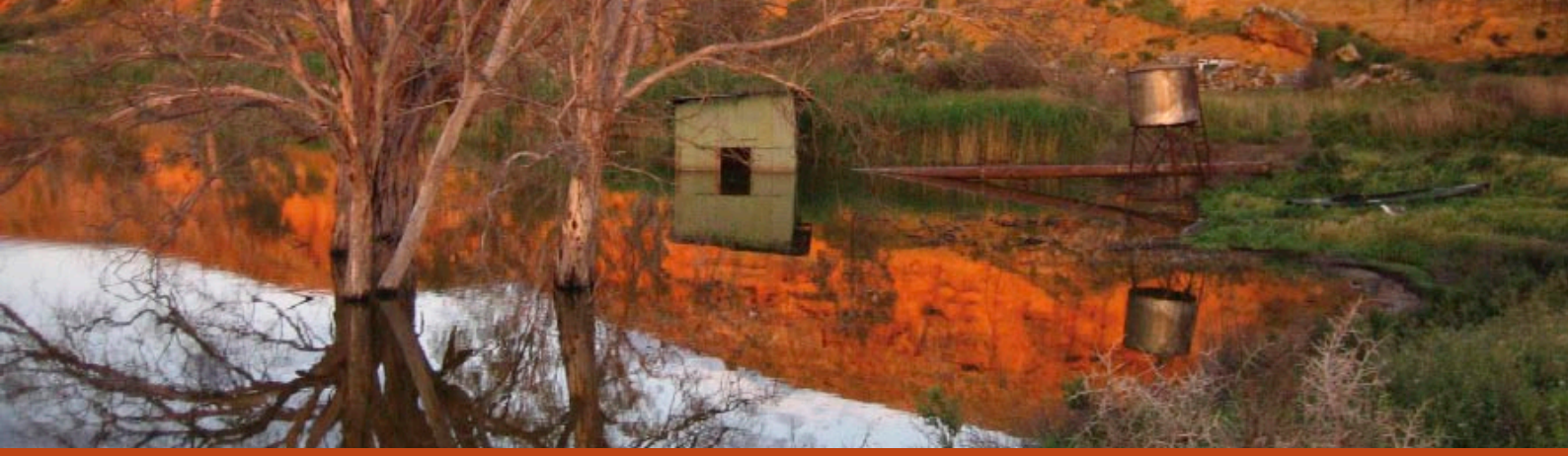

SOUTH AUSTRALIA'S 2008-09 REPORT TO THE BASIN SALINITY MANAGEMENT STRATEGY

Government of South Australia
Department of Water, Land and Biodiversity Conservation

Paiwalla Wetland, Nov 2006 (pump shed now removed)

ACKNOWLEDGEMENTS

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- South Australian Murray-Darling Basin Natural Resources Management Board
- SARDI
- SA Water
- PIRSA
- CSIRO
- Future Farm Industries CRC
- Australian Water Environments
- Other divisions within DWLBC

Cover photograph: Tumi Bjornsson

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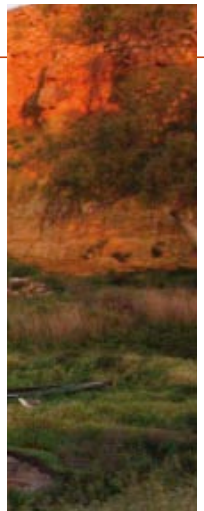

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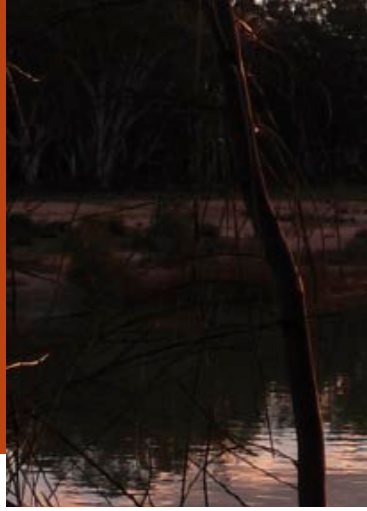
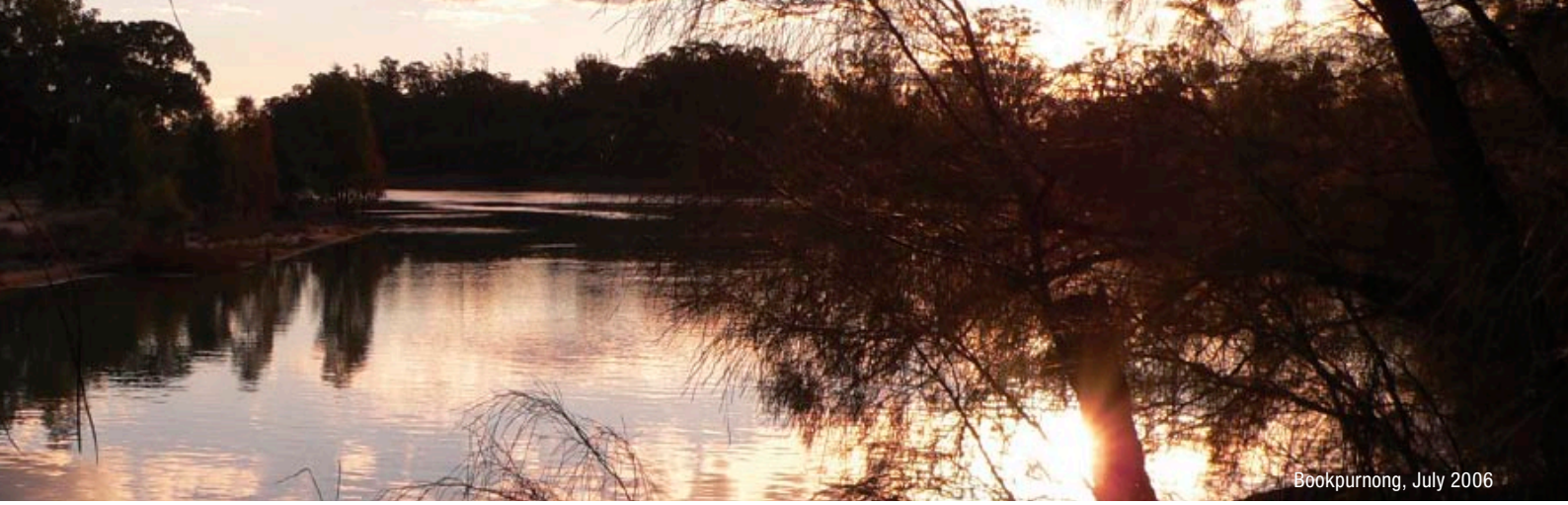
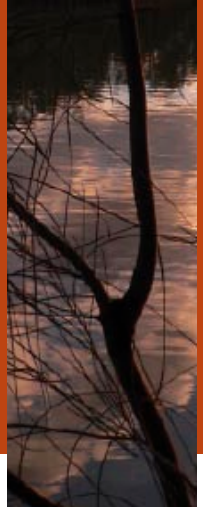




Bookpurnong, July 2006



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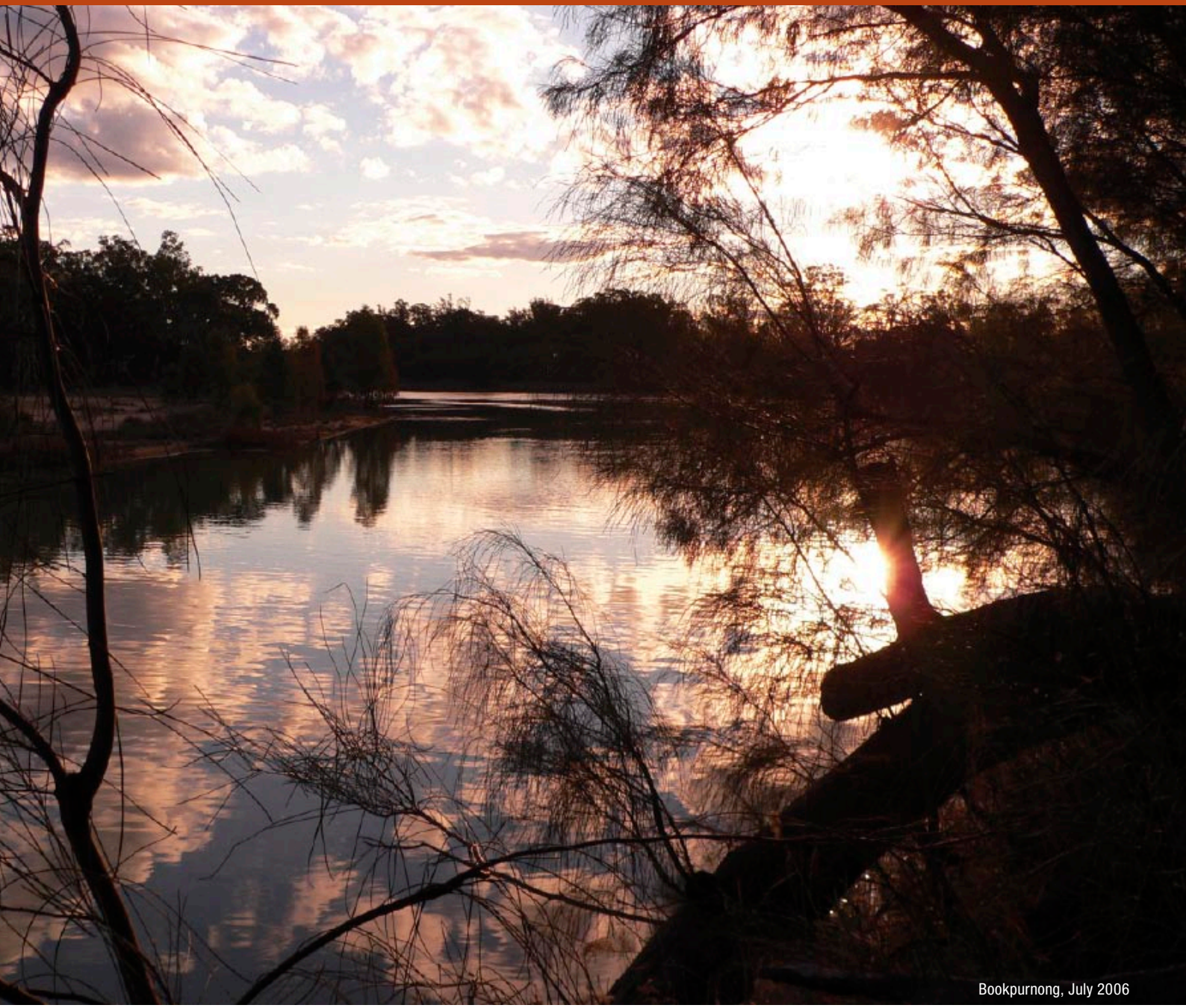
LIST OF ABBREVIATIONS

