regulation, factors such as reduced water availability, lack of regular high flow events, river regulation and land management practices have all resulted in changes in the timing of the discharge of salt from the Basin groundwater systems, wetlands and floodplains.

Most notably, salt has concentrated in floodplains and wetlands due to changes in the timing of wetting, drying and release cycles. This has impacted on the health of these systems. Broad scale environmental watering measures (including those under The Living Murray program) have been initiated to reinstate (or at least mimic) the natural wetting, drying and salt release cycles in these systems and larger volumes of environmental allocations are intended to be delivered to such systems in future.

Broad scale environmental watering measures will be beneficial to the health of floodplains and wetlands but also have the potential to mobilise significant volumes of salt to the river; resulting in accountable salinity impacts under Schedule B of the Murray-Darling Basin Agreement. The local real-time (short term) salinity impacts are likely to be particularly significant and will warrant decision-making before and during the course of managed events to ensure salinities do not exceed agreed salinity targets. South Australia supports the inclusion of such actions on the BSMS Salinity Registers; however the real time impacts need to be given serious consideration, particularly where multiple sites are being watered concurrently, as the cumulative salinity impacts may be significant.

The delivery of environmental water therefore needs to be appropriately managed to ensure an effective balance between restoring the health of wetlands, floodplain systems and managing potential salinity risk. This highlights the need for a real-time salinity management framework to ensure salinity risk can be assessed across all sites and watering events managed accordingly.

It is therefore essential that partner jurisdictions recognise the importance of managing real-time salinity impacts at all sites, and that an allowance of dilution water is made available, in addition to the allocation required to achieve the ecological objectives at the respective sites.

Chowilla Floodplain Icon Site

The Chowilla floodplain is underlain by a shallow highly saline aquifer and is well documented as a source of saline groundwater discharge into the River Murray. It is recognised that managed inundation of the floodplain via operation of the Chowilla environmental regulator will reduce soil salinity, thereby improving vegetation health and providing environmental benefit to the Chowilla region. However, it is understood that the inundation will also result in an increased discharge of salt into the Chowilla Creek and ultimately to the River Murray.

In December 2009, the MDBA approved construction of the Chowilla environmental regulator. The approval advice from the MDBA requested further work to assess the potential short term (real time) and long term salinity impacts of regulator operation to inform development of an appropriate regulator operating strategy, prior to operational approvals being granted.

An assessment of the real time salinity impacts of regulator operation, including consideration of salt from both groundwater and surface water sources was completed in March 2011 by Sinclair Knight Mertz (SKM).

Furthermore, comprehensive work was completed by Aquaterra in May 2012 to upgrade the Chowilla groundwater model. The upgrade to the model is documented in Aquaterra (2012) which has been peer reviewed (by an MDBA appointed peer reviewer) and is ready for accreditation in line with procedures set out in the BSMS Operational Protocols. Data from the groundwater model will support generation of a future BSMS Salinity Register entry for Chowilla.

In combination with the findings of the real time salinity assessment, the groundwater model outputs provide important information to inform development of an appropriate operating strategy and Basin and local level environmental watering plans. Both the strategy and the plans must be cognisant of potential salinity impacts and contain appropriate mitigation actions.

Possible salinity impact mitigation actions include use of dilution flows and a stepped draw down of regulator height to control release of saline return flows to river.

The first draft of the operating strategy is expected to be completed in the second half of 2012 and will be further refined before regulator operation commences, estimated to be in spring 2013.

Pike and Katarapko Floodplains

Significant investment in environmental watering infrastructure for broad-scale inundation is proposed for the Pike and Katarapko sites.

An investigation is currently being undertaken to quantify the likely salinity impacts and to assess what operational responses, such as dilution flow, may be required prior to seeking approval for construction and operation of the environmental watering structures.

Currently there is inadequate information available to develop a comprehensive and accurate groundwater model for the Pike and Katarapko floodplains. There is neither sufficient spatial hydrogeological data to construct a groundwater model, nor sufficient spatial hydrologic data to validate the model in terms of salt mobilisation.

It is noted that Schedule B, Clause 19 (1) (e) and the BSMS Operational Protocols do not explicitly require the use of a groundwater model to estimate potential salinity impacts. However, there remains a need to ensure an adequate assessment of salinity risk has been completed prior to approval for construction of regulators and watering actions occurring.

Catchment Management Consulting (CMC) was engaged to assess salinity risks associated with the proposed management actions at sites including Pike and Katarapko, consistent with the salinity assessment requirements within the BSMS Operational Protocols.

The intention of the project is to put the salinity risks associated with proposed surface water management actions at Pike and Katarapko into context, and to identify what further effort would be required to satisfy BSMS accountability requirements.

The spatial variability of groundwater attributes combined with a lack of defined operating regimes for floodplain environmental works generates considerable uncertainty in relation to salinity impact assessments. However, the actual impacts from any large watering actions will be measurable soon after the action; this is in contrast to irrigation actions for which there is generally a long lag time between action and impact.

Provisional salinity register entries can be established for Pike and Katarapko based on preliminary estimates using data that is currently available. These estimates would then be reviewed and improved following detailed measurement of the impacts during and post environmental watering actions.

Under the direction of an expert panel (including representation from MDBA), CMC is undertaking a historical analysis based on available data and tools to provide a preliminary estimate of the salinity impact.

This analysis method involves developing simple conceptual models of the prevailing salt mobilisation processes and incorporating these into a rapid assessment approach based upon the knowledge, experiences and more sophisticated analyses undertaken elsewhere.

Specifically, the method will:

- identify the salt mobilising processes prevailing at Pike and Katarapko using the salinity impact assessment framework developed by the MDBA;
- engage with the expert panel (together with other expert sources);
- access and collate the readily available data and information from elsewhere pertinent to the assessment;

- compare and contrast the outcomes of previous studies and assessments from elsewhere with the situation for the Pike River and Katfish Reach proposed works;
- initially, adopt only a relatively conservative worst-case assessment based upon the most likely high impact scenario;
- compare the results of this relatively simplistic analysis with the outputs of analyses and monitoring elsewhere;
- provide advice on an optimal future field monitoring and review process to review the outcomes of this provisional analysis both prior to and after the implementation of the works
- provide advice on the interpretation of the analysis given the range of uncertainty;
- provide advice on potential mitigation opportunities; and
- provide advice on the need and value of any additional investigation or analysis that might be justified prior to any commitment to the proposal.

Should construction of the floodplain infrastructure proceed following this assessment, it is intended that:

- a monitoring and data collection strategy will be developed and implemented to enable further improvements in the impact estimates, as per the current BSMS Operational Protocol requirements;
- infrastructure will be operated with caution in the first instances to minimise salinity risk and used to aid collection of further data and understanding of the impacts;
- the data gathered will be used to populate models that will be considered as part of any subsequent update/review of the salinity impact assessment; and
- if warranted, a more comprehensive modelling platform will be developed (groundwater and surface water model) to better estimate the potential/actual impacts.

Similar to the Chowilla regulator operations, the local 'real-time' (short term) impacts may be significant and will warrant advanced planning and decision-making to minimise salinity impacts during the course of managed events. The assessment of the dilution water required to support operations (to ensure river salinities remain within accepted targets) is likely to be the most critical issue and this will warrant further investigation and discussion.

3.3. SETTING SALINITY TARGETS

The Ministerial Council will adopt end-of-valley targets to protect values and assets while providing for targets to be revised, as new information becomes available. The partner Governments will empower catchment management organisations to advise on end-of valley targets and determine within-valley targets and monitoring arrangements, under salinity and catchment management plans.

(BSMS 2001–2015)

In light of the Water Act, 2007 (Cth) requirements for salinity objectives and targets in the Basin Plan, South Australia has directed effort in 2011-12 to reviewing the proposed salinity targets in the Proposed Basin Plan, and supporting the inclusion of these targets to complement the existing Basin Salinity Target.

3.3.1. Salinity Targets

The existing Basin Salinity Target at Morgan in South Australia (while supported by South Australia as key component of the BSMS) does not adequately provide for management of River Murray salinity below Lock 1 in South Australia. The development of the Basin Plan provides a critical opportunity to set salinity targets for high risk areas of the Basin, including the River Murray below Morgan.

The development of operational salinity targets (termed targets for the management of water flows within the draft Basin Plan) is a critical MDB management issue, especially for South Australia given the location of key water supply off-takes for Adelaide and country towns well below Morgan, at Murray Bridge and Tailem Bend. It is anticipated that the development of these targets will aid in improved operational planning to avoid the extreme salinity levels in the Lower River Murray and Lower Lakes, as experienced in the recent 10 year drought.

South Australia continues to actively support setting salinity targets to guide operational decisions within the Basin Plan. These targets will provide a basis to guide operational management actions, including the management of environmental water delivery.

Not including operational salinity targets in the Basin Plan provides little more for salinity management below Morgan than the existing BSMS, and it would be extremely unfavourable to have completed such an extensive MDB policy and legislative reform process, and have in place a new Basin Plan instrument that is effectively the same as the existing Schedule B.

Scientific Review of Proposed Basin Plan Salinity Targets

The Proposed Basin Plan (MDBA 2011) includes salinity targets and triggers for the River Murray in South Australia based on requirements for human consumption, irrigation, recreation, salinity management and the environment. Salinity targets in the November 2011 proposed Basin Plan comprised Murray-Darling Basin and end-of-valley salinity targets, a salt-load target (since relabelled as a salt load objective) for the River Murray system, and salinity operational targets (since relabelled as targets for managing water flows).

The purpose of the salinity targets is to:

- inform long-term planning for water resource plans;
- specify water quality targets to which particular entities must have regard when performing functions, including in relation to the management of water flows;
- inform monitoring and evaluating the effectiveness of the Basin Plan; and
- ensure adequate flushing of salt to the ocean.

The Proposed Basin plan salinity targets (MDBA 2011) were reviewed by DFW, DENR and the Goyder Institute and documented in a series of reports (Bloss et al (2012), Heneker et al (2012), Lamontagne (2012) and Higham (2012)).

The reports identified that there is considerable uncertainty as to the ability of MSM-BIGMOD to represent and predict the salinity impacts of the changed distribution of water under the proposed Basin Plan. In particular, the salinity impact of environmental water management on the River Murray floodplain is not yet well quantified and consequently not explicitly represented in the model. Nonetheless, the model was considered to provide some useful insights into water quality trends.

An assessment of compliance with targets and triggers relating to South Australia was completed based on modelled salinity outputs generated by MSM-BIGMOD, shown in Table 1. Additionally the MDBA and South Australian environmental water requirements were assessed to determine if the salinity based requirements could be achieved under the 2750 GL scenario.

For the locations assessed in South Australia, the proposed Basin Plan 2750 GL scenario leads to an improvement in salinity according to the modelled outputs. The maximum period of exceedance of the 500 mg/L target value is also improved by this scenario, reducing to 92 days compared to a maximum period of exceedance of 124 days under baseline conditions. The improvements are thought to be due to increases in lower-range flows which provide additional dilution of salt inflows. These downward trends in salinity should be viewed as indicative only, due to the limitations identified above..

Proposed human consumption, irrigation and operational targets were met for all sites in South Australia under the modelled conditions.

Table 1 - Compliance with Salinity Targets and Triggers

Salinity Target or Trigger	Reporting site	Target value (mg/L)	Target value, EC (µS/cm)	Compliance17 with target over modelled period (1/1/1975–30/6/2009)	
				Baseline Conditions	2750 GL Scenario
Water quality targets for raw water for treatment for human consumption (MDBA 2011a, S.8.13)	Tailem Bend	500	830	95%	97%
Water quality targets for irrigation water – Southern Basin, Murray River and Tributaries (MDBA 2011a, S.8.14)	Tailem Bend	500 95% of the time	830 95% of the time	95%	97%
Salinity Operational Target (MDBA 2011a, S.8.18)	Murray Bridge	500 95% of the time	830 95% of the time	96%	97%
	Morgan	500 95% of the time	830 95% of the time	97%	99%
Salinity trigger point at which water in the River Murray System becomes unsuitable for meeting critical human water needs (MDBA 2011a, S.10.05)	Tailem Bend	840	1400	100%	100%
BSMS- Basin Salinity Target	Morgan	-	800 for 95% of time during Benchmark Period (1/5/75 to 30/4/00)	96% (96% during Benchmark Period)	98% (99% during Benchmark Period

The salt-load target that was assessed was expressed indicatively as the provision of sufficient flow to enable export of salt and nutrients from the Basin through an open Murray Mouth (as per Table 2). The indicative target is flows through the mouth >3 200 GL/yr, 100 percent of the time, averaged over the preceding 10 years. Heneker & Higham (2012) found that this flow over the barrages occurred in 78 percent of the years under the Baseline scenario and in 99 percent of years under the 2750 GL scenario.

Table 2 - Assessment of MDBA Environmental Water Requirements

Target	Environmental Water Requirement	Without Development	Baseline	Target	2750 GL Scenario
Salt export: Provide sufficient flows to enable export of salt and nutrients from the Basin through an open Murray Mouth	10 yr rolling average flow >3200 GL/yr in 100% of years (Flow target indicative of salt export target of 2 million tonnes per year)	100%	78%	100%	99%
Maintain a range of health estuarine, marine and hypersaline conditions in the Coorong, including health populations of keystone species such as Ruppia tuberosa in South Lagoon and Ruppia megacarpa in North Lagoon	Maximum salinity of 130 g/L in South Lagoon of the Coorong	67 g/L	291 g/L	130 g/L	122 g/L
	Maximum salinity in South Lagoon of Coorong < 100 g/L in 95% of years	100%	82%	95%	96%
	Maximum period of salinity > 130g/L in South Lagoon of the Coorong	0	323	0	0
	Maximum salinity of 50 g/L in North Lagoon of the Coorong	50 g/L	148 g/L	50g/L	59 g/L
	Maximum period of salinity > 50g/L in North Lagoon of the Coorong salinity	0	148	0	91
Maintain desired ecological character of Lower Lakes through managing water quality	Lake Alexandrina salinity <1000 EC for 95% of all years		70%	95%	95%
	Lake Alexandrina salinity <1500 EC for all years		95%	100%	98%

Overview of South Australia's Response to the Basin Plan Salinity Provisions

The Government of South Australia utilised the results of the Scientific Review along with additional information to review the Proposed Basin Plan and to develop a submission to the MDBA recommending key amendments to ensure the effective management of salinity and water quality across the MDB.

Key salinity management recommendations included in the South Australian Government submission on the Murray Darling Basin Authority's Draft Basin Plan (Government of South Australia (2012)) included:

- A target at or near the border must be retained in the WQSMP.
- The WQSMP must be strengthened through the inclusion of additional salinity operational targets upstream of South Australia to:
    - drive accountability for operational decision making by all jurisdictions in the connected southern system;
    - enable the significant salt accessions to the River Murray from upstream locations to be managed; and
    - provide a recognisable basis for the assessment of water quality entering the State.
- The additional upstream target sites need to be geographically located so that they inform understanding of salt discharge from major tributary valleys.
- Additional salinity operational targets downstream of Murray Bridge are also required..