ADCP	Acoustic Doppler Current Profiler
AHD	Australian Height Datum
BL4EA	Bookpurnong Lock 4 Environment Association
BSMS	Basin Salinity Management Strategy
BSMAP	Basin Salinity Management Advisory Panel
BSMS TLM	Basin Salinity Management Strategy/The Living Murray
CSSSM	Community Stream Sampling and Salinity Mapping
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEH	Department for Environment and Heritage
DWLBC	Department of Water, Land and Biodiversity Conservation
EC	Electrical Conductivity
FAE	Field Application Efficiency
FFI CRC	Future Farm Industries Cooperative Research Centre
GIS	Geographic Information System
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(ning)

MAT	Management Action Targets
MBI	Market Based Instruments
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
MERI	Monitoring, Evaluation, Reporting and Improvements
ML	Megalitre (1 000 000 litres)
NAP	National Action Plan for Salinity and Water Quality
NHT	Natural Heritage Trust
NRM	Natural Resources Management
NWI	National Water Initiative
PIP	Pike Implementation Project/Plan
PSR	Performance Story Reporting
RCT	Resource Condition Targets
RMEM	River Murray Environmental Manager
RSDMP	Riverland Salt Disposal Management Plan
SA	South Australia
SA MDB	South Australian Murray-Darling Basin
SA MDB NRMB (the Board)	South Australian Murray-Darling Basin Natural Resources Management Board
SARMSS	South Australian River Murray Salinity Strategy
SAMRIC	South Australian Murray-Darling Basin Resource Information Centre
SARDI	South Australian Research and Development Institute
SASP	South Australia's Strategic Plan
SIMRAT	Salinity IMpact Rapid Assessment Tool (formerly SIMPACT)
SIS	Salt Interception Scheme
SL	Side Looking
The PLAN	Regional Natural Resource Management Plan
TLM	The Living Murray
TLM IGA	The Living Murray Inter Governmental Agreement
WAP	Water Allocation Plan for the Prescribed River Murray Watercourse
WQSMP	Water Quality and Salinity Management Plan
WSAT	Wetland Salinity Assessment Tool
WUE	Water Use Efficiency



Bookpurnong, July 2006

Executive Summary

Murray-Darling Basin salinity management remains a significant issue for South Australia because of 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; the influence of human development in mobilising salt to the River Murray, and the ultimate implications of salinity in terms of water quality for all uses, including metropolitan Adelaide. Salinity impacts largely occur in South Australia through reduced water quality and degradation of the floodplain. This report demonstrates progress in 2008-09 towards managing these impacts.

The effects of drought

The extreme drought conditions continued into 2008-09, resulting in the progressive reduction in water flow to South Australia to only 1 800 Megalitres (ML)/day across the border and a minimum flow over Lock 1 of about 1 000 ML/day.

The minimum flow over Lock 1 is required to ensure water is able to be delivered for pumping to over 90% of the State (in dry years) for critical human needs, evaporation losses, restricted irrigation use and to provide 350 Gigalitres (GL) per annum past Wellington and into Lake Alexandrina.

The weir pools between Locks 1 to 5 were maintained at their normal full supply levels for most of the year. Salinities remained generally low from the border to Lock 1. At the end June 2009, the salinity was 375 EC at Lock 2, 414 EC at Lock 3 and 222 EC at Lock 6.

The situation below Lock 1 was quite different as the reduction of flows to South Australia in several consecutive years (less than entitlement) has significantly impacted on salinities below Lock 1. At the end of June 2009, the salinity at Mannum was 592 EC and at Murray Bridge was 668 EC. The water level in Lake Alexandrina was minus 0.88m AHD and the water level in Lake Albert was minus 0.35 m AHD.

Bookpurnong, July 2006

Salinities remained at elevated levels in both lakes and ranged between 4 800 EC to 30 000 EC depending on the location.

On-going drought conditions continued to impact on the delivery of the South Australian Murray-Darling Basin Natural Resources Management Board's (the SA MDB NRM Board's) Irrigated Land and Water Management Planning Programs in 2008-09.

In 2008-09 the SA MDB NRM Board was actively involved in the upgrade of three Land and Water Management Plans (LWMP) in the districts of Bookpurnong-Lock 4, Pyap-Kingston on the Murray, and Taylorville. The upgrade of these plans has been impacted by the drought with community engagement levels difficult to maintain during this time.

In the lower reaches of the South Australian Murray-Darling Basin (SA MDB) (below Lock 1), record low water levels and poor water quality has resulted in little irrigation. The prospect of another season of severely reduced water availability is likely to drive a major change in the irrigation demographic below Lock 1. The SA MDB NRM Board has continued to work with irrigators below Lock 1, however, the issues confronting these water users are beyond the scope of what can be addressed through the SA MDB NRM Board's Irrigated Land and Water Management Planning Program.

New irrigation pipelines to service the Langhorne and Currency Creek irrigation areas will come on-line in 2009-10 which will assist irrigators to access improved water quality; however, heavy reductions in allocations will still confront the region in the coming season.

Impact of water sharing rules

Special water sharing arrangements were implemented for the 2008-09 water year. Improvements in resource availability have been provided to the states on the basis of the 3L water sharing rules, which resulted in 50 percent of South Australia's improvements being redirected to the Upper States to repay imbalances. The Murray-Darling Basin Authority (MDBA) water accounting procedures and these associated imbalances were independently reviewed and considered by the Basin Officials Committee resulting in numerous accounting upgrades.

Carry-over of water allocations for irrigators

Carry-over is a useful mechanism for irrigators to supplement heavily restricted allocations and more effectively manage inter-seasonal risk.

The carry-over scheme for 2008-09 allowed for 100 percent of unused restricted 2007-08 volumes to be allocated as carry-over in 2008-09, with 94.2 GL allocated.

In 2008-09 carry-over was provided as a water allocation, fully tradeable both intra and inter-state, consistent with arrangements in other jurisdictions.

KEY ACHIEVEMENTS

- Widespread use of Irrigation Recording and Evaluation Software (IRES) by Bookpurnong irrigators to make informed management and scheduling choices during severe water restrictions.
- Release of the report of the Bookpurnong Floodplain Pilot Project which trialled floodplain management techniques.
- Lodgement with the MDBA of the Approval Submission for Pike Salt Interception Scheme (SIS).
- Completion of the second stage investigation for bore drilling and confirmation of pipeline route for the Murtho SIS.
- Finalisation of the proposal to use conventional bore pumps in two areas and extend the Cliff Toe Drain within the Loxton SIS.

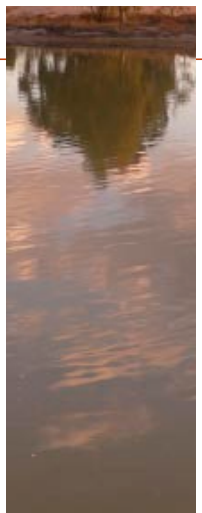
- Investigation into the required rehabilitation work at the Noora Disposal Basin that will result in on-ground work in 2009-10.
- Completion of a set of numerical groundwater models for South Australian section of the River Murray, with the update of the Morgan to Wellington MODFLOW groundwater model.
- Completion of the Riverland Watertable Time Series maps.
- A study of surface water-groundwater interaction to help manage wetlands resulted in improved knowledge to assist the development of wetland rehabilitation plans.
- Installation of new telemetered monitoring sites to increase availability and accuracy of South Australian salinity data.
- Development of a new Salinity Management in Irrigated Horticulture training workshop to assist irrigators with managing rootzone salinity.
- Adoption of the SA MDB NRM Regional Plan containing water asset targets and associated management action plans.
- Conclusion of the SA MDB Community Stream Sampling and Salinity Mapping (CSSSM) project to enable communities to identify areas within their catchments at risk of salinity.

SIGNIFICANT WORK

- Progression of the project "How efficient are we?", which aims to document historical improvements in water use efficiency since 1960. The outputs of the project will inform investment in Land and Water Management Planning and provide independent evidence to support assumptions in regional groundwater models.
- Preliminary analysis for salinity targets below Morgan to assist in maintaining real-time salinity levels for all water users.
- Further negotiations with the MDBA to commence collaborative investigations to the potential impacts of floodplain salt mobilisation.
- Review of all weir pool manipulations to date, including the potential salinity impacts of all manipulation actions.
- Development of an options paper for salinity Market Based Instrument (MBI) policies for South Australia.
- Development of a model to quantify salt impacts from the operation of the proposed Chowilla environmental regulator.
- South Australian Government has been developing an information memorandum to offer the potential opportunity for the general public to access salt interception scheme water off the Woolpunda pipeline for commercial end use.

FUTURE WORK

- Modelling of real time impacts of salinity from the Chowilla environmental regulator.
- Work in partnership with the Murray-Darling Basin Authority to develop an improved understanding of the processes of floodplain salt accumulation and salt mobilisation and their impact on salt load to river.
- Build on existing work on salinity targets below Morgan and continue to conduct research into appropriate targets to assist in providing input to the forthcoming Water Quality and Salinity Management Plan (WQSMP).
- Work on increasing the robustness of South Australia's Basin Salinity Management Strategy (BSMS) Salinity Register entries.



Bookpurnong, July 2006

1 Nine elements of the BSMS

The following sections highlight how South Australia has implemented each of the nine elements of the BSMS in the South Australian Murray-Darling Basin (SA MDB) (Figure 1) for 2008-09.

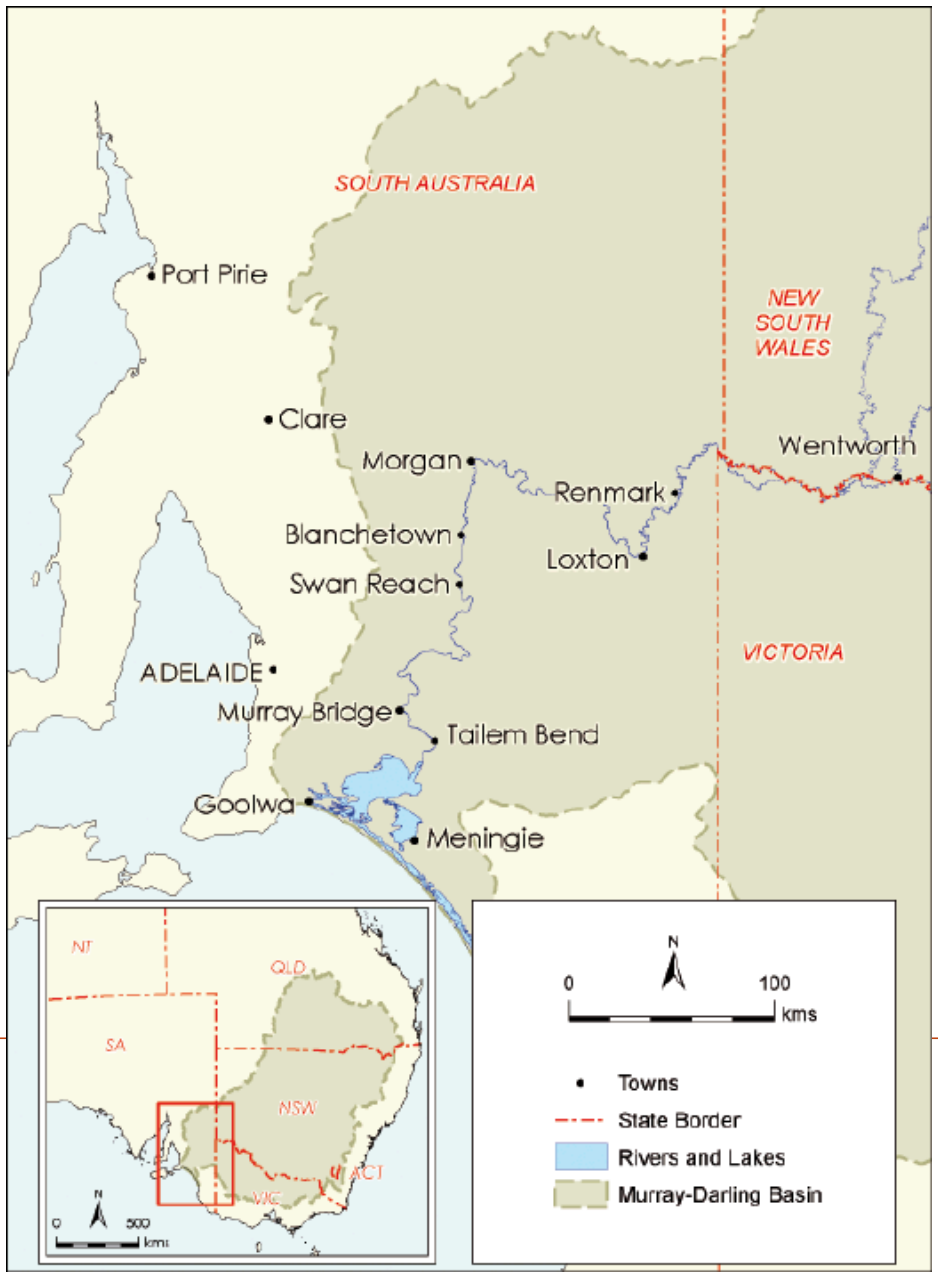
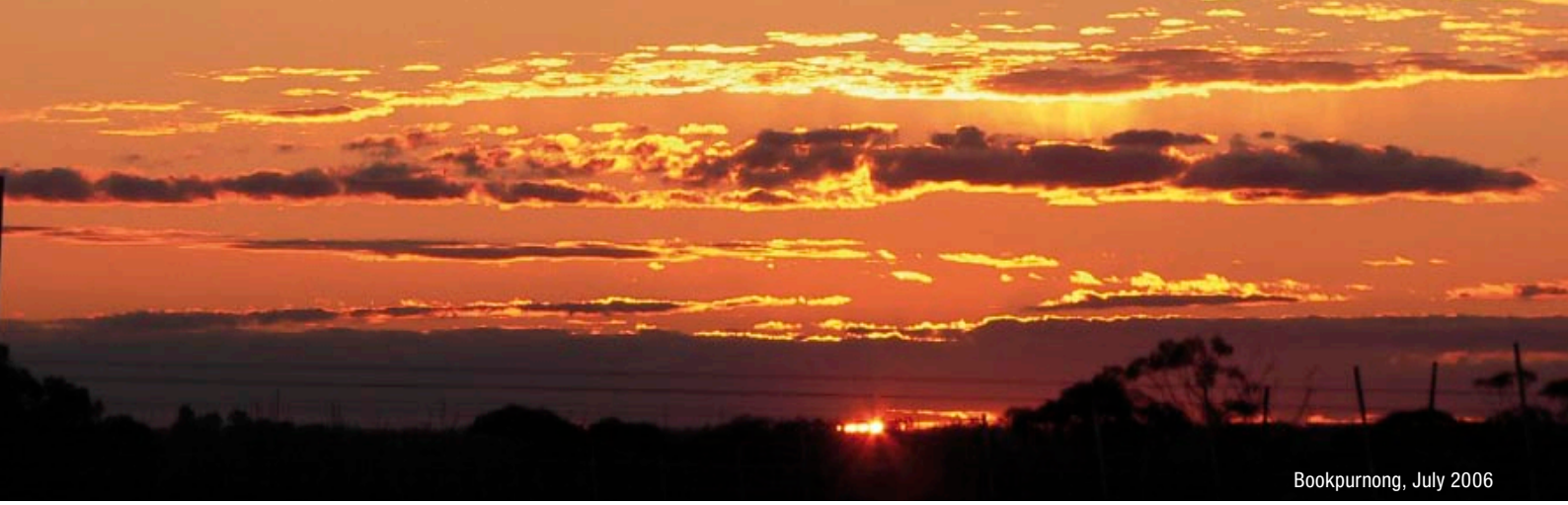


Figure 1: South Australian Murray-Darling Basin



Bookpurnong, July 2006

1.1 Developing capacity

Policy and technical advice on salinity and irrigation management is provided to River Murray irrigation communities (primarily in the Riverland) through the Department of Water, Land and Biodiversity Conservation (DWLBC) by a regional senior policy officer based in Berri. The purpose is to provide a strong framework to support on-ground actions and complementary policy with the aim of reducing salinity impacts of irrigation on the River Murray.

The work is undertaken in conjunction with the SA MDB NRM Board, Local Action Planning (LAP) Associations and irrigator groups. This cooperative framework has paved the way for the establishment and support of a number of case study areas.

Each case study group incorporates a range of tools and on-ground actions to facilitate the use of best available information in day-to-day irrigation scheduling. The goal is to minimise drainage so that it does not exceed 10-15% of an irrigation application. The case study groups also act as a catalyst for increased irrigator involvement in developing irrigation related policy and programs.

PIKE RIVER CASE STUDY

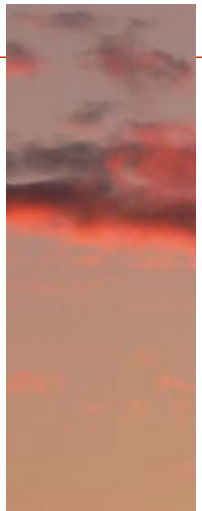
Since August 2007, the Pike River Land Managers, Renmark to the Border LAP, DWLBC and the Department for Environment and Heritage (DEH) have been working cooperatively on the Pike Implementation Plan (PIP). The PIP integrates solutions for floodplain degradation, sustainable water supply for irrigation, stock and domestic water users as well as salinity management (both regionally and on the floodplain). The project includes community representation at all levels of decision-making.

An Investment Plan is in development and should be completed by October 2009. Numerous investigations have been undertaken to improve baseline understanding of the Pike River System. The Investment Plan will outline a number of initiatives for funding by Regional, State and Commonwealth bodies. A second Memorandum of Understanding has also been developed and agreed between stakeholder representatives.

BOOKPURNONG LOCK 4 CASE STUDY AND IRES

As an initiative to demonstrate accountability in irrigation management, the Bookpurnong Lock 4 Environmental Association (BL4EA) supported the use of the Irrigation Recording and Evaluation Software (IRES). IRES continues to be used on a wide scale within Bookpurnong. The ongoing drought has resulted in extreme efficiency gains due to severe water restrictions. The software has allowed irrigators to make more informed choices in management of their properties and scheduling irrigation. IRES automatically calculates field application efficiency as irrigation records are entered. Field application efficiency (FAE) considers the efficiency of each irrigation event and requires a soil water balance to be calculated daily. This calculation is very different to the method used in the River Murray Prescribed Water Allocation Plan (WAP) whole of season calculation. Results are reported as an index between 0 and 1 with values less than 1 estimating that drainage has occurred. FAE is comparable across different crops and properties if a consistent methodology is used.

All data sets have been calculated using water meter readings (using hours of irrigation in calculations may result in different values). Also the age of plantings is not taken into account in calculations.



IRRIGATOR ANNUAL REPORTING AND BASELINE INFORMATION FOR IRRIGATED LAND

Baseline irrigation data for all licensees in the River Murray Prescribed Watercourse was updated in 2007-08 and once again a large degree of change was noted as a result of continuing drought conditions. A snapshot report based on data collected in 2007-08 is available for download at:

www.samdbnrm.sa.gov.au/Board_Projects/Irrigation_Management/Downloads.aspx

As has been the case over the past few irrigation seasons, water use efficiency indices were not calculated as a result of the very low irrigation allocations. Several irrigation districts generated regional reports on irrigation efficiency via IRES.

Although no formal irrigation annual reporting was conducted, the irrigated crop survey database has been utilised to inform high level projects such as the Critical Water Allocations for permanent plantings and the development of the Business Case for the Murray Futures – Industry Renewal project.

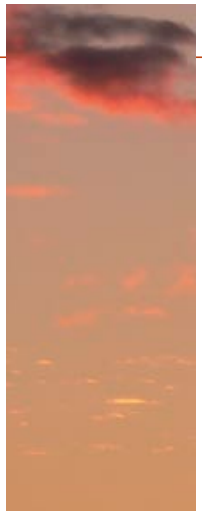
UPDATING LAND AND WATER MANAGEMENT PLANS

Bookpurnong-Lock 4, Pyap-Kingston on Murray and Taylorville LWMP areas are at the final stages of updating their Land and Water Management Plans. Several of the plans have been delayed due to additional investigations carried out to inform the plans including groundwater and vegetation health projects.