MDBA subsequently released a revised Basin Plan on 6 August 2012. South Australia has assessed this and provided formal feedback to the MDBA in line with Basin Plan consultation processes. In summary, and in response to the water quality and salinity provisions, South Australia continues to advocate for:

- inclusion of a minimum water level target in the Lower Lakes, to assist in managing connectivity with the Coorong and an open Murray Mouth;
- inclusion of a maximum salinity target of 1500EC for 100% of the time in the Lower Lakes;
- relocation of the Lock 6 salinity target to the Border, to provide a more accurate picture of water quality entering South Australia;
- inclusion of targets for raw water for treatment for human consumption (included in the November 2011 version of the Basin Plan but subsequently deleted);
- measurement of the salt load objective over 3 years as opposed to 10 years;
- drafting changes to clarify that the salinity targets should not be exceeded, rather than met (incorrect intent); and
- clarification of how assessments will be made as to whether actions can be cost effectively undertaken to meet the salinity targets.

3.4. MANAGING TRADE-OFFS WITH THE AVAILABLE WITHIN-VALLEY OPTIONS

The States will analyse and review the best mix of land management, engineering, river flow, and living with salt options to achieve salinity targets while meeting other catchment health targets and social and economic needs. The States will assist communities to understand and agree the options with affected groups, industries and people through best practice planning processes.

(BSMS 2001-2015)

The Government of South Australia is working with local communities, scientists, technical experts and engineers to address tradeoffs and develop long-term sustainable solutions.

3.4.1. South Australia's River Murray Operating Plan

The River Murray in South Australia is operated in accordance with South Australia's River Murray Annual Operating Plan. South Australia's River Murray Annual Operating Plan 2011-12 (the Plan) was the first annual plan to be developed and finalised. In 2011-12, the River Murray in South Australia was managed and operated under the guidance of the 2011-12 Plan, which sought to integrate and optimise the delivery and management of water to (and within) South Australia to:

- accommodate the needs of all water users to the extent that is practically possible within system constraints;
- outline preferred environmental watering priorities and urban and irrigation water delivery requirements under a range of inflow and water availability scenarios (taking into account river health, salinity, water quality and river management targets);
- provide for operational arrangements to underpin the security of supply for all consumptive uses;
- ensure that requirements are fulfilled under the:
    - Murray-Darling Basin Agreement and the associated schedules; and
    - Murray-Darling Basin Authority's River Murray System Annual Operating Plan 2011-12 and the Objectives and Outcomes Document for River Operations for 2011-12; and
- provide a documented and transparent rationale for South Australian River Murray operational decisions made in 2012-13.

The 2011-12 Plan contains eight objectives, most of which were achieved:

- optimisation of water accessibility for all users;
- improved water quality in Lake Albert (target of less than 2 000 EC);
- water levels in the Lower Lakes to be maintained above 0.40m AHD;
- fishways operated during the peak migration periods (July to January);

- delivery of consumptive water aligned with anticipated timing demands;
- water quality and salinity to remain within defined targets;
- deliver environmental water to achieve greatest ecological benefit for river, floodplains, wetlands and the Coorong, Lower Lakes and Murray Mouth; and
- optimise the use of unregulated flow.

3.4.2. Environmental Watering Actions

Delivery of environmental water plays a vital role in supporting the health of South Australia's River Murray and its floodplains and wetlands. Over the past six years environmental watering has ensured the maintenance of drought refuges, prevented the loss of species and habitat, and enabled re-colonisation and re-establishment of species and ecosystem functions when higher flows returned.

Environmental water bids for 2011-12 were developed and submitted to the Murray-Darling Basin Authority's (MDBA) The Living Murray Program (TLM) and the Commonwealth Environmental Water Holder (CEWH). A workshop with ecologists and wetland managers identified priority assets for watering. The criteria used to prioritise 2011-12 watering sites built on the knowledge, experience and monitoring information from previous watering actions.

Securing water for barrage releases was the highest priority watering action. The TLM watering proposal to pump water to above pool wetlands located on the Chowilla Floodplain also remained a priority. CEWH water releases commenced in December 2011 but a return to unregulated flow conditions and unresolved Basin policy constraints stopped delivery after a few weeks. Subsequent high flows meant that no further environmental water was required in South Australia.

Increased flows to South Australia from both regulated and unregulated sources had a positive impact on water levels in the Lower Lakes, resulted in good flows over the barrages, lowered salinity levels in the lakes, improved fish passage and contributed to keeping the Murray Mouth open. There has been continuous flow through the barrages to the Coorong since September 2010.

Compared to previous years, 2011-12 was much different in terms of planning and prioritising for environmental water. Many new opportunities arose due to the high flow conditions. The need to revisit watering proposals was an interesting challenge, particularly with the many uncertainties surrounding natural flow conditions, environmental water releases for upstream watering actions, and approvals for watering in South Australia. This highlights the need for State environmental water managers and the water holders to be flexible and adaptive throughout the environmental water management process.

3.4.3. Barrage Operations and Water Levels in the Lower Lakes

High flows throughout 2011-12 have maintained salinity in Lake Alexandrina well below 1000 EC, with the exception of short-term and localised salinity spikes near the barrages due to reverse head conditions. Despite the high flow conditions, Lake Albert salinities have remained high, due to limited water exchange through 'The Narrows'. Water levels in Lakes Alexandrina and Albert have been 'cycled' during 2011-12 over a range of around 0.3m, to

facilitate water exchange between the lakes and to reduce salinity in Lake Albert. Over the past twelve months, the average salinity in Lake Albert has reduced from around 6400 EC in July 2011 to 3700 EC at the end of June 2012. Lake level cycling will continue in 2012-13 to facilitate further salinity reductions. Water levels and barrage operations are managed closely by DEWNR, SA Water, the Murray-Darling Basin Authority and the Commonwealth Environmental Water Holder.

3.4.4. Reuse of Salt Interception Scheme Water

Saline groundwater extracted by SIS along the River Murray in South Australia has been identified as a potential resource for economic development. Examples of commercial uses of saline groundwater across Australia include inland aquaculture, salt harvesting, chemical extraction and energy production.

DEWNR in conjunction with other departments has undertaken significant work over several years to demonstrate the economic and environmental feasibility of using water sourced from SIS for commercial purposes. Some examples of work completed include SARDI aquaculture trial at Waikerie, release of an Information Memorandum seeking expressions of interest in SIS saline water reuse, and an evaluation report and scoping study.

The evaluation report and scoping study have identified that opportunities for furthering the exploration of the economic and environmental feasibility of using saline water produced in salinity management schemes are extremely limited. Information on the economic and environmental feasibility of using SIS water is freely available from SARDI/PIRSA and numerous other research bodies. This information provides a very strong basis for commercial ventures to make sound business decisions, and further research or work in this area is unlikely to yield significant returns.

3.4.5. Pike Sustainable Extraction Limit Project

Pike River is a major floodplain and anabranch system of the River Murray in South Australia that bypasses Lock and Weir 5. The Pike floodplain region has been identified as a High Conservation Value Aquatic Ecosystem on a national level due to is unique hydrological and ecological character. The Pike River Anabranch is also an important source of irrigation water for the Pike irrigation area and is licensed to extract approximately 26 GL per annum from the system.

The local community have identified the need to set a Sustainable Extraction Limit (SEL) for Pike River to avoid over-extraction, and adverse water quality conditions, especially to those extracting from the lower sections. The limit on extraction from the river will also protect environmental water delivered through the system as part of a floodplain improvement program.

A project is currently underway to work at a community level to identify a SEL which will then be promoted for inclusion in the next River Murray Water Allocation Plan.

A number of scenarios have been modelled to examine the impact of increasing extractions above current levels. The impact of increased extraction varies depending on location, level of extraction, River Murray flows and long term factors such as the completion of the remainder of the Pike salt interception scheme.

The setting of a SEL will enable improved management to ensure that water flows and levels do not decrease to a point where there is likely to be further ecological impact, and that the potential for future salinity impact within the Pike River as a result of water extraction is reduced.

3.4.6. South Australian Weir Pool Manipulation Program

No targeted weir pool manipulation events for environmental outcomes were undertaken during 2011-12. It was proposed that a Lock 1 weir pool manipulation be undertaken in spring 2011. Prior to undertaking the weir pool manipulation a number of activities were required to be completed. Due to uncertainties relating to these activities, it was agreed to defer the proposal. However, due to the high rainfall events across the catchment, unregulated flow achieved the same effect as the proposed weir pool raising.

There may be an opportunity to undertake weir pool manipulation (raising) in conjunction with the delivery of environmental water to South Australia during the spring of 2012. This opportunity is currently limited to weir pool raising in the Lock one to two reach. A range of activities and constraints including construction activity at Chowilla and at Locks two and four will prevent any manipulation of other weirs during 2012-13. Planning is in progress to prepare for implementation of the proposed weir raising at Lock one.

Projects to further progress the weir pool manipulation program in South Australia have been incorporated into the Riverine Recovery project of the Murray Futures program. This includes a range of investigations to fill knowledge gaps and support planning, risk management and progressive implementation of the South Australian River Murray Weir Operating Strategy.

During 2011-12 a literature review of existing research was completed. This focused on the likely impacts of weir pool manipulation on river salinity. The literature review provided a summary of key points and recommendations from previous groundwater and surface water modelling exercises on weir pool manipulation, and identified relevant information contained in reports that could be utilised to further identify potential salinity risks and management strategies.

3.4.7. South East Flows Restoration Project

The South Australian Government is investigating the feasibility of diverting surplus fresh water from the South East drainage network into existing South East wetlands and the Coorong South Lagoon.

The South East Flows Restoration Project (SEFRP) is in the early stages of investigation and it is yet to be determined if the project is feasible – both technically and financially.

The project proposes to use a combination of natural water courses, newly constructed floodways and existing drains to divert surplus water, which currently flows into the sea, towards the Coorong.

Some of the anticipated benefits arising from the project include reducing salinity levels in the southern lagoon of the Coorong, protecting and improving South East marine environments, and providing additional fresh water to South East wetlands.

The DEWNR is currently consulting with the traditional owners, landholders, local councils and other stakeholders to inform them about the proposal and to seek their input.

The State Government will shortly complete a survey of land along the proposed flowpath which will help determine if the project is feasible.

The SEFRP will potentially divert water from a number of catchments currently captured by the Blackford Drain, Drain L and Drain M. These catchments contain important wetlands located downstream of potential diversion points, including the Robe Lakes (Drain L estuary), Lake Hawdon, and Lake George. A primary objective of the SEFRP is to ensure that the ecological health of these downstream wetlands is maintained and only surplus water will be considered for diversion towards the Coorong.

3.4.8. Implementation of the Riverine Recovery Project

Implementation of the Riverine Recovery Project (RRP) commenced in July 2011. The project aims to improve ecological outcomes for floodplains and wetlands, use environmental water more effectively, provide social benefits, and deliver up to 15 GL of environmental water savings to the Commonwealth to help protect or restore environmental assets in the Murray-Darling Basin. To this end, the RRP is aimed at improving the efficiency of environmental water use and re-allocating these water savings for the benefit of the environment.

The Australian Government has committed up to $78 million to the project and the South Australian Government has committed up to a further $8.7 million. This funding will be used to undertake activities across a suite of Project Elements.

One such element is the improvement of floodplains through the provision of critical infrastructure for enhanced environmental flows, fish passage and habitat and connectivity of the floodplain and the river channel. These activities aim to reverse the effects of degradation and restore the ecological health of two significant floodplain sites: Pike and Katfish Reach (Katarapko). A preliminary salinity assessment of further proposed works at these sites has commenced and will be completed in 2012-13 (refer to section 3.2.1).

Another project element involves undertaking necessary investigations and installation of infrastructure to re-introduce more natural wetting and drying cycles for wetlands to improve ecosystem health and resilience. Planning and landholder engagement activities commenced during 2011-12.

Investigations have also commenced to enhance river operations by varying the timing and delivery of environmental water and, where appropriate, adjusting the height of weirs, building upon work previously undertaken by the State and Murray-Darling Basin Authority. These activities will aim to make the most of available water resources whilst taking potential salinity impacts into consideration.

Information management will also be improved to support decision-making. This means that various indicators of wetlands and floodplains, including wildlife, vegetation and water quality, will be monitored and stored for easy access with the results being used to better inform the management of environmental water. This will enable positive ecological, biological and water quality outcomes to be maximised with the available water resources.

RRP aims to achieve measurable long-term improvements in the health of the riverine environment between Wellington and the South Australian border. The project will enable more effective use of water and support regional communities and is linked with the Murray Futures Long-Term Plan for the Coorong, Lower Lakes and Murray Mouth by extending the efforts to build resilience and address river health across the whole of the River Murray system in South Australia.

3.5. IMPLEMENTING SALINITY AND CATCHMENT MANAGEMENT PLANS

This Strategy acknowledges gains made by existing plans, but requires that actions in existing and new plans, or the plans themselves, will need to be assessed and reported against the end of-valley and Basin targets and recorded on Salinity Registers.

The partner Governments will continue and enhance support for land and water management plans (LWMPs) in irrigation regions.

The partner Governments will enhance support for development and implementation of ICM Policy-compliant salinity and catchment management plans in dryland regions.

(BSMS, 2001-2015)

The significance of River Murray salinity as an issue for South Australia is reflected in it being recognised through key State level strategies and plans. The aim is to facilitate management action within South Australia that contributes to improved salinity outcomes locally and thus assists in meeting BSMS objectives.

3.5.1. State Plans and Strategies

South Australia's Strategic Plan

An updated South Australian Strategic Plan (SASP) was released in September 2011. A year in the making, the updated Plan reflects the input of thousands of South Australians and responds to what the community viewed as most important for our future. This input has formed visions and goals right throughout the Plan. The updated Plan now has 100 targets which align with visions and goals drawn directly from community input.

Management of salinity in the Murray-Darling Basin continues to be recognised in the Strategic Plan with a specific salinity target: River Murray Salinity – South Australia maintains a positive balance on the MDBA's Salinity Register (T.77, formerly T3.11).

An implementation plan and fact sheet for this target were released in 2007-08. The graph from this fact sheet (Figure 7) is updated periodically to reflect updates to South Australia's balance on the Salinity Registers. Accordingly, Figure 7 is based on the November 2011 salinity registers. The graph projects South Australia's salinity credit balance over time; this informs future policy directions and guides further investment and management actions to maintain the State in positive credit balance.