The Taylorville area has adopted a groundwater monitoring program for the Markaranka floodplain to assist in identifying any groundwater lowering as a result of the extension of the Waikerie Salt Interception Scheme on the opposite southern side of the River Murray.

HOW EFFICIENT ARE WE? HISTORICAL IMPROVEMENTS IN WATER USE EFFICIENCY SINCE 1960

This project was developed to better inform investment in land and water management planning districts by highlighting the major drivers of improved efficiency since 1960. A second objective is to benchmark land and water management planning districts, based on currently available data. Additionally, the report will provide evidence to support groundwater model development and maintenance in relation to the efficiency of historical irrigation water application to determine drainage. Issues identified by the project include the lack of consistent good quality data, which allows an estimation of deep drainage from irrigation. The final report is scheduled for completion by late 2009.



1.2 Identifying values and assets at risk

Salinity can have considerable impacts on social, economic and ecological values and assets. The River Murray is a significant water resource in South Australia, supplying an average of 60% of Adelaide's water (and up to 90% in dry years) and is the only water supply for many regional communities. The River Murray also provides water to sustain irrigated horticulture, agriculture and other industries along the river. The risk of salinity to water users is well recognised.

Floodplains in South Australia are at risk of the impacts of increased salt loads from irrigation development, coupled with the impacts of river regulation and changed flooding regimes. Due to drought and river regulation, the salt loads that reach the floodplains have accumulated over a much longer period. When flooding eventually does occur, the stored salt will be released and pose risks to downstream users and environments.

South Australia has focussed on investigations and projects to understand and manage the salinity risks to floodplains and how these integrate with environmental management and the salinity risks that the floodplains pose.

BOOKPURNONG FLOODPLAIN PILOT PROJECT

The Bookpurnong Floodplain Pilot Project aimed to trial and document different floodplain management options that could be used at other floodplains, such as Chowilla. The project has now concluded.

Over the past five years, the project implemented the following floodplain management strategies:

- surface water flooding;
- groundwater lowering to promote the movement of freshwater from the River Murray into the floodplain;
- combination of surface water flooding and groundwater lowering;
- freshwater injection into a shallow aquifer; and
- pulse pumping of a groundwater production bore, fluctuating groundwater levels to provided vegetation health benefits.

The pulse pumping trial operated on a two weeks on, two weeks off cycle over a six-month period with the aim of reducing the salinity levels in the root zone. Monitoring has shown positive impact on the vegetation health through this form of operation (see Figures 2 and 3).

The final milestone for 2008-09 was to produce reports outlining work undertaken, the monitoring implemented, the results observed and data analysis. These reports are available to anyone interested in understanding potential management techniques for other floodplains and can be downloaded at http://www.dwlbc.sa.gov.au/publications/rpts/index.html

Figure 2: Visual evidence of epicormic grown on E. camaldulensis in 2005 turning into canopy by 2007

Figure 3: Visual evidence of E. camaldulensis in a low extent category transitioning to a higher crown extent category over the duration of the study period

SALINITY IMPACTS OF THE LIVING MURRAY ACTIONS

South Australia remains aware of the need to account for the long-term in-river salinity impacts of The Living Murray (TLM) actions. The Murray-Darling Basin Commission (Meeting 96, 26 August 2008) endorsed the following Basin Salinity Management Strategy/ The Living Murray (BSMS/TLM) High Level Principles:

(i) The governments signed up to the TLM Inter Governmental Agreement (IGA) are jointly responsible for the salinity impacts (credits and debits) of TLM environmental watering, including both the dilution impacts of water delivery along the Murray River channel, and the salt mobilisation arising from environmental watering events;

(ii) The governments signed up to the TLM IGA are jointly responsible for the salinity impacts (credits and debits) of TLM water recovery actions post 23 August 2003 (consistent with the TLM Business Plan 2007); and

(iii) Investment (if any) to offset TLM salinity impacts will be considered in terms of the combined impact of all TLM actions.

At this meeting it was also noted that "jointly responsible" means that any credit or debit arising from the combined impact of all TLM actions would be attributed equally between New South Wales, South Australia, Victoria and the Commonwealth, consistent with the approach for attributing the 61 EC Joint Works and Measures Program, as prescribed in the BSMS Operational Protocols.

With the transition to the MDBA, the TLM/BSMS Coordination Taskforce has not continued. However, it is expected that the Basin Salinity Management Advisory Panel (BSMAP), which replaces the former BSMS Implementation Working Group, will continue to progress the work of the former TLM/BSMS. South Australia is applying these principles in the work being progressed on the proposed construction of the Chowilla environmental regulator.

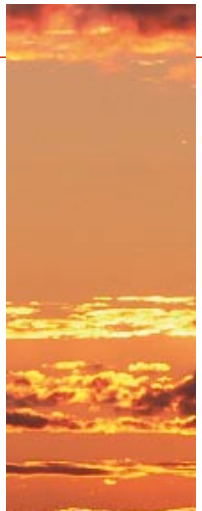
CHOWILLA FLOODPLAIN ICON SITE ENVIRONMENTAL MANAGEMENT PLAN

The Chowilla Floodplain Icon Site contains a high diversity of both terrestrial and aquatic habitats, supporting populations of rare, endangered and nationally threatened species, and has many sites of cultural significance.

The Chowilla Icon Site Management Plan is currently being implemented by the SA MDB NRM Board and includes a proposal for the construction of the Chowilla Creek environmental regulator. The environmental regulator will enable flooding of up to 50% of the floodplain and ensure the protection of significant areas of Red Gum and Black Box vegetation. However, the Chowilla floodplain is underlain by a shallow, highly saline aquifer, which is a well documented source of saline groundwater discharge into the River Murray. Managed inundation of the floodplain via operation of the proposed Chowilla Creek environmental regulator is expected to increase leaching of salt from the floodplain soil and reduce soil salinity; thereby providing environmental benefit to the Chowilla region. However, it is also expected to result in an increased discharge of salt into the Chowilla Creek and, ultimately, to the River Murray.

Potential salinity impacts from operation of the proposed regulator may be both long-term and short-term. Initial modelling has resulted in a provisional estimate of an entry for the BSMS Salinity Registers for the Chowilla Creek environmental regulator and associated works of 4.5EC within 100 years. Further modelling and model upgrade will be necessary for the model to be deemed 'fit for purpose' and to formalise the Salinity Register entry. DWLBC is currently working with MDBA to address this. In addition, as the proposed regulator will be the first entry on the BSMS Salinity Register relating to an environmental works, DWLBC and MDBA are working to establish how environmental watering actions are to be included.

Regarding the short-term impacts, modelling by DWLBC (2007) has indicated that operation of the Chowilla Creek environmental regulator could result in the addition of approximately 450 tonnes/day of salt post-flooding. The salinity impact at Renmark (immediately downstream of Chowilla) of an additional 450 tonnes/day is likely to be in the order of 160 EC at flows of 50 000 ML/day and 80 EC at 10 000 ML/day. While this assessment assumes an instantaneous draw down of water level rather than a stepped draw down and possibly over-estimates peak salt loads, it does highlight the need for measures to avoid unacceptable short-term salinity increases.



As a starting point, a number of measures have been investigated and modelled to determine their effectiveness. These include:

- adding dilution flows following the draw down period. This may involve managing drawdown to coincide with delivery of water to the Lower Lakes and Coorong;
- managing the rate of water level draw down behind the regulator to manage the peak salt load (this could be reduced by approximately 50% if a "stepped" drawdown is implemented; however, the total salt load remains relatively similar); and
- managing the duration and/or operating level of the regulator structure to manage salt returns.

South Australia will continue to work with the MDBA to build upon initial modelling work under the direction of The Living Murray Hydrologic Monitoring Taskforce.

More broadly, work is also being progressed in 2009-10 under the direction of the MDBA's BSMAP to improve understanding of the processes and scenarios under which floodplain salt is discharged to river, the extent of the risks associated with these salt loads and options to mitigate the risks. South Australia will have input to this work through representation on the BSMAP.

ENVIRONMENTAL WATERING

From November 2008 to June 2009, 43 wetlands were watered along the South Australian reach of the River Murray. The SA MDB NRM Board, in partnership with landowners, the Commonwealth Government, DEH, DWLBC and the South Australian Research and Development Institute (SARDI) coordinated the watering and monitoring program. Fish, birds, frogs, vegetation within and surrounding the wetlands, and groundwater and surface water levels and quality were measured. In total, 32 GL were used for the watering, with 10 GL used at Lake Bonney alone to manage rising salinity. Water delivery has been either via gravity or through pumping.

Most of the wetlands that received water have been isolated from the main river channel so that water of poor quality does not return to the River Murray. Banrock Station was initially not connected to the River Murray but monitoring showed no salt impacts so it was reconnected for a short period.

A total of 19 wetlands on the Chowilla floodplain have received environmental water over the past 12 months. All of these sites have received environmental water on previous occasions. Sites watered in summer have responded strongly. The response to autumn watering has been variable, although it is expected that the response will continue into spring 2009.

Monitoring of tree response over the past five years indicates that watering on two or more successive occasions is required to restore health to highly stressed trees.

In addition to tree response there have been positive responses recorded for frogs, birds and vegetation. In association with summer environmental watering, there was a breeding event of the nationally listed Southern Bell Frog *(Litoria raniformis)*. Thousands of water birds have also been recorded comprising 29 species including the threatened Australasian Shoveler *(Anas rhynchotis)*, Blue Billed Duck *(Oxyura australis)* and Musk Duck *(Biziura lobata)*.

While the environmental watering project has conserved large areas of long-lived vegetation, restored flood-dependent vegetation, and provided resources for floodplain biota across 19 wetlands throughout Chowilla, pumping is recognised as a short-term solution and has limited capacity to influence more than 5-10 percent of the floodplain.

FLOODPLAIN HEALTH AND SALINITY RISKS OF FUTURE FLOODING

Salt is a natural part of the Australian landscape and rivers, particularly in the lower parts of the MDB. However, river regulation and greatly reduced flows, particularly in the last decade, have resulted in little discharge of salt to the sea. Much of the salt remains in the floodplains along the lower parts of the River Murray and the salt becomes mobilised when the floodplains are watered as a result of natural flooding and/or through planned environmental watering events. High salinity levels have the potential to significantly affect water quality for all water users, including the environment.

In 2008-09, South Australia developed a proposal to investigate the processes and scenarios under which the accumulated salt in the floodplains is mobilised, the extent of the risks associated with increased salt loads to the River Murray and options to mitigate the risks. Specifically, the proposal suggested the project would establish:

- an improved understanding of the processes of floodplain salt accumulation and salt mobilisation on salt load to river;
- an improved understanding of how these processes can be influenced and/or controlled by other actions;
- a model with the ability to predict impacts of salinity in terms of in-river salt load, to enable regional scale salt accounting in the riverine corridor and risks to downstream water quality post-flood; and
- management options.

Addressing this issue will require a whole-of-basin approach, and in light of limited State funds to address this issue, South Australia wrote to the MDBA (March 2009) to formally express its interest to work with the MDBA on floodplain salinity and risks of future flooding, and provided the project proposal for information. Although a formal response from the MDBA has not yet been received, it is understood that funds were approved at Ministerial Council June 2009 and MDBA will work to initiate a project in 2009-10.

SOUTH AUSTRALIAN WEIR POOL MANIPULATION PROGRAM

No weir manipulation events took place during 2008-09 due to the continuing low flow and drought conditions across the MDB system. However, the drought conditions have resulted in a significant ongoing drawdown of the weir pool below Lock 1.

A monitoring program was undertaken examining the impacts of this weir pool drawdown on vegetation, birds, fish and water quality along the River Murray Channel and associated wetlands below Lock 1.

Detailed designs and works are underway to upgrade five priority secondary regulating structures on anabranch creeks that have been assessed as having the potential to fail or allow water to pass around under maximum weir pool raising events. Concept design and preliminary costings have been developed for a further three structures.

A further river reach (Lock 2 to 3) has been surveyed to assess pumping infrastructure and how it would be impacted by weir pool manipulation events.

Work is underway in conjunction with scientific community and river operators to develop an Operating Strategy to guide the implementation of weir pool manipulation events that will maximise potential ecological outcomes within the existing constraints.

The SA MDB NRM Board contracted Aquaterra to undertake a review of all weir pool manipulation work to date, including the potential salinity impacts of all manipulation actions. The work completed to date on assessing the potential salinity impacts of weir pool manipulation indicates the range of responses possible geographically. A combination of factors are controlling salt loads including the volume of water flow, the salinity of the groundwater, gradients of groundwater mounds, permeability, the rate of lowering of the weirs, the connection of the backwaters with the groundwater and the sill levels for wetlands and backwaters.

All of these factors will impact on the ultimate salinity impact of an event. As a result, it is important to have a detailed monitoring program in place, including groundwater response and stream monitoring, to assess the impacts of an event. Recommendations by Berens et al (2007) included:

- dual level salinity and depth loggers for groundwater monitoring;
- soil salinity profiling prior to and post weir pool manipulation; and
- groundwater salinity monitoring before, during and for several months after weir pool manipulation.

Investigations to date show that Lock 1 to 2 and Lock 5 to 6 have the lowest predicted salinity impacts for weir pool lowering.

Aquaterra are doing further work in 2009-10 to review salinity impacts of weir pool raising. South Australia will initiate discussions with MDBA in 2009-10 as to the potential salinity accountability implications of weir pool manipulation.

SALINITY MANAGEMENT BELOW MORGAN

The BSMS has focused on managing salinity in reaches and catchments above Morgan, as this is where the Basin Salinity Target is located. However, maintaining salinity levels in the River Murray below Morgan is also important for water supplies for metropolitan Adelaide, towns, irrigation, industry, tourism, the Lower Lakes, Murray Mouth and the Coorong. This has again been highlighted in 2008-09. Although flows have been actively managed as far as possible to provide dilution benefits, salinity levels have increased in the lower River Murray and the Lower Lakes as a result of the overall reduced flows and evaporation.

The Independent Audit Group - Salinity has previously recommended that salinity targets below Morgan be developed to protect the significant assets and populations (eg Adelaide) that may be affected by high salinity below Morgan. Additionally, salinity targets below Morgan will aid real time operations, as peaks in salinity (which can be accommodated in the current Basin Salinity Target) may be unacceptably high for critical human needs or for agricultural and ecological requirements.

South Australia has undertaken some preliminary analysis for salinity targets below Morgan, particularly at the water off-takes for urban water use at Mannum and Murray Bridge, to assist in maintaining real-time salinity levels in this reach of the River Murray. Alongside this, the MDBA currently has two major initiatives that require a substantive review of the existing salinity targets in the Murray-Darling Basin:

1. **Water Quality and Salinity Management Plan (WQSMP):** The MDBA must include salinity objectives and targets in the Basin Plan (Water Act 2007, Part 2, Division 1, Section 25 (1) (b)). These targets, together with other water quality targets, are part of the mandatory content of the Plan and will be used to monitor the condition of key environmental assets and the health of the Basin system overall. In undertaking this function, the MDBA must have regard to the National Water Quality Management Strategy.
2. **Basin Salinity Management Strategy (BSMS):** The MDBA has established a series of End-of-Valley salinity targets, including a Basin Salinity Target at Morgan, South Australia. The MDBA must, at intervals of not more than 5 years, review the adequacy and appropriateness of each End-of-Valley Target (Water Act 2007).

In 2009-10, the MDBA will initiate a project to both review the suite of BSMS End-of-Valley Targets, and to recommend salinity objectives and targets for adoption in the WQSMP. South Australia intends to build on its existing work on salinity targets and continue to conduct research into appropriate targets in parallel with the MDBA process, to assist in providing input to the WQSMP consultation process.

1.3 Setting salinity targets

During 2008-09, considerable effort has been made to investigate where the discharge of saline groundwater into the River Murray occurs in South Australia, particularly below Lock 1 where declining flows have reduced river levels, increasing the risk of accelerated groundwater discharge. Additionally, bore network data has been analysed to determine the trends in groundwater levels over time, particularly around the groundwater mounds in the Riverland.

The investigations will inform the development of salinity targets in the Basin Plan's Water Quality and Salinity Management Plan.

MONITORING TARGETS

The installation of telemetered monitoring sites has significantly increased the availability and accuracy of South Australia's salinity data. Polling of sites with data updated daily to the State Water Archive web site has enabled river operators to manage the whole of the River Murray operations on a daily basis. New salinity, flow and level sites have been installed at Morgan, Swan Reach, Mannum, Murray Bridge, Tailem Bend, Wellington, and several sites in the Lower Lakes and Coorong areas.

Total salt loads at Morgan have increased by about 24 000 tonnes, or 18 percent from 2007–08 (Figure 4). However, they did not reach the levels of 2006-07 which were 23 percent higher than current levels. Salt loads over the border into South Australia have increased by about 44 000 tonnes or 38 percent from 2007-08 and are 25 percent higher than 2006-07.

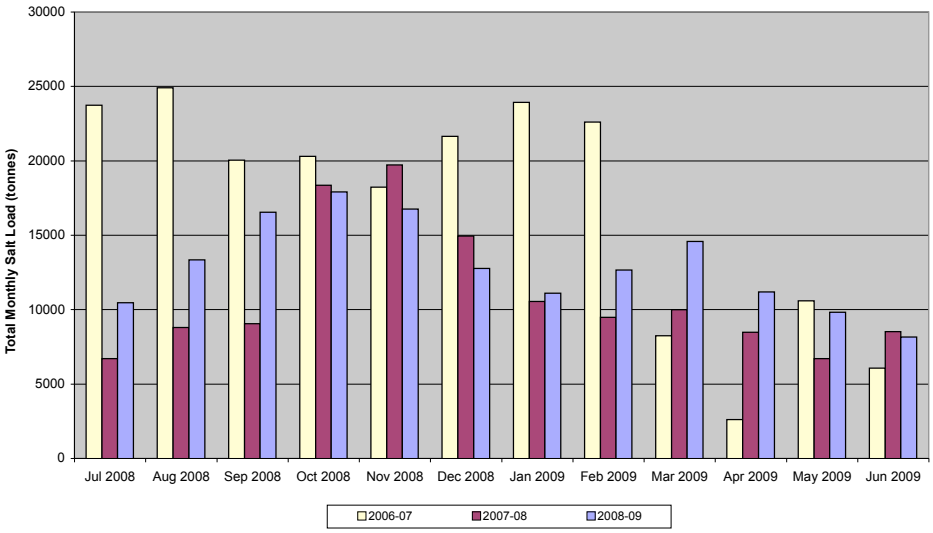


Figure 4: Total salt load at Morgan 2006-07, 2007-08 and 2008-09

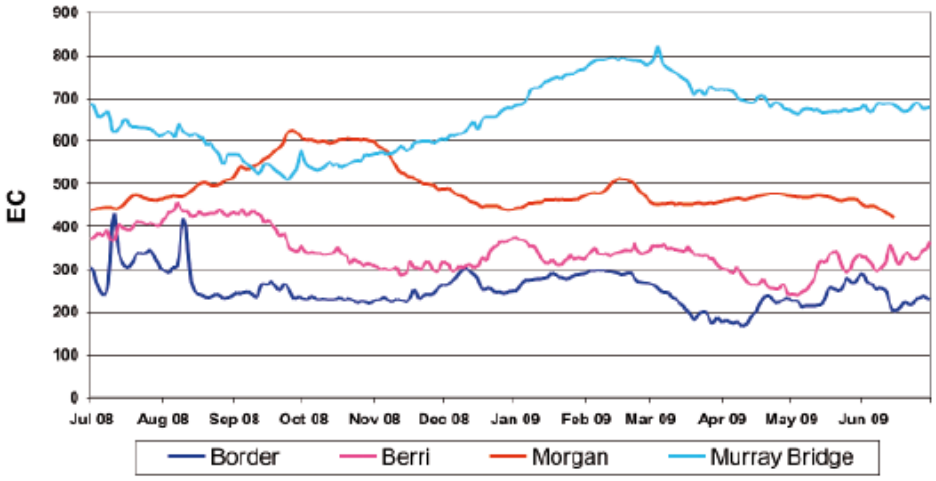


Figure 5: EC in South Australia during 2008-09

ACOUSTIC FLOW MEASUREMENTS

Another year of low flows in the River Murray has highlighted the importance of Acoustic Doppler Current Profiler (ADCP) technology. This instrumentation is the only technology that can accurately measure low water velocities. The past year has shown a large increase in the number of gaugings performed. A project was initiated in 2007-08 to verify the flows over each lock in South Australia with monthly ADCP gaugings, and was followed up by 3-monthly gauging of each lock in 2008-09. The measurements at Lock 1 are being used for salinity modeling for the lower reach of the river.