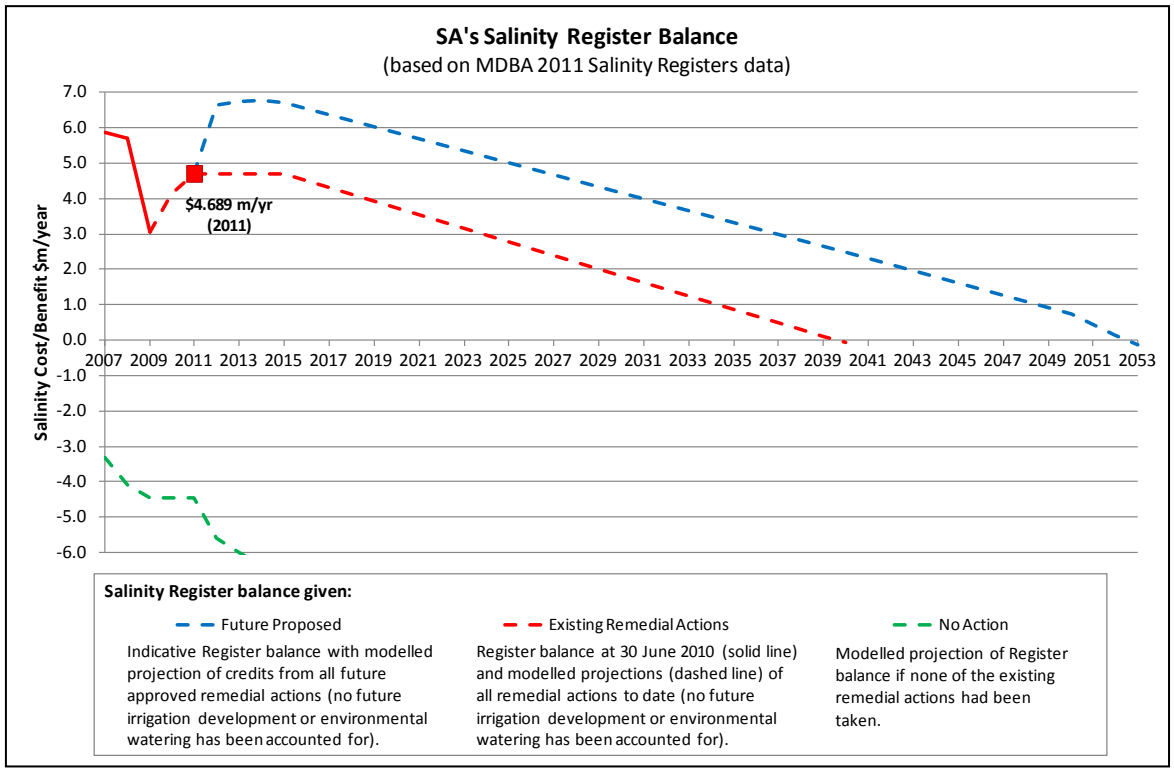

Figure 7 - Graph of South Australia's salinity register balance based on the November 2011 Salinity Register

Fact sheets relating to SASP targets can be downloaded at: http://saplan.org.au/targets/77-river-murray-salinity

As the Government is accountable to the public for implementation of the Plan and the achievement of targets, progress is monitored through a clear and independent audit of the results against established benchmarks. An Audit Committee is currently assessing progress against T.77 and public progress reports are due for release in 2012. These reports include ratings of progress to date and assessments about whether a target is likely to be achieved within the timeframe.

DEWNR is of the view that South Australia needs to continue to recognise River Murray salinity as a priority issue in its own right within high level State plans like SASP to facilitate ongoing investment in management actions. In implementing SASP, the BSMS Salinity Registers provide an existing framework for quantifying long term salinity impacts, thereby supporting ongoing SASP salinity target reporting.

South Australian State NRM Plan

The new blueprint for managing South Australia's natural resources 'Our Place Our Future': State Natural Resources Management Plan, South Australia 2012 – 2017, was released by the Minister for Sustainability, Environment and Conservation, Paul Caica on 5 June 2012. The plan sets the direction for NRM in South Australia for the next decade, with specific priorities for the next five years.

Management of salinity and water quality is recognised under guiding target 6- 'maintain the productive capacity of our natural resources'. The target will be assessed against trends in salinity in the River Murray.

Water for Good

The objective to remain in credit on the BSMS Salinity Registers remains an important action within a key State level strategy, Water for Good. The relevant Water for Good action (Action 56) is to 'Maintain a positive balance on the MDBA's Salinity Register, and continue to implement strategies and actions to ensure the real time management of salinity in the lower reaches of the River Murray so that water quality remains at levels suitable for human consumption'.

The desired outcome is that the entire length of the River Murray is a healthy, working waterway that continues to provide critical human water needs for Adelaide and regional South Australia, irrigation requirements and water for the environment. Key performance indicators include measurement of salinity and water quality levels in the Lower Murray. The South Australian Government reports quarterly in terms of progress against this action. Progress in 2011-12 is clearly aligned with progress in BSMS implementation and reflects the key milestones as identified in the Executive Summary of this report.

Water for Good also contains an action regarding re-use of saline water: Action 42 – 'Explore the economic and environmental feasibility of using saline water produced in salinity management schemes' discussed under managing trade-offs. This action is now complete.

South Australian River Murray Salinity Strategy

The fifteen-year vision of the South Australian River Murray Salinity Strategy (2001) is to maintain salinity in the River Murray in South Australia at current levels (i.e. when the Strategy commenced). The strategy is now dated. South Australia is awaiting the launch of the Basin Plan (including the Water Quality and Salinity Management Plan) to ensure this Strategy is revised and updated to be consistent with the current and future Basin salinity management priorities. This will ensure that the Strategy is aligned with the Basin Plan. It is possible that a specific South Australian River Murray Salinity Strategy is not developed and salinity provisions will instead become embedded in a broader South Australian River Murray management strategy, to reflect an integrated management approach.

River Murray Act

The *River Murray Act 2003* provides for the protection and enhancement of the River Murray and related areas and ecosystems. The *River Murray Act 2003* has two specific objectives which relate to the management of salinity in the river, these are:

- water quality within the River Murray system should be improved to a level that sustains the ecological processes, environmental values and productive capacity of the system; and
- the impact of salinity on the ecological processes and productive capacity of the River Murray system is to be minimised.

The *River Murray Act 2003* requires the Minister for the River Murray to prepare an Implementation Strategy to ensure that the objectives of the Act are achieved. The initial implementation strategy was finalised in 2006. The Implementation Strategy:

- sets out the priorities that the Minister will pursue in order to achieve the Objects of the Act and to further the implementation of the Objectives for a Healthy River Murray;
- sets out the strategies that the Minister intends to adopt to meet those priorities; and
- takes into account the State Natural Resources Management Plan and the Planning Strategy.

The implementation strategy has two key priorities that relate to salinity management within the South Australian MDB;

- preventing increases in salinity and working to reduce current salinity levels including the 'legacy of history'; and
- controlling clearance of endemic native vegetation, and encouraging re-vegetation.

The River Murray Act Program in 2011-12 continued to implement a referral and compliance function to protect the values of the River Murray including water quality.

In 2011-12 a framework was also developed for redeveloping the implementation strategy. A risk assessment will underpin the setting of key priorities of the strategy including water quality, environmental flow, river health and human dimension. The risk assessment process will be undertaken to determine key risks and appropriate control mechanisms.

Salinity is a key risk across all four priority areas and a major activity of the implementation strategy will be to determine long term strategic and short term management actions to address future salinity risk. The implementation strategy will be developed over the coming year and ongoing implementation will include maintaining a register of risks and ensuring that high risks are addressed.

Salinity Zoning Policy Review

The Salinity Zoning Policy is designed to maximise irrigation development potential while minimising salinity risk. It achieves this by allocating salinity credits available to South Australia to irrigation development behind salt interception schemes and in low salinity impact zones, subject to available credits. Credits have not been allocated to high salinity impact zones to date, as a policy decision was made to not permit further development in these zones. However, salinity credits have been allocated in the high salinity impact zone where significant commitments to the development prior to 30 June 2003 exist.

Since the development and implementation of the salinity zoning policy in 2005 there have been several developments in water policy at both a State and National level. These changes include:

- implementation of the 2009 River Murray WAP;
- unbundling of water rights;
- transformation of water rights;
- Commonwealth water buyback and exit grants; and
- development of the Basin Plan.

The salinity zoning policy is currently being updated to align with new and revised policies. Some of the amendments to the salinity zoning policy include, updating of terminology to align with site use approval, updating of references to legislation, policies and plans, and removal of provisional credit assignment. As part of the River Murray WAP review process described in the next section, it is intended that certain elements of the salinity zoning policy will be included in the updated WAP to improve transparency.

As part of the review process it has also been identified that there may be future opportunities to establish new High Salinity Impact (Salt Interception Scheme) Zones. The establishment of new zones can occur as additional schemes are commissioned in which South Australia holds a local share of the benefit of the scheme, i.e. for Shared works where South Australia has contributed additional capital to the scheme to address post 1988 irrigation impacts. However, for a High Salinity Impact (Salt Interception Scheme) Zone to be declared the benefits of the scheme must be assessed and the zone of influence of the scheme established.

The South Australian funded bores of the Pike SIS became operational in 2010. While the Pike scheme is now operating effectively, only Stage 1 of the scheme is complete (four of a potential 59 bores). While this provides a salinity benefit, the zone of influence is relatively limited. Therefore, at this time the demarcation of a separate Pike High Salinity Impact (Salt Interception Scheme) Zone will not occur.

South Australia is working with MDBA to finalise an entry for the constructed component of Pike on the BSMS Salinity Registers to reflect this benefit. When finalised, this benefit will be added to South Australia's general pool of development credits which is available to offset irrigation development in the Low Salinity Impact Zone.

3.5.2. Regional Plans and Strategies

River Murray WAP

The SA MDB NRM Board, in accordance with the *Natural Resources Management Act 2004*, (NRM Act) is responsible for developing Water Allocation Plans for the South Australian MDB region in partnership with DEWNR.

The Water Allocation Plan for the River Murray Prescribed Watercourse (WAP) was adopted by the Minister and publicly released in 2002. Under the NRM Act, water allocation plans must be reviewed at least once every five years. A review of the WAP was undertaken in 2007 resulting in limited changes. Minor amendments of the WAP have also occurred pursuant to section 89 of the NRM Act.

A formal review process is now underway. It is expected that the 2012 review will result in significant changes to the existing WAP as the policies are essentially pre drought, pre National Water Initiative (NWI), pre The Living Murray agreement; and pre *Water Act 2007* and amendments to the Murray-Darling Basin Agreement and its Schedules.

There are continuing policy obligations that an amended WAP must comply with. South Australia as a signatory to the BSMS is obligated to maintain its position on the MDBA salinity register in positive balance. South Australia is accountable under Schedule B for offsetting actions implemented after 1st January 1988 that affect river salinity.

The review and update will build on the knowledge gained through implementation of the existing salinity and water use efficiency principles in the current WAP, and through the lessons learnt as a result of unbundling of water rights into separate water management authorisations.

South Australian Murray-Darling Basin Natural Resources Management Plan

Implementation of the SA MDB Regional NRM Plan continued in 2011-12 with Regional Outcome Reporting (RoR) workshops conducted in 2012 to assess the progress towards the targets contained in the plan.

Progress towards the achievement of salinity and water use related Management Action Targets (MATs) was demonstrated in the two years since the previous evaluation workshop; however, the assessment of some targets was impacted by a lack of up to date irrigation footprint and irrigation practice data. This outcome reinforced the need to invest in the continued collection of baseline irrigated land use and practice data.

The Regional NRM Plan is now approaching its first 5 year review since implementation commenced in 2009, with an updated plan due for delivery in 2014.

Updating Land and Water Management Plans

A major focus in 2011-12 in relation to Land and Water Management Planning (LWMP) has been to complete a basin-wide prioritisation process for the development of Land and Water Management Plans. The prioritisation process was completed by the SA MDB NRM Board LWMP coordinator, utilising relevant data and information.

A draft report has been completed that prioritises 16 of the 21 LWMP zones within the SA MDB NRM region. The report comprises a review of:

- salinity zoning/policy and areas of high salinity impact;
- irrigation efficiency data;
- groundwater level data; and
- relevant technical reports.

The prioritisation process has been successful in determining the areas of highest risk, based on known impacts and availability of key data. It is now recommended that technical investigations are undertaken in areas identified as high risk to confirm the results and upgrade data.

3.6. REDESIGNING FARMING SYSTEMS

The partner Governments will coordinate and enhance research and development into new farming and forestry systems that deliver improved control of groundwater recharge in the high rainfall grazing, winter rainfall cropping, and summer rainfall cropping zones. Over and above current programs the Commission will enhance research and development into new industries based on salinised resources, such as broadacre saltland agronomy, saline aquaculture, and salt harvesting.

(BSMS, 2001-2015)

Minimising the salinity impact of irrigation actions remains of critical importance. By applying the latest irrigation technology on farm, the long-term sustainability of irrigation developments is enhanced while minimising discharge of saline groundwater to the river, thus having significant salinity benefits for the River Murray.

Current BSMS Salinity Register projections indicate that salinity levels are likely to rise in the medium to long-term and that within South Australia there are limited opportunities for salt interception capacity to be increased. Improvements in irrigation water use efficiency are therefore essential for maximising the benefits from salt interception schemes and minimising salinity impacts of irrigation. Such improvements will also contribute towards meeting any new salinity objectives within the Basin Plan (Water Quality and Salinity Management Plan) as well as expected new Sustainable Diversion Limits for water extraction from the River Murray system.

3.6.1. Water for the Future

The Murray Futures program aims to secure future water supplies, renew irrigation industries and communities, and secure improvements to the river's health by providing flexibility in how the system is managed in the future. Two projects under Water for the Future relate to improving on farm irrigation efficiency and will be implemented by the SA MDB NRM Board.

During 2011-12 the SA MDB NRM Board was successful in attracting funding through Round 2 of the Australian Government's On-Farm Irrigation Efficiency Program (OFIEP) and Round 2 of the Private Irrigation Infrastructure Program - South Australia (PIIPSA). The combined funding injection of over $20 million will support the delivery of over 120 individual irrigator projects and generate water savings in excess of 6.5GL.

On-ground implementation of the OFIEP and PIIPSA projects commenced in the latter part of 2011-12 and will continue over the next 24-36 months.

The SA MDB NRM Board also commenced the development of a funding application for Round 3 of the On-Farm Irrigation Efficiency Program in June 2012 with the outcome of the bid expected to be known later in 2012.

3.6.2. High Input Fertigation Management

Almond production in the MDB is increasingly based on high water and fertiliser inputs. Mid-range treatments in recent research aimed at maximising production applied 420 kg/ha of Nitrogen and 600 kg/ha of Potassium applied through fertigation, with average water application of 18ML/ha.

Specific research for the almond industry has shown that common fertiliser practices within the industry often result in some of the fertiliser not being utilised by the trees (at specific times during the season), and therefore available to be leached out of the rootzone, potentially causing contamination of the water resource (Figure 8).

As well as providing research data to allow assessment of appropriate fertigation management practices for specific crops, soil solution sampling also has a potential as a management tool for irrigators. As such soil solution monitoring can assist irrigators in monitoring their fertigation and salinity management, thus avoiding the potential for negative outcomes from poorly managed fertigation programs or accumulated salts in the root zone.

Computer models have been used to simulate how and when these losses occur, and have helped develop management guidelines for the industry to minimise these losses. Two factsheets were prepared from the outcomes of this work (Skewes et al. 2011), and were distributed to the industry by the Almond Board of Australia.

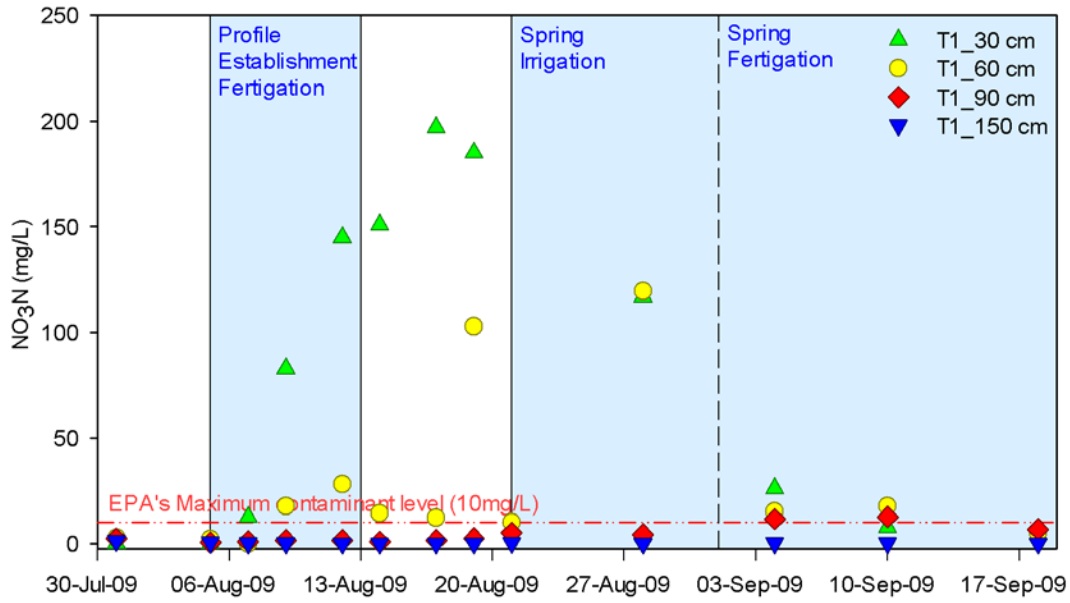

Figure 8 - Soil solution nitrate concentration at different depths under almond fertigation trial site

3.7. TARGETING REFORESTATION AND VEGETATION MANAGEMENT

The partner Governments recognise the necessity for landscape change specifically targeted at salinity control. In order to facilitate such targeted change, where changed farming systems are not adequate, the Commission will further develop the concept of a vegetation bank to have the capacity to finance extension of forestry outside of traditional forestry areas.

The partner Governments will further consider the financing of native vegetation management, rehabilitation and land stewardship, and the commercialisation of short rotation tree crops, particularly for the wheatbelt.

(BSMS, 2001-2015)

Reforestation and vegetation management activities are significant in promoting overall catchment health and land management. Reforestation can also provide long-term benefits in terms of stabilising groundwater movement and thus discharge of saline groundwater to the river.

3.7.1. Revegetation and Restoration Activities

The South Australian Murray-Darling Basin Regional NRM Plan contains several management actions targets to facilitate revegetation and restoration within the. These are:

- B1.1- Protect and manage an additional 10 000 hectares of existing priority remnant native ecosystems by 2014;
- B1.2- The extent of native ecosystems is increased by 15 000 hectares by 2014; and
- B1.3- A 10 percent improvement in the condition of 25% of native ecosystems in the Region by 2014.

To achieve these targets the SA MDB NRM Board, DEWNR and partners undertake a range of on-ground projects.

Large scale landscape programs such as BushBids, Woodland BushBids, the On-ground incentive schemes and the South Australian Multiple Ecological Communities Environmental Stewardship project are dramatically increasing the area of private land targeted for conservation management. The SA MDB NRM Board manages these and many other revegetation and restoration projects, that use market based approaches or traditional incentive programs to target key areas, be they geographical or based on priority species.

Woodland BushBids has enabled the protection and active management by private landholders of 5337 hectares of remnant vegetation across the Murraylands (between Cambrai and Morgan). The program aims to improve the condition of remnant patches by 10 percent within a five year contract through pest and weed control, appropriate grazing management and supplementary plants. Within this area 1034 hectares of land have been offered into the Heritage Agreement covenant available in South Australia.

During 2011-2012, the South Australian Multiple Ecological Communities Project (part of the Australian Government's Environmental Stewardships program) has successfully contracted

private land managers to protect and improve 2821 hectares of Peppermint Box grassy woodland and Iron Grass grassland, both priority threatened ecological communities.

The original BushBids program in the Eastern Mount Lofty Ranges has been in place since 2006 and continues to ensure that 2064 hectares of grassy woodlands are actively managed each year to promote regeneration and restoration.

The Woorinen Recovery Project (funded by the Native Vegetation Council) completed 150 hectares of revegetation and 350 hectares of remnant protection targeted at restoring and expanding the Triodia shrubby dunes of the Northern Murray Mallee, critical habitat for threatened Mallee birds.

Community groups and non-government organisations are also important contributors to revegetation and conservation within the SA MDB. During 2010-11, the Eastern Hills and Murray Plains Catchment Group, Goolwa to Wellington Local Action Planning Group, Murray Mallee Local Action Planning Association and the Coorong District Local Action Planning Association provided technical advice to 137 landholders and over 500 community members. These groups were responsible for the implementation of 88 hectares of revegetation, 361 hours of threat abatement and the protection of 1100 hectares of remnant vegetation.

During the 2012-13 the Board will be rolling out two new BushBids programs to again increase the area of restoration, regeneration and revegetation. These will occur on the River floodplain between Swan Reach and Overland Corner and across the Southern Mallee along the Mallee Highway.

3.7.2. The River Murray Forest

The aim of the River Murray Forest project is to plant regionally native species along the River Murray in order to improve biodiversity and ensure carbon sequestration outcomes.

A total of 2450 hectares have been offered by landholders for planting through the tender process. These areas are now under contract. Plantings will be staged over several years to allow for seasonal conditions and seed supply. To date 1420 hectares of the contracted area has been planted. This project is managed by DEWNR and funded by the Government of South Australia.

3.8. CONSTRUCTING SALT INTERCEPTION WORKS

The Commission will construct and operate new joint (partner Government funded) salt interception works to protect Basin-wide assets and values, including the shared water resources of the Murray and Darling Rivers. This will provide protection beyond the benefits from simply meeting end-of valley targets, based upon agreed cost sharing and benefit allocation principles. The benefits will continue to include salt disposal entitlements to offset the impacts of future actions that aggravate salinity.

(BSMS, 2001-2015)

Salt interception remains a key salinity mitigation strategy for the River Murray. Salt interception has proven valuable in providing a reduction of saline groundwater flows to the River Murray, thereby reducing in-river salinity and protecting water quality for all water uses.

Within South Australia, all salt interception schemes, except the Qualco-Sunlands Groundwater Control Scheme, have been constructed through the Salinity and Drainage Strategy or the Murray-Darling Basin Authority's Basin Salinity Management Strategy. Operating schemes in South Australia include Woolpunda, Qualco-Sunlands, Waikerie (1, IIA and Lock 2), Bookpurnong, Loxton and Pike. A Salt Interception Scheme (SIS) is currently under construction at Murtho.

The established SIS continue to meet their operational targets and intercept large volumes of saline groundwater from entering the River Murray. Table 3 presents a range of data relating to the existing SIS within South Australia. In 2011-12, the program that oversees the development of new SIS within DFW was largely completed, with the Murtho SIS expected to be commissioned in 2012. South Australia continues to promote the benefits of constructing the remainder of the Pike SIS; however, the future of the project is currently unknown.

Table 3 - Operating SIS within South Australia

Scheme	Date Commissioned	Joint works vs. South Australia %		Construction Costs ($M)			Volume Pumped 11-12	Salt Load Intercepted 11-12	Average Salinity 11-12
		SA	Joint works	Total	SA	MDBA	ML	(t/yr)	EC
Woolpunda SIS	Dec. 1990	-	100	$25	-	$25	5,520.8	113,420	32,218
Waikerie 1, IIA and Lock 2 SIS	Stage 1: 1992 Stage 2: Sep. 2003	-	100	$15.6	-	$15.6	3,522	61,867	30,652
	Oct. 2009	6	94	$4.4	$0.26	$4.19			
Bookpurnong SIS	Sep. 2006	30	70	$21.8	$6.5	$15.3	228	5,541	35,018
Loxton SIS	Stage 1: 2009 Stage 2: Nov. 2010	2	98	$19.5	$0.39	$19.1	400	3621	15405
Pike SIS	Stage 1: 2010	8	82	$25.32	$2.02	$23.3	281	17,305	68,525

3.8.1. Waikerie SIS

Developed in 3 stages - Waikerie I (1992), Waikerie IIA (2003) and Waikerie Lock 2 (2009)

Waikerie 1 SIS was constructed as a joint works under the Murray-Darling Basin Commission's Salinity and Drainage Strategy while Waikerie IIA SIS was constructed as a joint work and Waikerie Lock 2 SIS was constructed as a shared work under the Basin Salinity Management Strategy

Averaged over a 30 year time period, Waikerie I intercepts approximately 60 tonnes of salt per day, Waikerie IIA an estimated 23 tonnes of salt per day and the Waikerie Lock 2 scheme was designed to intercept a total of 39 tonnes of salt per day from entering the River Murray.

Waikerie 1 SIS currently provides a 30 year average benefit of 12.8 EC at Morgan while Waikerie IIA provides 9.0 EC and Waikerie Lock 2 provides 10.6 EC benefit at Morgan (12.8 EC, 8.2 EC and 10.8 EC respectively in the interpolated format).

In 2011-12, the Waikerie SIS continued to operate effectively with few operational problems. An optimisation study has enabled the flows from some bores to be reduced to save pumping costs while still maintaining the interception targets.

A review of the Waikerie to Morgan Numerical Groundwater Model in 2011-12 resulted in adjustments to these benefits which will be entered on the Salinity Register once the five year review of the schemes is completed.

3.8.2. Woolpunda SIS

Constructed as a joint works under the Murray-Darling Basin Commission's Salinity and Drainage Strategy

First section was commissioned in 1990; the balance in 1992

Intercepts a total of 150 tonnes of salt per day with a benefit of 47.4 EC, based on pre and post 1988 irrigation development

In 2011-12 investigations were completed to determine the economic viability of extending the Woolpunda SIS, and an approval submission was presented to the MDBA for consideration. This has not yet been approved but could form part of a future program of SIS works. The investigation determined that the scheme could be extended on both sides of the river towards Lock 3 and would intercept an additional 17 tonnes of salt per day with a benefit cost ratio of 1.31.

The scheme was conceptually designed to include three production bores, one located on the Overland Corner Floodplain and the other two located near Banrock Wetland. Disposal would be through the existing Woolpunda disposal main to Stockyard Plains Disposal Basin.

3.8.3. Loxton SIS

Designed to intercept a total of 70 tonnes of salt per day from entering the River Murray to provide an 11 EC benefit at Morgan over a 30 year time period

Constructed in two stages – floodplain and highland

The Floodplain section of the scheme became operational at the start of 2009 and is currently intercepting a total of 50 tonnes of salt per day. The floodplain section was completed early in 2011

The Loxton SIS was conceptually designed to intercept an estimated 70 tonnes of salt per day from entering the River Murray with a 30 year average 19 EC benefit at Morgan. Due to the complex hydrogeological conditions in the area the design of the scheme had to be altered during construction which resulted in delays to completion of the scheme and a reduction in the amount of salt intercepted.

In April 2011 the Murray-Darling Basin Authority Chief Executive declared the Loxton SIS to be effective (Clause 64 of the Murray-Darling Basin Agreement) and that the agreed salinity credits are to be placed on the Salinity Registers in accordance with Clause 22 (1) of Schedule B to Schedule 1 of the *Water Act 2007* (Cth).

The Loxton SIS will provide a 30 year average salinity benefit of 11 EC at Morgan.

3.8.4. Bookpurnong SIS

Constructed as a shared works under the Murray-Darling Basin Commission's Basin Salinity Management Strategy and commissioned in September 2006

Intercepts an estimated 50 tonnes of salt per day

Benefit of 11.5EC at Morgan over a 30 year time period

In 2011-12, the fifteen floodplain bores generally operated satisfactorily with no significant issues and with groundwater levels being held below their target levels. The seven highland bores likewise generally maintained groundwater levels below their target levels although some are suffering chemical clogging problems that are being addressed through some trial rehabilitation techniques.

A detailed investigation program was completed to better understand the aluminium oxide clogging problem in part of the area that has to date precluded extension of the scheme into the affected zone. The key objective of the study was to assess and understand the processes leading to the dissolution and re-precipitation of aluminium.

3.8.5. Qualco-Sunlands Groundwater Control Scheme

Commissioned in 2001

Reduces salt load to the river by 19 tonnes of salt per day with a 4.8EC benefit at Morgan

Operated by local irrigators through the Qualco-Sunlands Groundwater Control Trust, which was established under the *Groundwater (Qualco-Sunlands) Control Act 2000*

The drought and severe restrictions on irrigation allocations has resulted in a considerable reduction in drainage to the groundwater mound. Under these conditions groundwater levels have essentially stabilised. The scheme is currently being operated on a care and maintenance basis with most pumps running for only two hours per day. The exception is the three bores adjacent the river that provide salt interception benefit; these continue to be operated to provide that benefit.

3.8.6. Murtho SIS

Approved for construction as a shared works by the MDBC BSMS at the end of 2007

Construction of the scheme is still underway and is expected to be completed in 2012-13

Conceptually designed to intercept a total of 99.4 tonnes of salt per day or a 20.2EC benefit at Morgan

Construction of the Murtho SIS continued in 2011-12 with construction works expected to be completed in the final quarter of 2012.

3.8.7. Pike SIS

Conceptually designed as a 59 highland SIS bore scheme with 28.5km of pipeline to intercept a total of 167 tonnes of salt per day or an EC benefit at Morgan of 35.4EC over the 30 year time period

Existing disposal infrastructure such as the Lyrup Surge vessel and the Disher Creek and Noora Gravity main pipelines will transfer the intercepted groundwater from the Pike SIS to the Noora Basin

The scheme has been conceptually costed at $25.321M

In 2011-12 Stage 1 of the Pike SIS comprises of 4 production bores along the Simarloo area and 2.7km of pipeline connecting into the Noora Disposal Main was commissioned. The constructed scheme prevents approximately 12 t/day of salt entering the River Murray and provides a benefit of 3.2 EC at Morgan (expressed as a 30 year average).