Again in 2008-09, very low water velocities and weed growth in the acoustic path, along with operational changes in the Chowilla Anabranch, have resulted in degraded data from the eight acoustic "side-looker" (SL) sites. However, the main site (A4261091), where Chowilla Creek flows into the River Murray, continues to operate well.

An SL site was established in 2008-09 in Rufus River to measure the outflow from Lake Victoria. This site has provided continuous flow data since installation, enhancing the daily rated flow calculation.

A new SL site at Morgan (Figure 6) was established in 2008-09 to enhance salt load calculations at that location, and will be calibrated over the next 12 months to better understand flow patterns within that reach of the river. Calibrations will continue in the long-term as different flow conditions are encountered. This site has already shown the occurrence of negative (ie upstream) flows under strong southerly wind conditions.

Telemetry at Chowilla, Rufus River and Morgan continuous flow sites enable river operators to have access to this data via a web-based display on a daily basis.

Figure 6: A4261110, continuous flow site at Morgan

SALT LOAD INVESTIGATIONS

Numerous surveys were conducted in 2008-09 to investigate the accession of salt loads to the River Murray in South Australia. The surveys include:

- close interval EC surveys, which generate 3D salinity mapping and cross-sections, have been carried out at Bookpurnong Cliffs, Overland Corner area, Loxton SIS reach, and at Toolunka reach near Waikerie;
- surface salinity mapping surveys have been carried out in the Lower Lakes and from Lock 1 to Murray Bridge ;
- the 18th large scale Run of River survey was conducted from Lock 6 to downstream of Lock 1; and
- nanotem surveys from downstream of Lock 2 to Berri.

Close Interval EC Surveys – Bookpurnong Irrigation Area

The Bookpurnong salinity mapping delineated a small zone of very high EC (90 000+) accessions, possibly upwelling from a lower aquifer (Figure 7). Subsequently, deep hole sampling was undertaken for chemical and ion analysis. The mapping clearly showed the large mixing zone downstream of the accession as the denser saline water flowed under the main river flow.

Importantly, the mapping also showed a large temperature gradient in the high EC water, with temperatures up to 5^{0}C higher than the background river water. These elevated temperatures and the large mixing zone downstream of the deep hole indicate the accession is very active. The sample analysis indicates the accessions are from the Lower Bookpurnong beds, a highly transmissive aquifer with salinities in the 80 000 – 90 000 EC range.

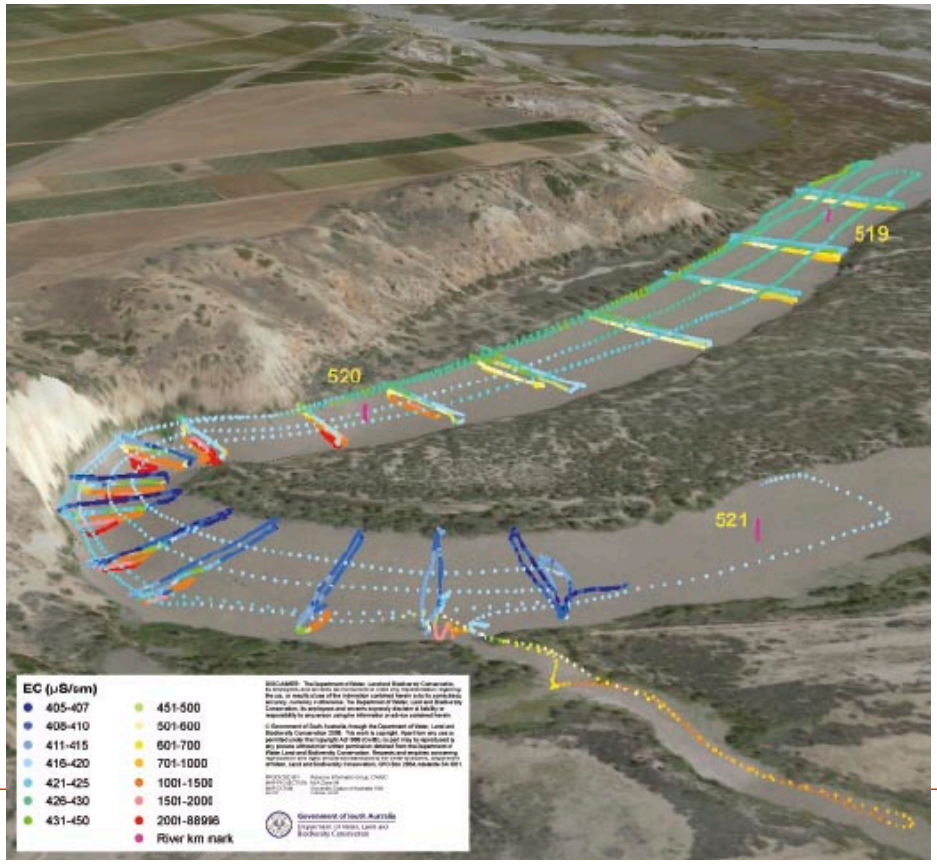


Figure 7: 3D EC mapping at Bookpurnong Cliffs, looking downstream

Close Interval EC Surveys – Overland Corner

At Overland Corner, previous EC cross-sections performed while Banrock Lagoon was dry showed only minor accessions. The latest salinity mapping performed since the lagoon was refilled as part of the wetting/drying cycle shows significant localised areas of accessions along the deeper sections of the Banrock bank. Refer to Figure 8.

Salt Load Investigations – Loxton Irrigation Area

During February 2008, three cross-sectional salinity and velocity surveys (A, B and C) were undertaken at Loxton between river kilometres 495 and 492. The data was captured at various depths to ensure adequate representation of the variation in salinity and velocity within the cross-sections. The objective of the surveys was to use the data to quantify the salt load to be offset by the Loxton Salt Interception Scheme, which is entering the river from the Loxton Irrigation Area (Figure 9).

GIS techniques were used to analyse the salinity and velocity data at each cross-section and estimating the salt load within the river reaches AB and BC. In the analysis, the effect of the irrigation extraction, which is located approximately 200 metres upstream of cross-section B, was taken into account.

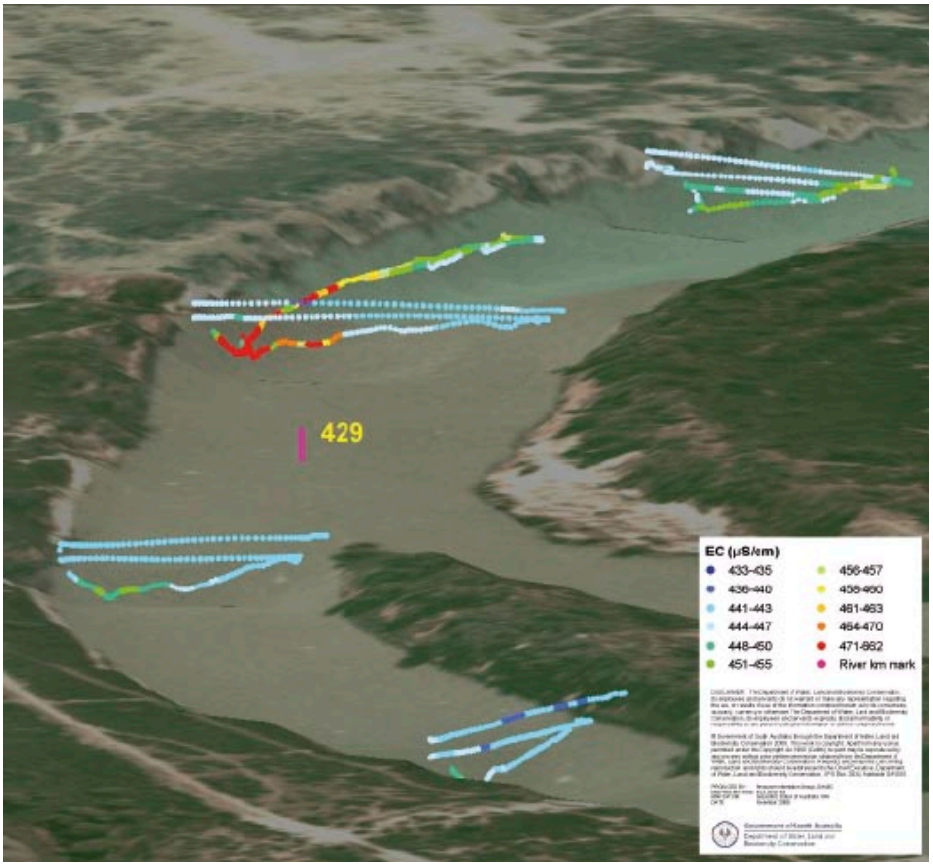


Figure 8: 3D EC mapping at Overland Corner, looking downstream

The results of the GIS analysis were compared with the numerical groundwater model results and showed good agreement with the numerical results especially for the river reach between sections B and C. Due to the uncertainty related to the estimation of the irrigation extraction, the results of the two methods were not compared for the river reach AB.

The analysis results indicate that the Loxton Irrigation Area would appear to be contributing 13 tonnes/day of salt to the river between Sections B and C.

This preliminary study suggests that additional cross-sectional salinity and velocity data (one upstream and downstream of the pump station) are required in order to assess the impact of the pumping activities occurring just upstream of Section B.