3.8.8. Riverland Salt Disposal Management Plan

Saline groundwater intercepted by Salt Interception Schemes is disposed of to either one of the two disposal basins located within South Australia. The Bookpurnong, Loxton and Pike Stage 1 Salt Interception Schemes dispose to the Noora Disposal Basin (20km east of Loxton), once constructed the Murtho Salt Interception Scheme will also dispose to the Noora Disposal Basin. The Woolpunda, Waikerie and Qualco-Sunlands Salt Interception Schemes dispose to Stockyard Plains Disposal Basin (15km southwest of Waikerie).

Stockyard Plains Disposal Basin

Located 15km southwest of Waikerie

Encompasses a number of natural shallow depressions with floor elevations as low as 24mAHD and has a design top water level of 31mAHD

The maximum available pond area is about 7km^2 and with the basin operated at 31mAHD the current design capacity is 300L/sec

Owned and operated by the MDBA

Schemes that dispose to the basin: Woolpunda – 165L/sec; Waikerie 103L/sec; Qualco-Sunlands – 35L/sec

Noora Disposal Basin

Located 20km east of Loxton and commissioned in 1982 with an estimated land size of 3600ha

Established to dispose of irrigation drainage water from the Comprehensive Drainage Schemes (CDS) stored at Berri and Disher Creek Disposal Basins, over time due to improved irrigation practices and prolonged drought conditions the volume of water disposed from the CDS has reduced from an estimated 119L/sec to 40L/sec

Receives water from the CDS and also from the Salt Interception Schemes

The current design capacity of the basin operating at 19.0m AHD is 435L/sec comprising a 100 year long-term average of 395L/sec from the SIS's and 40L/sec from the CDS

Owned and operated by the Government of South Australia

Schemes disposing to the Noora Basin are: Bookpurnong – currently 43L/sec,; Loxton – currently 57L/sec; Pike –10L/sec;

3.9. ENSURING BASIN-WIDE ACCOUNTABILITY: MONITORING, EVALUATING AND REPORTING

The partner Governments will demonstrate accountability by reporting to the Commission and Council through State end-of-valley Report Cards and Commission Salinity Registers that record the salinity effects of actions, including salt interception schemes and salinity and catchment management plans. The Council will receive audits every five years for each valley and Commission Register entry, assessing impacts on river salinity and progress towards targets, with the provision to require further action as necessary.

(BSMS, 2001-2015)

South Australia undertakes programs of salinity monitoring, evaluating and reporting at different organisational levels and for different purposes. These programs are of great value in enabling South Australia to meet long-term accountability requirements under Schedule B (BSMS Salinity Registers entries) as well as providing a basis for understanding the short-term variations in-river salinity to guide real-time management actions.

3.9.1. Monitoring

Overall salinity monitoring

Higher flows in the River Murray were again the dominant factor affecting salinity and salt loads in South Australia during 2011-12. Salinities at the South Australian border remained low in the 200 to 250 EC range with a maximum at Morgan of 450 EC (Figure 9). Figure 10 provides a comparison of total salt loads across the past four financial years. The maximum salt load at Morgan in 2011-12 was approximately 250 000 t/month in May 2012 (Figure 11).

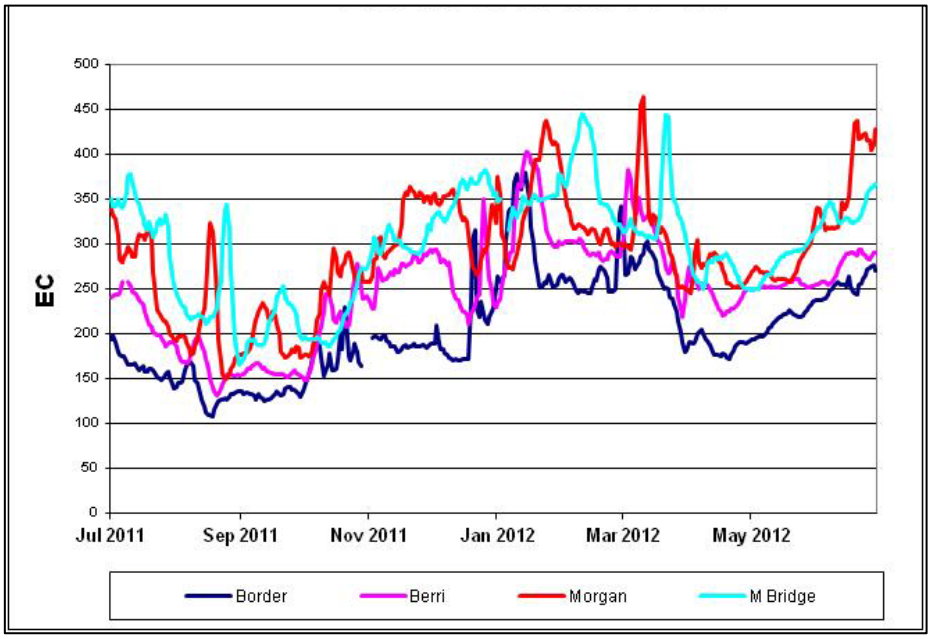

Figure 9 – Salinity in EC in South Australia during 2011-12

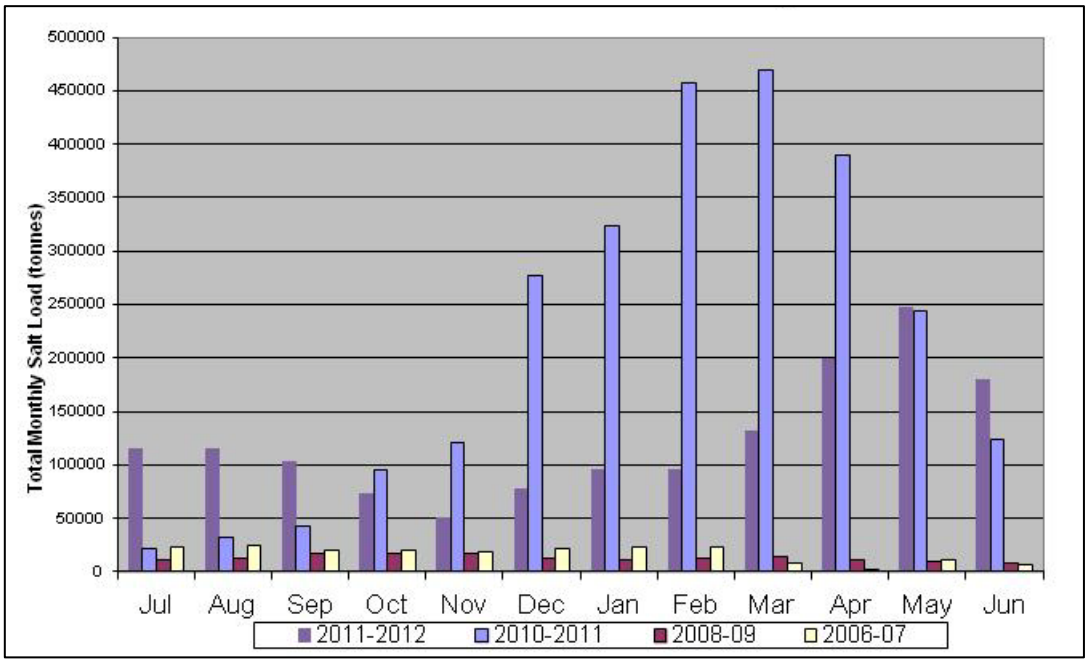

Figure 10 - Total salt load at Morgan 2006-07, 2008-09, 2010-11 and 2011-12

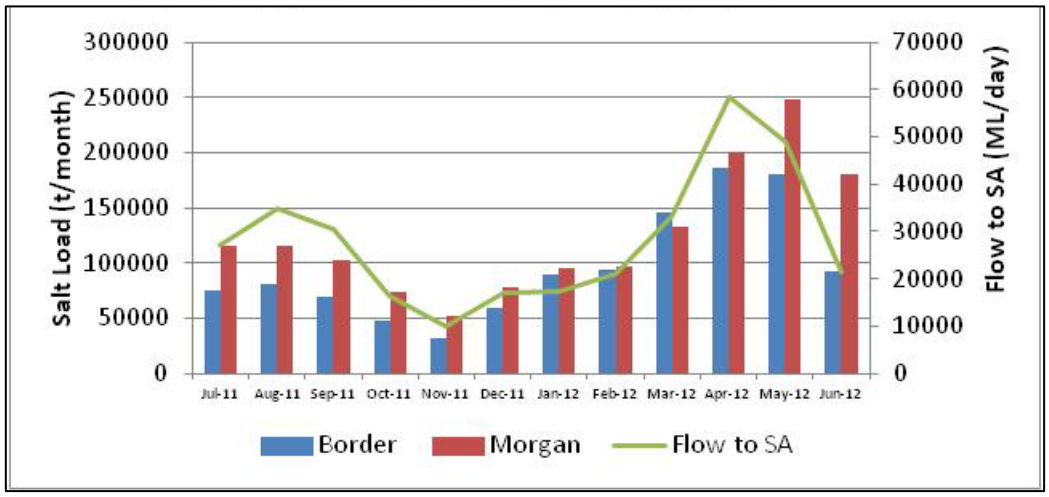

Figure 11 - Salt load SA Border and Morgan 2011-12

The telemetered salinity monitoring equipment has performed well and enabled real-time observation of salinity changes along the river. The upgraded equipment also enabled a very high percentage of 'good' quality data to be collected, as any equipment malfunctions can be quickly addressed, resulting in little missing or poorer quality data.

Flow Monitoring

The Chowilla Creek flow monitoring site has continued to operate well through the high flows. Gaugings have confirmed the validity of the newly developed Velocity Index rating. This will be a particularly useful site given the construction of the Chowilla regulator, and the need to monitor downstream flow and salinities once regulator operations commence.

NanoTEM Survey

The recent floods and highest river levels for 15 years provided a unique opportunity in early 2012 to collect baseline NanoTEM data from Waikerie to Murtho, following a major riverbank recharge event and to assess the operation of the SIS. Four previous NanoTEM surveys (undertaken since 2004) have been used to locate saline groundwater discharge areas, inform the location of SIS borefields and provide some qualitative assessment of scheme performance.

With more schemes being commissioned and more data becoming available, a methodology for quantitatively evaluating the effectiveness of the schemes has been developed. This provides an assessment of the salinity of the riverbed sediments at various depths and the development of freshwater lenses in the riverbed under the influence of SIS pumping. The initial effectiveness of an SIS is the interception of the saline groundwater flow and the subsequent building of freshwater lenses indicates a degree of 'overpumping' which provides added protection from salt inflow following a flood. With the Murtho SIS to be commissioned by late 2012, baseline data from the NanoTEM survey can be compared against data collected post SIS operations commencing.

Close Interval EC Surveys

No close interval 3D EC surveys were carried out in 2011-12 due to the high flows in the whole river system.

Run of River Salinity Surveys

Run of River salinity surveys were not conducted in 2011-12 due to river flows being too high to provide the slower travel times needed for salt load calculations.

Dryland Salinity Monitoring

Within the South Australian Murray-Darling Basin (SA MDB), the State Government monitors groundwater trends in two focus catchments at risk of dryland salinity. The Keyneton site in the Eastern Mount Lofty Ranges and the Cooke Plains site on the Coastal Plain are representative of local and regional groundwater flow systems (GFS) respectively. The focus catchments are an integral component of a land salinity monitoring network established across SA's dryland agricultural regions. Monitoring at these sites provides a useful indication of groundwater levels (also referred to as depth to groundwater) and hence trends in salinity risk in the region.

(Refer to: http://www.environment.sa.gov.au/Knowledge_Bank/Science_research/Monitoring_evaluation_analysis/Monitoring/Land_salinity_monitoring).

Rainfall in the region has been above average in 2010 and 2011, and near average rainfall in the autumn of 2012. These recent wetter years have resulted in some episodic rises in groundwater levels across the region. As yet, the episodic rises have not lead to significant changes to longer-term trends, both rising and falling groundwater levels, across the region.

Localised outbreaks of dune seepage (perched water tables causing saline/waterlogged conditions) have occurred at several mallee locations, including Karoonda and Parilla. If above-average rainfall persists, episodic rises in shallow groundwater systems will continue to pose an increased risk for localised outbreaks of dryland salinity across the region.

Automatic Weather Monitoring network

The SA MDB NRM Board continued to manage and maintain the regional automatic weather monitoring network during 2011-12. During this period, the dedicated website received over 18 000 visits demonstrating the resource is extensively utilised to inform on-farm decision making.

During 2011-12 the Board has maintained full compliance with its data provision obligations pursuant to the Commonwealth Water Regulations and in 2012-13 will be seeking to undertake further projects that encourage the adoption of local weather data into on-farm irrigation management practices.

Evapotranspiration Study

During 2011-12 the SA MDB NRM Board commissioned an Evapotranspiration (ETo) study with the aim being to determine the most suitable source of ETo (short or tall) and respective crop coefficient (Kc) values for the main crop types in the South Australian MDB.

Figure 12 shows a comparison between 2011-12 ETo (short) values derived from the SA MDB NRM Board's Loxton weather station compared with the ETo (short) figures from the official BoM AWS located at the Loxton Research Centre.

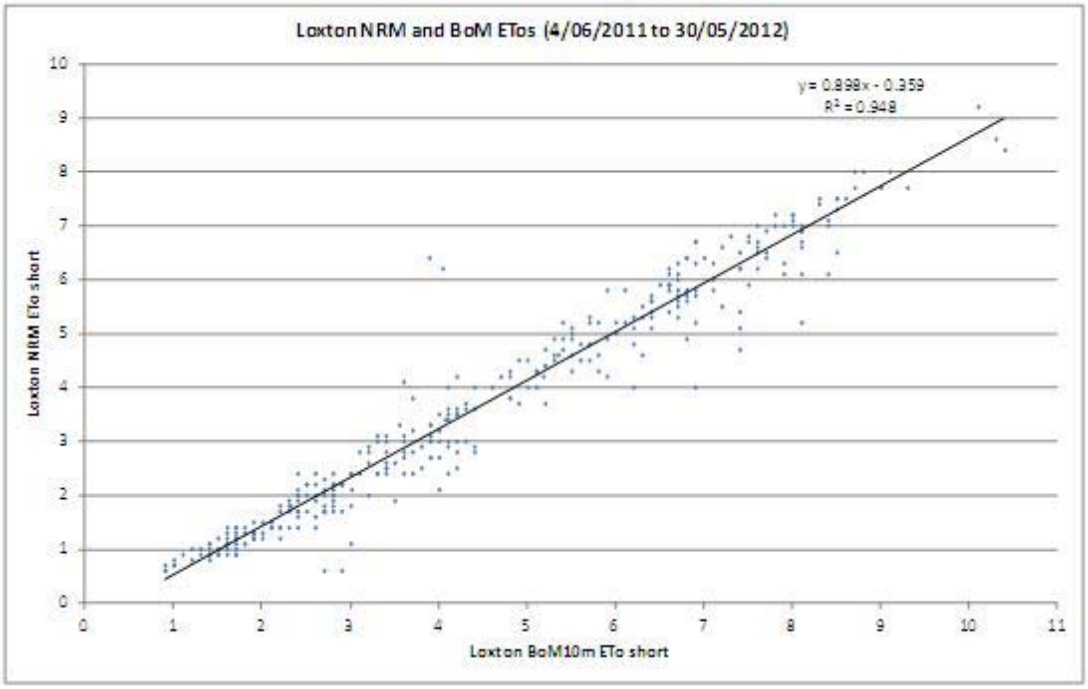

Figure 12 - Comparison of ETo data from NRM and BoM weather stations

The results of the study will support improved water use efficiency by fostering broader use of ETo in irrigation management, through greater understanding of the best ETo method and respective Kc values to use for major crop types.

3.9.2. Evaluating

Simplified Salinity Assessment Using the SIMRAT Model

SIMRAT (Salinity Impact Rapid Assessment Tool) was developed by the Murray-Darling Basin Commission and was accredited in 2005 to assess the salinity impacts of water trades in the Mallee Zone. Since that time South Australia has utilised SIMRAT to estimate and report on the salinity impacts of permanent water trade (1988 to 2008-09) and Site Use Approvals (2009-10 to current). The SIMRAT assessments of irrigation are used as interim entries on the Salinity Registers and will ultimately be replaced by the output of the suite of numerical groundwater models, which are updated with the current irrigation footprint at intervals of approximately five years.

The SIMRAT model operates on the ESRI ArcInfo Workstation platform. With the imminent transition to the ESRI ArcGIS 10 package, the ArcInfo Workstation platform will no longer be supported. In anticipation of this transition a remedy was sought to remove reliance on this soon to be outdated platform. The solution is the compilation of the SIMRAT model output using the assumptions agreed upon and documented in the South Australian Salinity Accountability Statement 1988-2003 and in the Basin Salinity Management Strategy.

The key assumptions include:

- that 85% of the total water traded or added to a Site Use Approval is used by the crop, with the 15% remaining partitioned into 5% losses (e.g. evaporation) and 10% Root Zone Drainage (RZD);
- irrigation area is based on usage of 10 ML/Ha. For example, if the volume was 100 ML the notional area would be 10 hectares. An application rate of 10 ML per hectare was considered to be reasonable average for a theoretical assessment, as vines require approximately 6–8 ML per hectare where as almonds require approximately 14 ML; and
- that the nearest portion of the property to the irrigation supply will be used as the location for the assessment, as salinity impacts are generally higher closer to the River.

Essentially the compilation involved a model run of the entire South Australian Murray-Darling Basin (within the SIMRAT boundary) with the assumption of 100 mm of drainage (RZD) per annum across the entire region (10% of 10 ML/ha). The SIMRAT output (individual grid layers representing salinity impact at year 1 to 40 then at 10 year intervals - 50, 60, 70, 80, 90 and 100 years) was then compiled into a single spatial layer, with individual polygons representing the grid cells in the SIMRAT output.

This has significantly streamlined the assessment process. Rather than running an individual assessment through the SIMRAT model, the compiled model output spatial layer is queried, removing the need for the ArcInfo Workstation platform and vastly decreasing the processing time required. Previously, the time to run the SIMRAT model for an individual assessment was around and 20 minutes (depending on network speeds) whereas the simplified assessment now returns a result in a few minutes. The simplified method provides the same assessment results but in much less time and on a platform (ESRI ArcGIS) that will continue to be supported indefinitely.

Groundwater Models in South Australia

South Australia now has a complete set of MDBA accredited groundwater models that span the full length of the River Murray in South Australia, as shown in Figure 13. The models are key to the estimation of salt loads entering the River Murray, and thus are the basis for accountable action entries on the BSMS Salinity Registers, including mallee clearance, irrigation development, improved irrigation practices and rehabilitation of irrigation infrastructure, groundwater control and salt interception schemes.

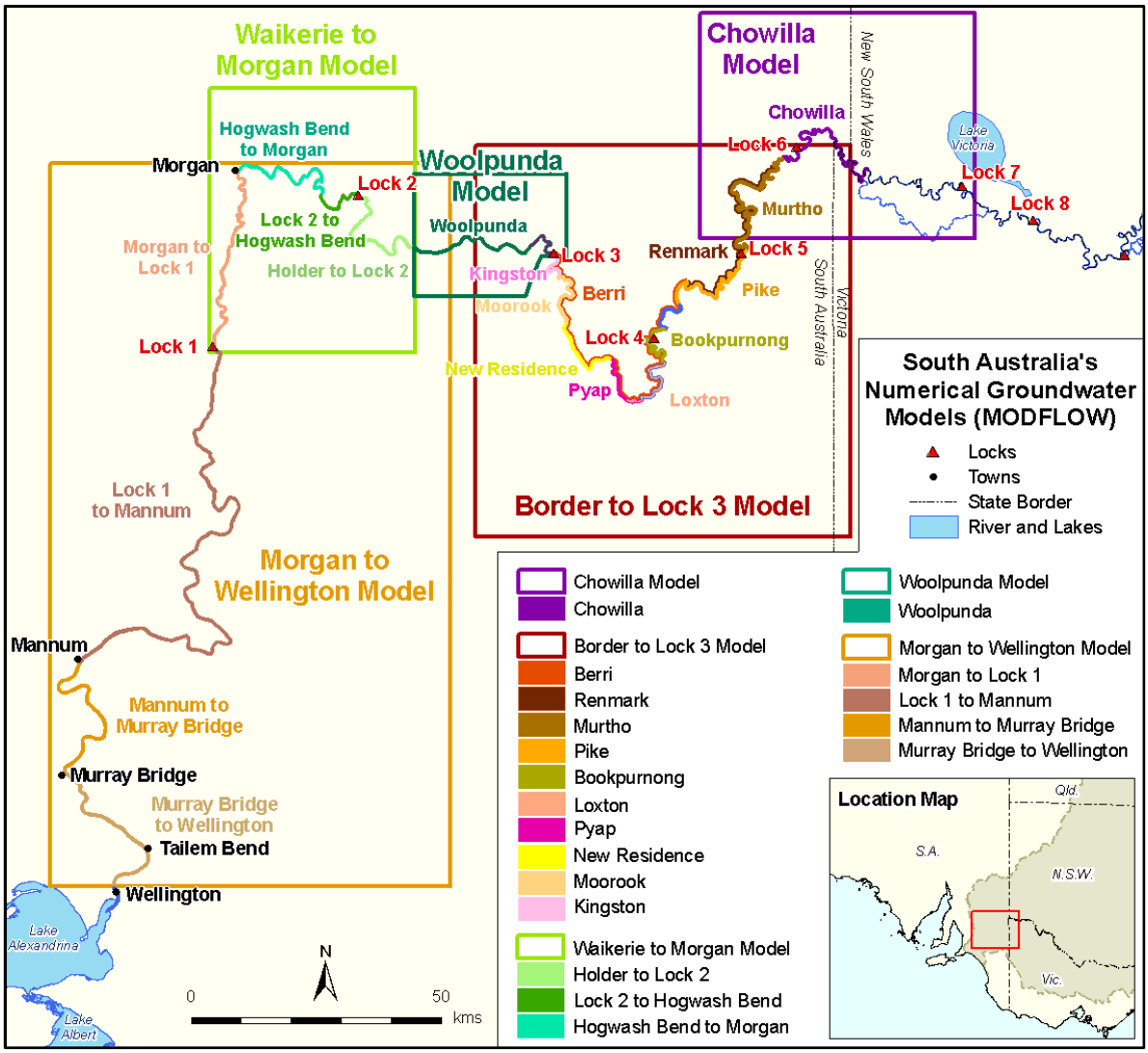

Figure 13 - Coverage of South Australia's Numerical Groundwater Models

Groundwater Model Review Process

An important process of the BSMS Salinity Registers is the review of entries and the models from which the entries are derived. The entries require review every five years (Schedule B, clause 33 (1b)) while models utilised in the Salinity Registers require review at intervals of not more than seven years (Schedule B, clause 39 (1)).

A single South Australian salinity registers entry is the sum total of outputs from the same set of scenarios from each model (e.g. summing the irrigation scenario from each model ensures that the irrigation registers entry represents the impact of that action in every geographic zone). The registers entries are updated annually as model updates

progressively occur (e.g. to incorporate new data, information and modelling techniques). In this way a single register entry does not have one review date; rather, its geographic components will undergo review and update as the underlying model reviews occur. Table 4 shows the timeframes for the review of South Australia's models.

Table 4 - Timeframes for review of South Australia's numerical groundwater models for BSMS Salinity Registers

Regional Model	Sub-zones	Completed	Accredited	5 Year Review Completed	5 Year Review Accredited	Next 5 Year Review Due	Update Scheduled
Border to Lock 3	Loxton Bookpurnong	2004	2005	2011	2011	2016	2016-17
	Pike Murtho	2006	2006			2011	2013-14
	Renmark Berri	2007	2011			2016	2014-15
	Pyap New Residence Moorook Kingston	2008	2011			2016	2015-16
Lock 3 to Morgan	Woolpunda	2005	2005			2010	2012-13
	Waikerie Qualco-Sunlands Cadell	2005	2005	2012	2012	2017	2018-19
Morgan to Wellington	Morgan to Lock 1 Lock 1 to Mannum Mannum to Murray Bridge Murray Bridge to Wellington	2006	2006	2010	2011	2016	2017-18

As reported in South Australia's 2010-11 Report to the BSMS, the Loxton-Bookpurnong Numerical Groundwater Model was the first South Australian model to undergo review. This model was accredited by the MDBA appointed peer reviewers in late September 2011. During 2011-12 South Australia has reviewed and updated the Waikerie to Morgan region within the Lock 3 to Morgan regional model (accredited in 2005), noting that the regional model has been separated into two models, Waikerie to Morgan and Woolpunda. The Woolpunda model is to be updated in 2012-13. The Waikerie to Morgan Numerical Groundwater Model 2012 was accredited by MDBA appointed peer reviewers in June 2012. The State accountable actions in the 2012 Salinity Registers will be updated with outputs from the Loxton to Bookpurnong model. The entries relating to salt interception schemes within these models will be updated once the five year review of the schemes have been finalised. This is expected to occur in 2012-13.

Revised MDBA Review Process

Commencing with the Waikerie to Morgan Numerical Groundwater Model 2012, the MDBA appointed peer reviewer is now engaged during the model development of South Australia's

models, rather than at the completion of the model as had been the case with all of South Australia's models to date.

South Australia is highly supportive of this change in process as the accreditation of previous South Australian models had been significantly delayed due to the issues raised by reviewers after the model had been finalised. Specifically, the Renmark to Berri and Pyap to Kingston models in the Border to Lock 3 region. For these models, accrediation took between three and four years from date of submission to the MDBA. By involving the reviewers during the model development process, issues can now be raised, clarified and addressed during the model development process, resulting in a better model and a more efficient accreditation process. Figure 14 shows the model development process employed by South Australia, with the preferred timing for MDBA appointed peer reviewer involvement highlighted.

Additionally, the MDBA has instigated the 'Inter-Jurisdictional Expert Panel for Five Year Reviews of Salt Interception Schemes' (the Panel) in which each of the jurisdictions are represented by technical staff (preferably a senior modeller and hydrogeologist). The Panel meet to consider methods adopted in State models and to raise issues or concerns with methods so that they can be openly discussed and resolved while the model is still in development.

Importantly, the Panel has raised a number of issues that require resolution at the broader BSMS level to ensure consistency in modelling of accountable actions across the jurisdictions. Many of these issues had previously been raised in reviews of South Australia's groundwater models but in the absence of MDBA guidelines have been beyond the scope of the State to resolve independently. In the absence of guidelines on these issues South Australia has provided justification for methods utilised. South Australia suggests that the MDBA lead the development of clearer processes, agreed across all jurisdictions, to achieve consistent representation of accountable actions on the BSMS Salinity Registers.

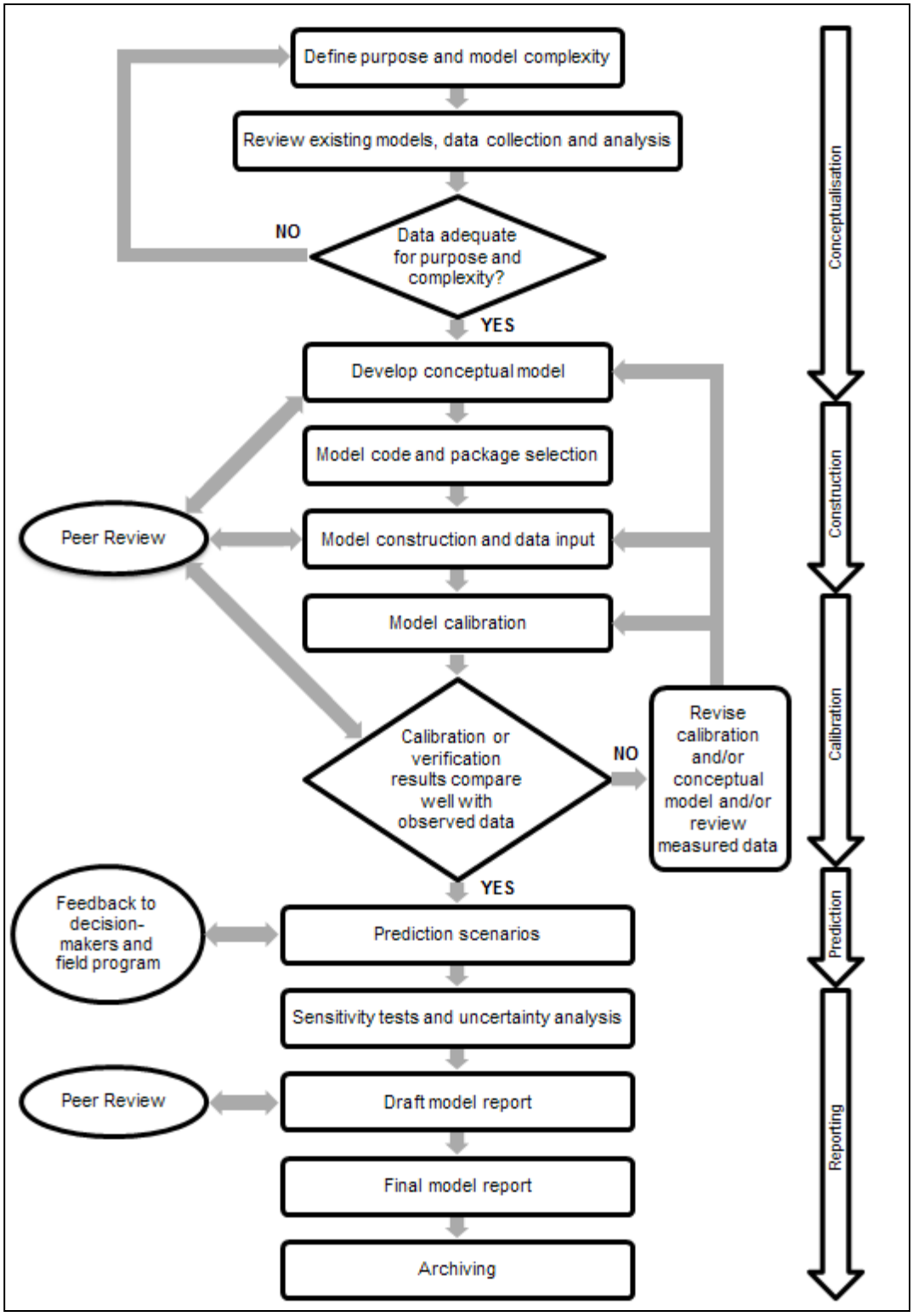

Figure 14 - The modelling process flowchart

Waikerie to Morgan Numerical Groundwater Model 2012

The objective of the development of the Waikerie to Morgan model is to incorporate information and knowledge acquired in the area since the previous model (Morgan to Lock 3 Regional Model 2005) was established. This will deliver an accredited model to inform State and SIS accountable action entries on the Salinity Register and to inform cost sharing for joint schemes.