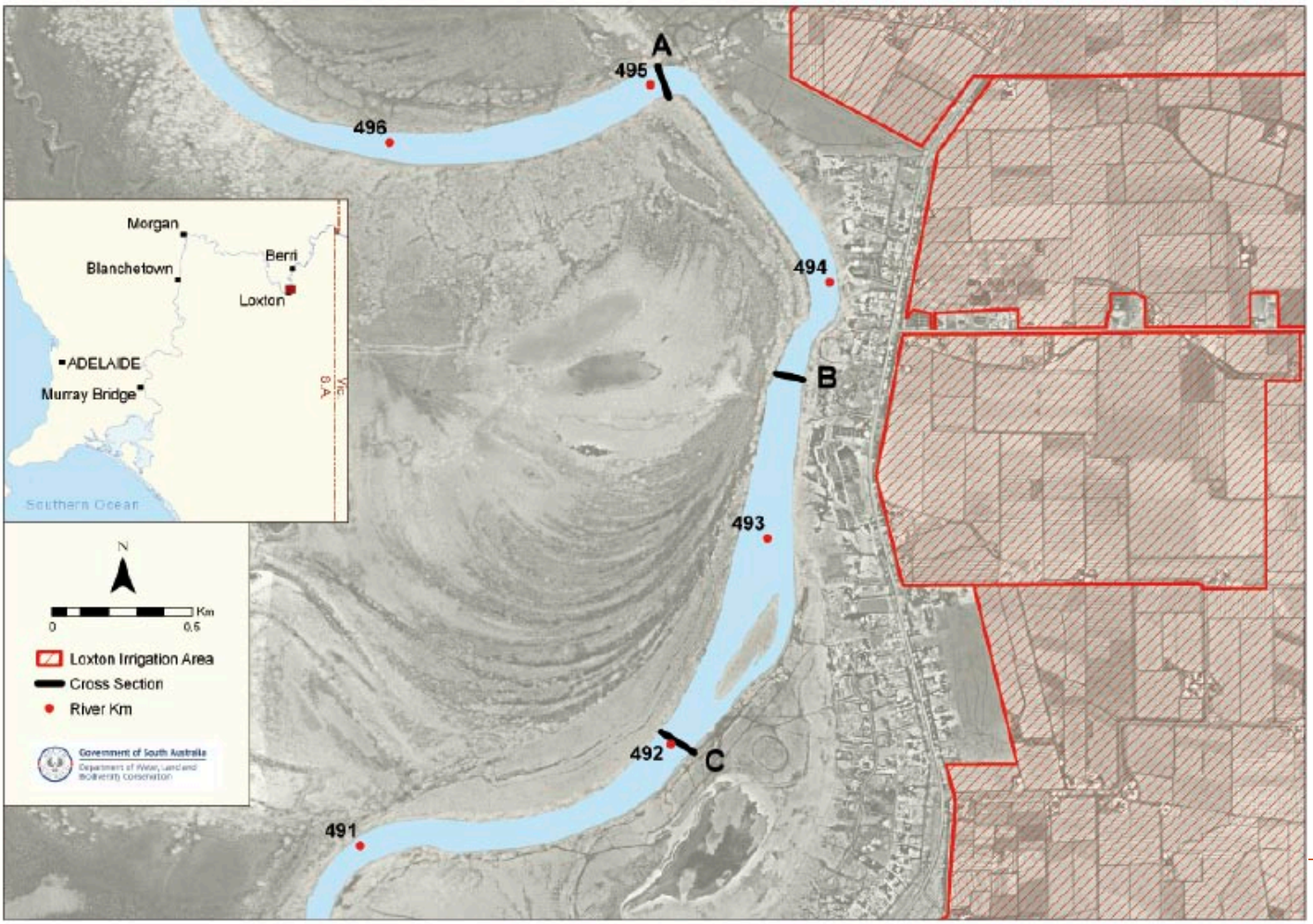


Figure 9: Location of cross sections A, B and C and the Loxton Irrigation Area

It is also recommended that detailed investigation be carried out to address the following issues:

- the impact of the Loxton Irrigation Area on the salt load accessions; and
- the effectiveness of the existing salt interception schemes.

The construction phase of the Loxton Salt Interception Scheme (highland component) is expected to be completed by the end of the 2009-10 financial year. Any further salinity monitoring or data collection will be carried out within this timeframe.

Surface Salinity Mapping – Lower Lakes

Tracking of salinity around the shores of the Lower Lakes has continued monthly and indicates the spread of salt water from the barrages into the lake system and the evaporative concentration effect of salinity in the lower lakes (Figure 10).

Figure 10: Track of surface salinity around the navigable edge of the Lower Lakes, June 2009 (imagery 2004)

Salt Load Investigations - Lock 1 to Murray Bridge

In January and April 2008, in stream salinity data was captured at 160 cross sections, approximately 1km apart, from Lock 1 to Murray Bridge (see sample at Figure 11). The objective of the two rounds of data collection was to use this and gauging station salinity information to approximate the salt load within the reach and to identify salinity hotspots.

Unlike upstream reaches, the speed of flows between Lock 1 and Murray Bridge is quite slow, making it difficult to track salt spikes or measure the velocity of the waters using ADCP technologies.

Further salinity surveys were conducted at weekly intervals between Swan Reach and Mannum in February 2009, with the results to provide more detailed information of salinity spike progression and travel speeds. The results of the analysis are to be compared with the numerical groundwater model results, to improve the understanding of groundwater and surface water interaction.

Run of River Salinity Survey

Run of River salinity surveys were conducted in April 2009 before river flows dropped too low to provide meaningful travel times for salt load calculations. This year was the 18th large-scale Run of River survey of salt accessions to the River Murray since 1985 and has delineated similar salt accessions to the 2008 survey.

The 2009 survey was conducted from Lock 6, (river distance 620 km) downstream to Lock 1 (river distance 274 km) over a 2 week period. Salt accessions from upstream of Lock 6 have been minimal for several years; hence the survey distance was reduced to start at Lock 6.

Between Lock 6 and Lock 1 salt accessions of 295 tonnes per day were calculated from data from the 2009 survey (Figure 12). This was again substantially lower than the 465 tonnes per day in 2006 and slightly higher than the 2008 survey (245 tonnes per day).

Larger accessions delineated include Chowilla, Block A and B near Renmark, Pike River, Loxton and the Sunlands-Qualco area.

With the current drought conditions and no over-bank flows, wetlands and river floodplains continued to contribute very low salt loads to the river.

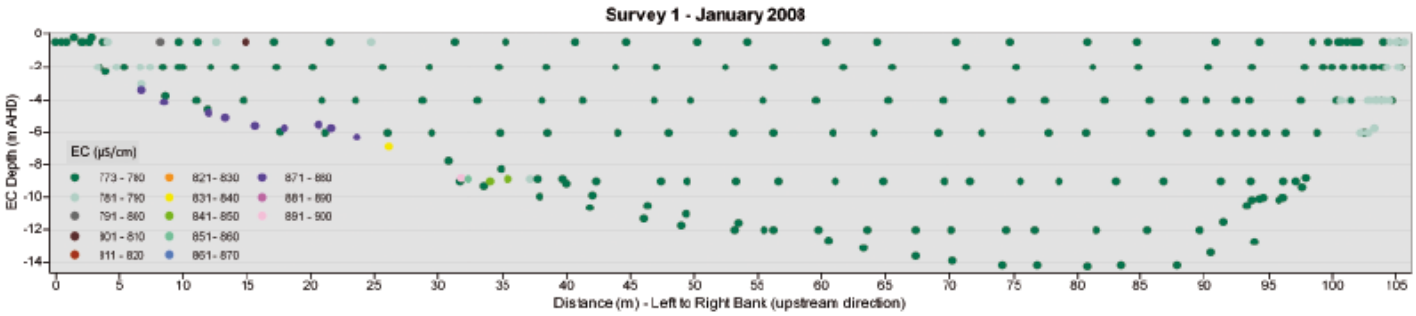


Figure 11: Cross section at kilometre marker 193 (halfway between Swan Reach and Mannum), January 2008

Bookpurnong, Woolpunda and Waikerie reaches had minimal salt accessions reinforcing the effectiveness of the salt interception schemes at these locations.

Smaller, but significant, accessions were noted at Murtho, Berri, Banrock and Murbko.

A Run of River salinity survey was also conducted from Swan Reach to Murray Bridge in February 2009 to attempt to delineate salinity accessions in this lower reach as water levels drop to under –1.0m AHD

During the commissioning of the Loxton SIS pumping bores, Run of River Salinity Surveys were being conducted every 3 months from Lock 4 to Pyap. This survey is delineating the changes in accessions of the Loxton Reach during the SIS startup phase (Figure 13). Total accessions of the Loxton reach have decreased from 64 tonnes in August 2007 to 21.8 tonnes in June 2009.

Similarly, a Run of River survey was conducted in February 2009 to provide a detailed base load of accessions prior to the startup of the new Waikerie - Lock 2 SIS bores. A similar survey will be done in September 2009, after the pump commissioning.

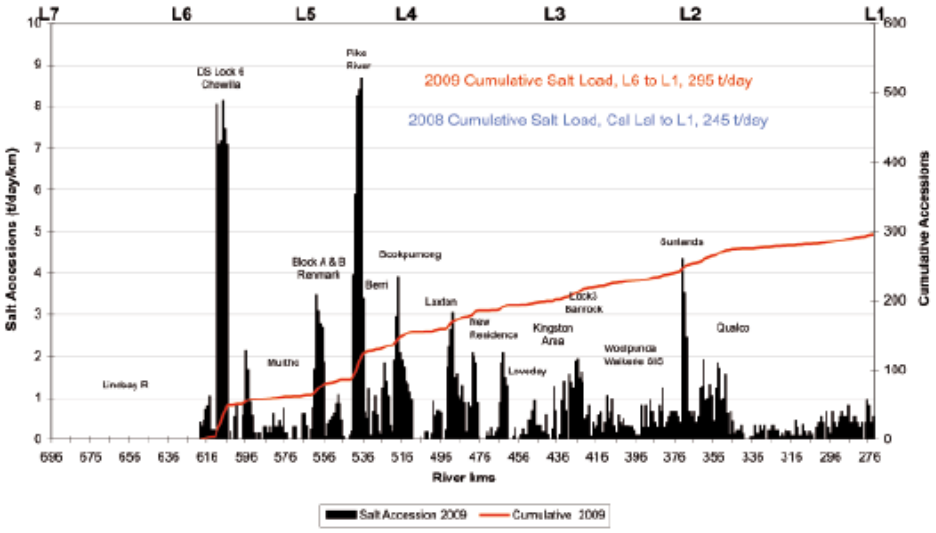


Figure 12: Run of River salinity accessions, Lock 6 to Lock 1, April 2009

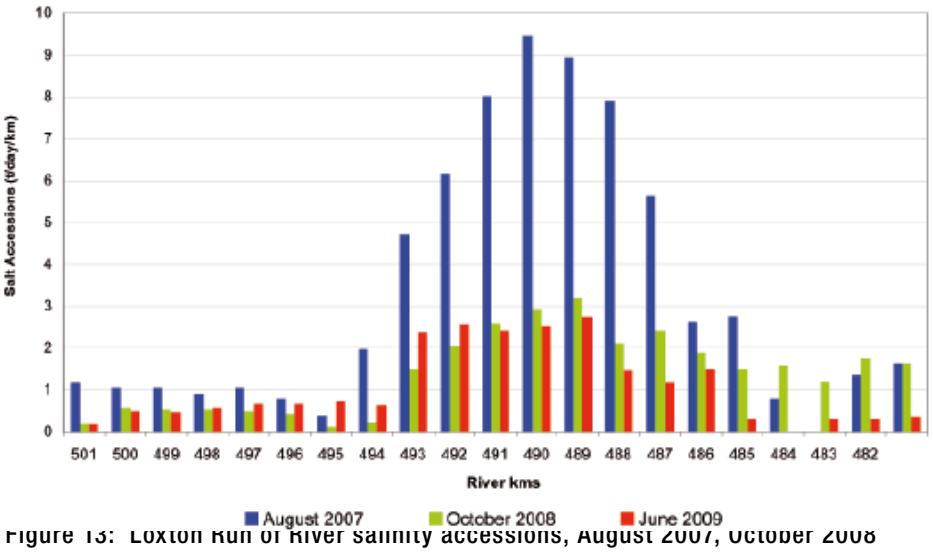


Figure 13: Loxton Run of River salinity accessions, August 2007, October 2008 and June 2009

NanoTEM Survey

Three major NanoTEM surveys have been conducted in previous years to obtain baseline information from Lock 1 to upstream of Mildura (2004), Wellington to Lock 1 (2005) and from Wentworth to Echuca (2006). Other smaller surveys have been taken, both repeating sites (eg Loxton to Bookpurnong) and in anabranches (Pike River, Lindsay River).