The MDBA appointed reviewers have endorsed the model as fit for purpose to inform accountable actions on the Salinity Registers and to inform cost sharing for joint schemes. The interpretation of the model's scenarios to inform entries on the Salinity Registers has been documented in a separate report 'Waikerie to Morgan Numerical Groundwater Model 2012 Key Information Summary for MDBA BSMS Salinity Registers' (in draft) to provide clarity and transparency to this process.

The improvements in the Waikerie to Morgan Numerical Groundwater Model 2012 have led to improved confidence in results compared to the previous Morgan to Lock 3 model due to:

- **Peer Reviewer Involvement**: MDBA peer reviewer and the 'Inter-Jurisdictional Expert Panel 5 Year Reviews of Salt Interception Schemes' have been consulted during the model's development. This has allowed input from multiple reviewers regarding model design, model process and reporting. Additionally, the South Australian led '5 Year Review for Salinity Registers Project Team' (comprised of South Australian policy and technical officers, SA Water Principal Engineer Salt Interception, MDBA Director Water Quality & Salinity Management and MDBA Director Salt Interception) also provided guidance during development to ensure the process aligned with BSMS requirements. Furthermore, South Australia engaged internal reviewers (model expert and hydrogeological expert), report reviewers and the endorsement of the Deputy Director and Director of Science Division with the Department to ensure a high quality output.
- **Split Morgan to Lock 3:** the Morgan to Lock 3 Regional Model has been split into 2 models (Waikerie to Morgan and Woolpunda). The split enables improved representation of the hydrogeologically of the region as less layers are required in each model and a finer scale can be employed resulting in a more stable model and less numerical errors. Additionally, evapotranspiration on the floodplain is now included.
- **Data improvements:** Sourcing data from experts including irrigation data (better mapping of footprints over time and estimates of application volumes) and salt interception scheme information (historical and recent pump information for all schemes).
- **Information improvements**: aquifer parameters, review of groundwater salinity data, up to date observation data included (potentiometric head, Run of River for confirmation).
- **Knowledge and understanding improvements**: result in improved hydrogeological conceptualisation for recharge (unsaturated zone process), aquifer interaction and groundwater flux to river.
- **Improved scenario approach**: better understanding of requirements for Salinity Registers, consistency of model assumptions (recharge for pre and post 1988 scenarios, middle point approach for simulation of operation of SIS), revised model reporting zones (to better align with MSM-BIGMOD reaches and local Land and Water Planning Management areas).
- **Improved approach to sensitivity tests**: model inputs tested include groundwater ET extinction depth, Glenforslan hydraulic conductivity, riverbed conductance and river level.

- **Meaningful uncertainty tests**: groundwater salinity and irrigation recharge inputs were varied to consider impact on measured historical salt load and prediction results.
- **High quality report:** includes detailed information and explanation about model, model inputs and outputs, detailed input condition and assumptions for model scenarios and objectives of the model.
- **Comprehensive archiving system:** Properly named and archived all data files and model files.

South Australia's Groundwater Model Warehouse for Archiving and Version Control

Development of groundwater models requires significant resources. It is therefore vitally important that models, once developed, be managed effectively, and considered a resource tool for expansion at some future time. This means that knowledge gains are consolidated and built on in an effective and efficient manner for future groundwater resource management scenarios.

To achieve effective management of groundwater models, the South Australian Groundwater Model Warehouse project was initiated. The Groundwater Model Warehouse is an internal State Government resource that provides guidance for identifying and archiving existing numerical groundwater models, developing operational rules for archiving models, protocols for using and developing numerical groundwater models and specifications for contracts which are used for numerical groundwater modelling projects. General rules for filing structures and model naming conventions provide consistency across modelling projects as well as templates to ensure high quality technical model reports.

3.9.3. Reporting

Five Year Review of South Australia's BSMS Salinity Register Entries

As noted in South Australia's 2010-11 Report to the BSMS, South Australia has progressively developed a suite of numerical groundwater models, based on the MODFLOW platform. The models utilise a series of modelling scenarios that are applied consistently to each MODFLOW model to derive South Australia's entries on the BSMS Salinity Registers. The scenarios allow the impact of highland actions such as mallee clearance, irrigation development (pre and post 1988), improved irrigation practices and rehabilitation of irrigation infrastructure, groundwater control and salt interception schemes to be assessed. South Australia now has a full suite of accredited numerical groundwater models for the entire highland area of the River Murray in South Australia and has begun the process of reviewing these models, commencing with the Loxton-Bookpurnong Numerical Groundwater Model in 2010-11, the Waikerie to Morgan Numerical Groundwater Model in 2011-12 and continuing with the Woolpunda Numerical Groundwater Model in 2012-13 (refer to 3.9.2).

South Australia's intention that the full range of highland State accountable actions on the BSMS Salinity Registers be derived from outputs from the suite of MODFLOW models was progressed in 2011 with the replacement of SIMRAT derived impacts for post 1988 irrigation with the MODFLOW model outputs, for the period 1988 to 2002-03.

As the MODFLOW models have been developed and accredited at different times, with their outputs contributing to multiple entries on the BSMS Salinity Registers, the timing for the 5

year review of each of South Australia's BSMS Salinity Register entries is not a single date. Rather, each entry will be updated as the individual MODFLOW models that contributed to the entry are updated.

Accountable Actions for 2012 BSMS Salinity Registers Update

With the accreditation of the Loxton to Bookpurnong Numerical Groundwater Model in 2011 the suite of highland accountable actions in these areas will be updated with the revised model output in the 2012 Salinity Registers. Noting that the entries for the Salt Interception Schemes (Loxton, Bookpurnong) will be updated once the five year review of these schemes is completed (expected in 2012-13).

Updates from the Waikerie to Morgan Numerical Groundwater Model 2012 will be sought in the 2013 Salinity Register.

Entries to be updated from the Loxton to Bookpurnong Numerical Groundwater Model include:

- SA Irrigation Development 1988 to 2010-11 (replacing the previous MODFLOW based assessment in these areas from 1988 to 2002-03 and the SIMRAT based assessments in these areas from 2003-04 to 2010-11)
- SA Improved Irrigation Efficiency and Scheme Rehabilitation
- SA Mallee Legacy of History - Dryland
- SA Mallee Legacy of History - Irrigation

Output from the accredited SIMRAT analytical model will continue to be used as an interim assessment from 2011-12 in the Loxton to Bookpurnong area and from 2003-04 in the remainder of the South Australian Murray-Darling Basin until such time as the underlying MODFLOW models in these areas undergo five year reviews.

Other updates to South Australia's BSMS Salinity Register entries in 2012 include SIMRAT based assessments for Site Use Approvals for 2011-12 (post 1988 irrigation impacts) and the inclusion of the South Australian funded construction of the Pike SIS.

Adjusting the existing entries for Post 1988 irrigation impacts

In the 2011 Salinity Register the entry for Post 1988 irrigation assessments was split into three entries, although several have been incorrectly named:

1. Irrigation Development Due to Water Trade with SA 1988 to 2002-03 (should be renamed 'Irrigation Development 1988 to 2002-03 (MODFLOW output))
2. Irrigation Development Due to Water Trade with SA 2003-04 to 2008-09
3. SA Irrigation Development Site Used Approved 2009-10 to 2010-11 (should be renamed 'SA Irrigation Development – Site Use Approvals 2009-10 to 2010-11)

The following changes are sought in the 2012 Salinity Registers:

- Adjust entry (1) above to include new MODFLOW output from the Loxton to Bookpurnong Numerical Groundwater Model 2011 for the period 1988 to 2010-11. Alternatively adjust entry (1) above with the Loxton to Bookpurnong 2011 model

outputs for 1988 to 2002-03 and create a new entry to reflect 2003-04 to 2010-11 impacts in Loxton to Bookpurnong from the updated model.

- Remove SIMRAT based assessments in Loxton to Bookpurnong from entry (2) above.
- Remove SIMRAT based assessments in Loxton to Bookpurnong for the period 2003-04 to 2010-11 from entry (3) above (these impacts are now included in the 1988 to 2010-11 MODFLOW impacts).
- Add additional impacts resulting from the SIMRAT assessment of Site Use Approvals for 2011-12 to entry (3) above.

Eventually all the SIMRAT based entries will be replaced with updated MODFLOW based assessments; however, these will occur at different times as per the 5 year review timeframes of the suite of numerical groundwater models.

SIMRAT based assessments of Site Use Approvals for 2011-12

Prior to 1 July 2009, the salinity impact of new irrigation development was estimated from the volume of permanent trade of water entitlement entering the River Murray Prescribed Watercourse assessed through the accredited SIMRAT model. However, recent water reforms in South Australia mean that it is no longer possible to estimate salinity impacts based on traded water volumes.

On 1 July 2009, water entitlements in South Australia were unbundled. Unbundling allows water users to trade their water separately from land and divides the water rights into their component parts: Water Access Entitlement, Water Allocation, Water Resource Works Approval and a Site Use Approval (SUA).

The SUA represents the permission to use water at a particular site in a particular manner and has replaced traded water volumes as the basis for accounting for the salinity impacts of irrigation development using the SIMRAT model. Adopting the SUA as the accounting mechanism is a precautionary approach to accounting for salinity impacts. This is because the SUA represents the maximum amount of water that can be applied at a specific site. In assessing a salinity impact based on this volume, the maximum potential impact is therefore represented.

In making the assessments, it was identified that changes to SUAs for 1 July 2011 to 30 June 2012 relate to either:

1. Variations to existing SUAs
2. Variations due to prior commitment

Not all of these variations are required to be brought to the Salinity Registers. A description of each follows.

Variations to existing SUAs

There are three variations to existing SUAs that are required to be entered onto the Salinity Registers in 2012. All of these variations occur in the low salinity impact zone within the Lock 1 to Murray Bridge reach of the River Murray and total 2402 ML. The impacts (in salt load tonnes per day) are 0.005 in 2015, 0.312 in 2050 and 0.586 in 2100.

In addition there were three variations to existing SUAs that fell outside of the SIMRAT model boundary and therefore could not be assessed. These variations totalled 3,378 ML.

SUA Variations due to Prior Commitment

The South Australian River Murray Salinity Zoning Policy establishes three salinity impact zones: low, high and high (salt interception). Subject to the availability of salinity credits and compliance with other principles in the River Murray Water Allocation Plan, new SUAs and variations to existing SUAs will be granted in the low salinity impact and the high salinity (salt interception) zones.

In the high salinity impact zone, new SUAs or variations to existing SUAs will only be granted if the applicant can prove that they were financially or legally committed to the development prior to 30 June 2003. This is referred to as Prior Commitment.

Prior Commitment clauses were included in the Salinity Zoning Policy as a transitional measure to ensure that entities with commitments to developments within the high salinity zone, prior to the implementation of the Salinity Zoning Policy in June 2003, were not unduly disadvantaged by the policy and so were exempt from the restrictions to develop in the high salinity impact zone.

Further uptake of outstanding Prior Commitment claims occurred in 2011-12. The volumes approved under Prior Commitment are based on a crop type and area processed through a water use efficiency calculator (to ensure compliance with the 85% efficiency principles in the WAP). In 2011-12, several updates occurred which have affected the volumes previously approved under Prior Commitment. The updates include a change to the volume allowed for almonds, updated long term average rainfall and the consolidation of water use efficiency calculators into a single calculator. These changes have resulted in increases to volumes previously approved.

An update to the 2012 Salinity Registers is not required where the Prior Commitment was approved on the basis of crop requirements for existing plantings at commencement of the Salinity Zoning Policy in 2003 (as irrigation development 1988 to 2002-03 is sourced from the MODFLOW suite of models which is based on the 2003 irrigation footprint, so this impact is already included in the Salinity Registers). There was one variation to SUA on this basis, located in the Lock 3 to Lock 2 reach for 257 ML.

An update to the 2012 Salinity Registers is required where the Prior Commitment was approved for new development, as this has not been captured in the MODFLOW suite of models and has not yet been included on the Salinity Registers. On this basis, in 2011-12 there were ten increases to SUA, totalling 19,085 ML, which require inclusion in the 2012 Salinity Registers.

The variations to SUAs that are to be entered on the Salinity Registers in 2012 in the low zone and as a result of Prior Commitment are presented at Table 5.

Table 5 - Updates for 2012 Salinity Register - Post 1988 irrigation

Assessment Year	Reach	Total Volume (ML)	Impact @ 2012 Salt tonnes/day	Impact @ 2013 Salt tonnes/day	Impact @ 2014 Salt tonnes/day	Impact @ 2015 Salt tonnes/day	Impact @ 2050 Salt tonnes/day	Impact @ 2100 Salt tonnes/day
2011-12	Border to Lock 5	4,124	0.00	0.00	0.00	0.00	0.22	11.15
2011-12	Lock 5 to Lock 4	11,523	0.00	0.05	0.06	0.06	26.84	105.47
2011-12	Lock 4 to Lock 3	2,929	0.00	0.00	0.00	0.00	0.06	0.82
2011-12	Lock 3 to Lock 2	85	0.00	0.00	0.00	0.00	0.03	0.52
2011-12	Lock 2 to Morgan	172	0.09	0.11	0.12	0.12	0.96	1.12
2011-12	Lock 1 to Murray Bridge	2,402	0.01	0.01	0.01	0.01	0.31	0.59
2011-12	Murray Bridge to Mouth	252	0.00	0.00	0.00	0.00	0.17	0.37
		21,487	**0.10**	**0.17**	**0.19**	**0.19**	**28.59**	**120.04**

Updating entries with data from newly accredited MODFLOW models

During 2011-12, two of South Australia's MODFLOW numerical groundwater models have been endorsed as fit for purpose as a basis for BSMS Salinity Registers entries: Loxton to Bookpurnong 2011 and Waikerie to Morgan 2012. However, additional documentation is required for Waikerie to Morgan before updating Salinity Register entries (this is currently being developed) and the SIS 5 Year Reviews are not yet complete for the schemes within these two models.

Therefore, only the following state accountable actions will be updated from the Loxton to Bookpurnong model in the 2012 Salinity Registers: post 1988 irrigation development (1988 to 2010-11), improved irrigation practices and irrigation scheme rehabilitation, Mallee legacy of history - dryland and irrigation.

It is anticipated that the Salt Interception Scheme 5 Year Reviews for Loxton, Bookpurnong, Waikerie 1, Waikerie IIA, Waikerie Lock 2 and Qualco-Sunlands Groundwater Control Scheme will be completed during 2012-13 so that the related entries can be sourced from the new models and updated in the 2013 Salinity Registers.

4. VALLEY REPORTS

South Australia is committed to contributing towards meeting the existing Basin Salinity Target and has also adopted it as a State target under the South Australian River Murray Salinity Strategy 2001-2015 (SARMSS). South Australia is keen for new operational targets to be specified in the forthcoming Water Quality and Salinity Management Plan that facilitate actions to enable management of River Murray salinity below Morgan.

4.1. END OF VALLEY REPORT CARD

The Independent Audit Group - Salinity has previously acknowledged that the End-of-valley Summary Report Card is not entirely suitable for South Australia, as it does not make provision for downstream targets, actions or reporting. However, South Australia has provided a description of the key monitoring sites at Table 6 and completed the relevant fields of the End-of-valley Summary Report Card, refer Table 7.

Table 6 - Monitoring sites

Monitoring site	Target EC *	Description
Border (downstream of Rufus River)	412	This site near the SA/NSW border effectively provides the salinity of water entering South Australia
Berri (Irrigation Pump Station)	543	This site has good long-term data and a continuous data recorder
Murray Bridge (Pump Station)	770	This site is a major off-take, and is downstream of the major urban off-take. The installation of a continuous recorder will ensure data quality will be maintained.

*Target EC for 80 percent of the time

Table 7 - End-of-valley summary report card

Valley	Interim 2015 Target (% of 2000 Benchmark Conditions)			Valley Reporting Site	Assessed Baseline Conditions – 1/1/2000	'Do Nothing' Legacy of History Impact –2015 Effect	Agreed 2015 Target	Progress Given Actions To-Date
								Current Year 2011-12
	Salinity		Salt load	(Shared resource sites shown in italics)	End of Valley: Flow, Salinity, Salt Load			End of Valley: Salinity, Flow, Salt Load
South Australia	Median	95%ile	Average					
Lock 6 to Morgan	Tba	800 EC	Tba	Murray at Morgan			800 EC	464 EC (Max) 414 EC (95 %ile) 339 EC (80 %ile) 54 100 ML/Day Max Flow
Monitoring Sites	Median	80%ile	Average					
Below Morgan	Tba	770 EC	Tba	Murray at Murray Bridge			770 EC	445 EC (Max) 386 EC (95 %ile) 350 EC (80 %ile) No flow data available
SA Border	Tba	412 EC	Tba	Murray at SA Border			412 EC	402 EC (Max) 306 EC (95 %ile) 254 EC (80 %ile) 59 800 ML/Day Max Flow
Berri	Tba	543 EC	Tba	Murray at Berri			543 EC	402 EC (Max) 346 EC (95 %ile) 290 EC (80 %ile) 54 650 ML/Day Max Flow

4.2. SUMMARY OF MONITORING SITES

In 2010-11 most of the pontoon mounted salinity monitoring equipment installed in the main river channel in South Australia was removed during the high flow period to avoid equipment damage. This year forecast high flows were low enough to leave all of the salinity data-loggers in place to continue monitoring through the high river events.

4.2.1. Border (A4261022)

The pontoon-mounted salinity monitoring equipment located at the SA – Vic Border provided reliable 'good' coded data for 99% of the time. Only 4 days of 'missing' data were not recorded due to a minor instrument malfunction.

Flow records for this site are derived from a rating at A4260200 (Victorian Gauging station, Murray River downstream of Rufus River) and A4140211 (Victorian Gauging station, Mullaroo Creek). During this period of high flows all flow data was derived from the rating tables developed for these sites. These rating tables are administered by THIESS Environmental. Maximum rated flow to South Australia was 59 800 ML/day on the 3rd of April, 2012.

This is the site recommended by South Australia for the Border target within the proposed Basin Plan.

4.2.2. Berri (A4260537)

The salinity monitoring equipment located at the Berri Irrigation Pumping Station continued to operate reliably, with 99 % of data being of 'good' quality in 2011-12.

Generally EC data was reasonably smooth due mainly to a regular monthly visiting and cleaning regime which kept biofouling to a minimum.

Flows for this site are calculated at Lock 4 (A4260515, 8km downstream of Berri), up to a stream-flow of 40 000 ML/day. Above 40 000 ML/day when water levels rise above the flow calculation formula range the high-flow gauging site at Lyrup (A4260663, 12km upstream of Berri) is used. Flows at Lock 4 were quality coded "good" for 100% of record below 40 000 ML/day for 2011-12.

The Lyrup high flow rating from 40 000 ML/day to 100 000 ML/day is rated 'good'. One extra gauging was completed on the minor recession in May 2012 to confirm the decreasing limb of the rating table.

Consequently the flows used to calculate salt loads at Berri are a combination of low flows at Lock 4 and higher flows at Lyrup and are rated good.

4.2.3. Morgan (A4260554)

The salinity monitoring equipment located at the Morgan Pumping Station pontoon operated reliably, with all data coded 'good' quality in 2011-12. Operation of the new EC instrument fitted to the Morgan flow site, 3.5 km downstream of the pumping station was continued and provided a backup EC reading for Morgan

The continuous flow station (A4261110), 3.5 km downstream of Morgan provided continuous flow data until February 2012 when an intermittent problem developed with the primary stage sensor. This problem has increased with time and currently no direct calculated flow from this site is possible. However the secondary stage sensor has continued to provide level data and the discharge data will be calculated using this secondary device to provide continuous flow for the missing periods. Repairs to the stage sensor will be undertaken when flows drop and divers can access the equipment safely.

Lock 1 calculated and rated flows were used to calculate salt loads at Morgan during this period. Salt loads will be calculated to confirm salt loads provided using Lock 1 rating.

4.2.4. Murray Bridge (A4261162)

The new water level and EC monitoring installation (A4261162) at Long Island continued to operate well and 98% of salinity data is coded 'good'.

No continuous flow measurements are possible at Murray Bridge, as detailed in the 2005-06 report.

5. RESPONSE TO INDEPENDENT AUDIT GROUP

South Australia values the process of annual audit by the Independent Audit Group – Salinity (IAG). The recommendations provided by the IAG in their annual reports promote action to address the high priority issues and highlight areas requiring additional investment. This is particularly valuable in a time of more limited resources for Murray-Darling Basin salinity management and a need to target key issues. South Australia's formal response to the 2010-11 IAG recommendations (as forwarded to the MDBA 27 January 2012) is provided below.

5.1. RECOMMENDATIONS

Recommendation 1: Accountability for salinity impacts of Environmental Watering

a) A set of high level principles, consistent with the National Water Initiative (NWI) and the Basin Plan, be established and agreed to by the Ministerial Council that will guide the development of the environmental watering plans, the institutional responsibilities and accountability for salinity under those plans.

b) The potential impacts of environmental watering on basin salinity be jointly explored through a modelling program of intensive scenario analysis by the Commonwealth Environmental Water Holder (CEWH), the Basin Salinity Management Strategy Advisory Panel (BSMAP) and the MDBA so that an informed application of the policy principles can be made.

South Australia supports this recommendation.

South Australia advocates a shared Basin wide approach to the allocation of credits and debits associated with the delivery and use of environmental water to ensure all jurisdictions share the burden of the accountability of the salt mobilised by environmental watering.

South Australia supports the incorporation of accountability within the BSMS but reiterates that the different temporal nature of irrigation and land based induced salinity (with changes occurring slowly over years or decades) and environmental watering induced salinity (with changes occurring rapidly and episodically with a duration of days to months) warrants consideration for a different method of accountability estimation. South Australia proposes the MDBA should trial a 'Register E' concept that resides within the existing BSMS Salinity Registers but with differentiation from the irrigation and land based salinity actions that are recorded in the existing Registers A and B.

In summary, and in relation to (a), South Australia has developed its own set of guiding principles and believes these are consistent with the NWI and the Basin Plan. South Australia has provided these to BSMAP to aid in inter-jurisdictional discussions. South Australia has also initiated discussions with the CEWH on this matter.

In relation to (b), South Australia strongly agrees and suggests that MDBA convene a meeting of the Environmental Watering Salinity Accountability Task Force (including representation from the CEWH and MDBA modellers) as soon as possible to progress this recommendation.

Recommendation 2: Planning for the new BSMS

The work program required to review the emerging salinity risks and re-appraise the elements of the BSMS be scoped by the Authority and Contracting Governments so that a new operational plan can be developed and adopted before the current plan concludes in 2015.

South Australia suggests that as the timeframes for developing a new strategy are likely to be long (for example, the BSMS Mid-term Review took some 18 months), this needs to be initiated immediately. The planning and development of a new Strategy should draw heavily on the priorities for salinity management as set out in the proposed Basin Plan including the salt export target and the salinity operational targets.

The policy directions set in the BSMS Mid-term Review and the priorities from recent salinity audits are also valuable guiding documents for setting the scope of the new BSMS. Due regard should be given to issues raised by jurisdictions in the current and proposed reviews of Schedule B and whether a new BSMS will be adequately served by the current Schedule.

Progressing work against the 2009-10 High Priority Recommendation #3 ("Re-assessing salinity risk in the Basin") is critical to ensure the policy and management directions are appropriate given the changed water regime emerging as part of the proposed Basin Plan.

Recommendation 3: Outstanding submission of register reviews

a) ***New South Wales should develop a schedule for up-coming Salinity Register reviews;***

b) ***Queensland should formally submit the three outstanding Salinity Register reports.***

South Australia supports this recommendation.

South Australia has made considerable effort in 2010-11 to finalise its outstanding register reviews – these are now complete and have been included in South Australia's 2010-11 Annual Report to the BSMS.

Recommendation 4: Promotion of the BSMS model success story

The success of the BSMS be promoted to demonstrate how good multi government programs can work when roles, responsibilities and accountabilities are well developed, an adaptive management framework is used and where excellent jurisdictional collaboration and commitment to progressing the strategy has occurred.

South Australia supports this recommendation.

However, South Australia does not support it being rated as fourth highest priority for the Basin Salinity Management program to address. The Basin Salinity Management program is already suffering in the face of limited resourcing. Progress on critical issues directly related to Basin salinity management such as accountability for environmental watering and reassessing future salinity impacts to inform the Strategy's successor are a higher priority for progress.

Promoting the success of the BSMS program is a communications/PR exercise and should be referred to the appropriate unit within MDBA, such as the communications unit, to lead with input from the Basin Salinity Management Program as required.

Recommendation 5: Resourcing the BSMS

The recent shortage of necessary skills in the MDBA Salinity program is limiting progress of the BSMS and Independent Audit Group-Salinity recommendations and needs to remedied as soon as possible.

South Australia supports this recommendation.

South Australia has expressed concern at the rate of progress of key BSMS projects led by MDBA in 2011 due to the skills shortage within the Salinity Strategy Program in the MDBA. South Australia has offered to provide project management resources with salinity expertise in exchange for funding as a short term solution. Such initiatives have operated successfully in the past.

However, building capacity within the Salinity Strategy Program at the MDBA is South Australia's preferred longer term solution.

Recommendation 6: Priority for upland catchment actions

Prioritisation for NRM investment in management actions for high salinity risk sub-catchments be further developed by synthesising data from the recent wet and dry periods, reviewing conceptual models and tools and approaches being used and preparing guidelines on preferred approaches and effective management options. The guidelines are to include emerging salinity risks.

South Australia supports this recommendation.

While upland catchment management is not applicable within South Australia from a salinity management perspective, South Australia strongly supports the need to assess emerging salinity risks and reassess existing risks of the upstream catchments. This will inform the need to invest further in joint works and measures, such as completion of the Pike salt interception scheme.

South Australia therefore requests the learnings from the recent New South Wales salinity audit be shared with other jurisdictions.

Recommendation 7: Targets and Monitoring sites review

A review process be established that combines end of valley salinity targets over the benchmark period with real time targets that can account for local high risk salinity processes operating and provide feedback to local communities.

South Australia supports this recommendation.

South Australia acknowledges that a substantial amount of work was completed on this issue in the development of the Basin Plan, through the Salinity Targets Review reports, as available on the Basin Plan Knowledge and Information Directory. These reports provide a valuable starting point from which Basin Salinity Management Advisory Panel can progress investigations into combining end of valley salinity targets over the benchmark period with real time targets. Such targets can enhance management of local high risk salinity processes and enable local communities to monitor changes in salinity within catchments.

South Australia therefore considers that such targets will greatly assist community land and water management groups and river operators in implementing actions and strategies to

deliver against salinity operational targets within the proposed Basin Plan. Further, South Australia proposes the salinity targets in the proposed Basin Plan be utilised to monitor changes in salinity within catchments with a view to prioritising future resources and management opportunities.

Recommendation 8: Salt Interception program review

The salt interception program is reviewed to consider optimising the system taking into account the increasing maintenance requirement and the operational costs and capital investment made.

South Australia supports this recommendation.

The recent high flow event has demonstrated that there are times when it is feasible - or in some cases, a necessity - to reduce or cease SIS pumping and this can save considerably on both future maintenance and operational costs.

Furthermore, South Australia believes that it is prudent to divert water from disposal basins to River in times of sustained high flows, as this provides an opportunity to discharge salt from the Basin to the sea while also prolonging the effective life of disposal basins. Further investigations into the use of SIS for floodplain health benefits (as opposed to in-river benefit only) should be progressed.

South Australia can offer expertise and advice on strategies that could be explored as part of a review of SIS operations led by MDBA.

Recommendation 9: Updated economic valuations in the registers and forward projections based on salinity risk.

The registers be interpreted annually for policy makers providing a current and forward economic valuation based on the values in the registers but which are in current dollars and the level of credits needed into the future taking into account any increase in credits to meet the target at Morgan.

South Australia supports this recommendation.

South Australia acknowledges the importance of the economic valuations in the registers, particularly as they extend beyond the modelled Basin target at Morgan and allow some insight to the impacts of salinity in the river reach below Lock 1. However, updating the economic valuations would be a significant undertaking and should also include updating the cost functions. This is because the current cost functions are focussed on irrigation, urban and domestic users and fail to reflect the cost of impacts of salinity on environmental assets such as the Coorong, Lower Lakes and Murray Mouth icon site. South Australia therefore also requests the MDBA lead updating the cost functions to include environmental costs as part of actioning this recommendation.

Recommendation 10: Salinity Impact Zoning

That New South Wales establish a salinity impact zoning policy for Sunraysia that is consistent with the zoning in Victoria and South Australia.

South Australia supports this recommendation.

South Australia is able to offer advice to NSW on how salinity zoning has progressed in South Australia. South Australia suggests that the MDBA's SIMRAT model may be suitable as the basis for determining the location of zoning boundaries in NSW, pending completion of the overdue five year review and update of this model and its input datasets (due in 2008).

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