The technique is very effective in providing a detailed picture of the electrical properties of the subsurface. Through detailed analysis of the results, including in-stream coring and analysis of material and porewater electrical properties, it has been demonstrated that the NanoTEM signal is a good indicator of groundwater-river interaction. Where the river loses water to the floodplain, fresh water in the sediments gives a very resistive signal. Where saline groundwater is discharging into the river, the signal is very conductive. Therefore the technique provides a good indicator of where gaining and losing reaches of the river occur. Repeat runs over the same reach of river have demonstrated that the results are very repeatable where conditions haven't changed.

Based on these observations, in June 2009 a new NanoTEM survey has been undertaken from the downstream end of the Lock 2 SIS (Hogwash Bend, west of Waikerie) to Berri.

The work was undertaken by the River Murray Operations Unit (SA Water) on behalf of the MDBA. As for previous surveys, the geophysics data has been collected by Zonge Engineering utilising the DWLBC Berri Hydrometric Services Unit for data capture, with data interpretation by Australian Water Environments.

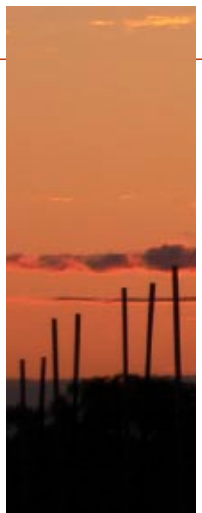
The aims of the survey are to:

1. collect baseline information before implementation of the Waikerie Lock 2 SIS;
2. collect new information through Waikerie and Woolpunda five years after the previous survey, and compare changes in riverbed resistivity with changes in irrigation and SIS operation in adjacent reaches;
3. review results through the Lock 3 to Loxton reach where no SIS has been operational but the impacts of drought should be more evident with larger losing reaches;
4. provide information on the performance of the Loxton and Bookpurnong SIS, which have been implemented since the 2004 survey; and
5. investigate evidence of a small point source salt load at Berri.

The project is well advanced, with data collection and data manipulation complete. Results are expected in October 2009.

RIVERLAND WATERTABLE TIME SERIES MAPS

A time series of watertable elevation maps have been prepared for the Riverland area using observed data from existing monitoring networks and extrapolations back in time to pre-European levels. This has allowed the growth over time in the watertable mounds beneath highland irrigation areas to be observed and the volume of groundwater stored in them to be calculated. Figure 14 shows the pre-European watertable contours while Figure 15 shows the 2005 watertable contours together with irrigated area extent in green. The formation of the watertable mounds beneath Loxton, Berri-Barmera, Waikerie and Sunlands irrigation areas can be clearly seen.



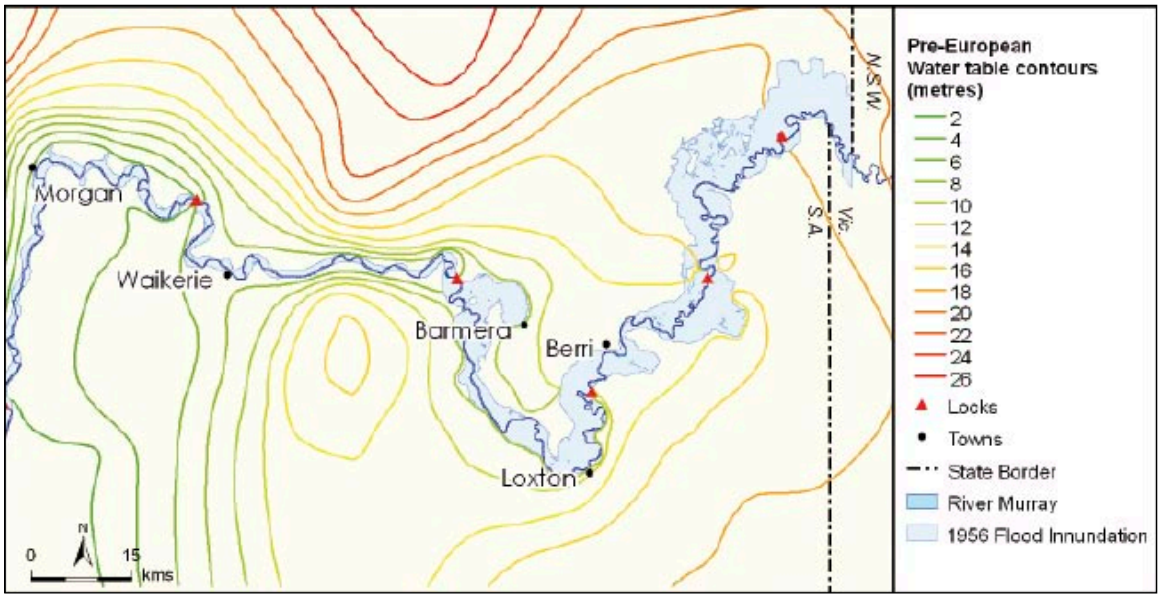


Figure 14: Pre-European water table contours

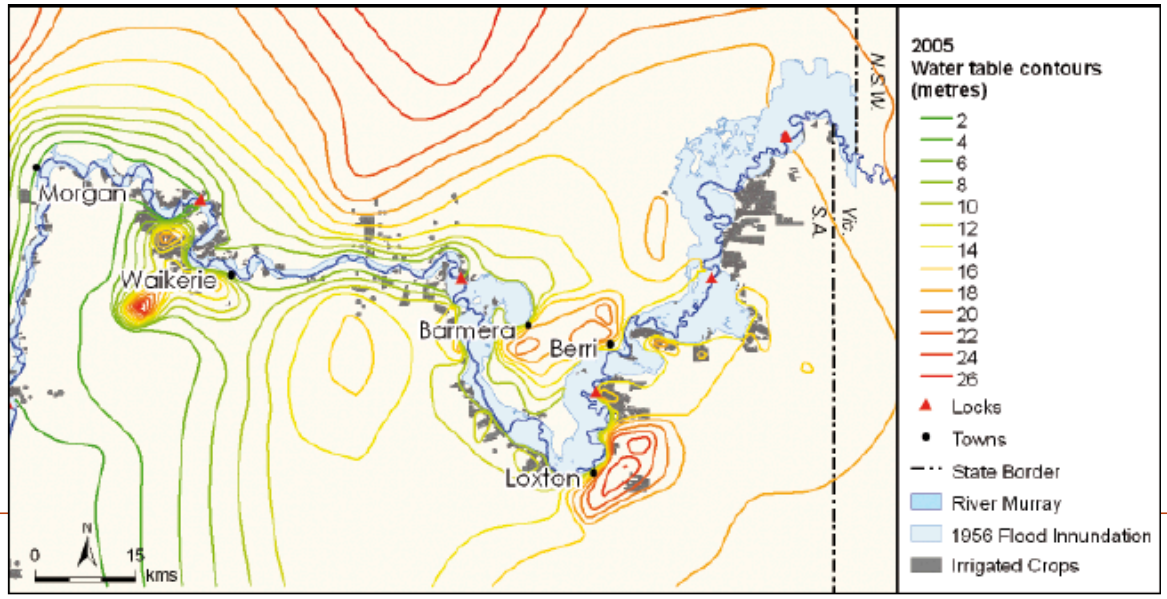


Figure 15: 2005 Water table contours and irrigation areas

The graph at Figure 16 shows the steady rise in the volume of groundwater stored in these watertable mounds up to a maximum of about 570 GL in 2000. The decrease in 2005 is due to improved irrigation practices and rehabilitation of water distribution networks which is reflected in widespread falls in water levels in the observation networks. This decrease pre-dates the effects of the current drought that should be apparent in the 2010 dataset which will appear in the next annual report.

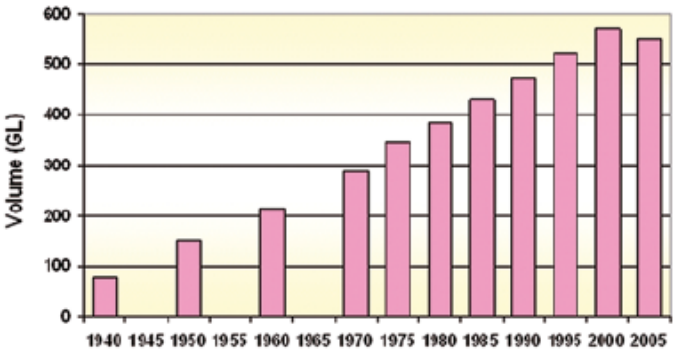


Figure 16: Estimated volumes stored in groundwater mounds

DRYLAND SALINITY

The depth to groundwater is used as a key indicator in land salinity monitoring, and for determining the level of salinity risk threatening valuable natural resources and man-made assets. Observation well data stored in the DWLBC database relevant to dryland salinity areas in the major dryland agricultural regions of South Australia has been analysed to determine apparent long-term trends in depth to groundwater (Dooley, Henschke and Wright, 2009). Where available, reliable groundwater data spanning three decades, from the mid 1980s to the present, has been used.

Results from analysis of depth to groundwater trends for selected wells in the combined regions are given in Table 1 and Figure 17.

Table 1: Summary of groundwater trends for the combined SA MDB and South East regions

Monitoring period	No. of bores	Percentage of bores		
		Rising	Falling	Stable
1986 - 1990	14	50	0	50
1990 - 2000	55	20	18	62
2000 - 2008	55	9	60	32

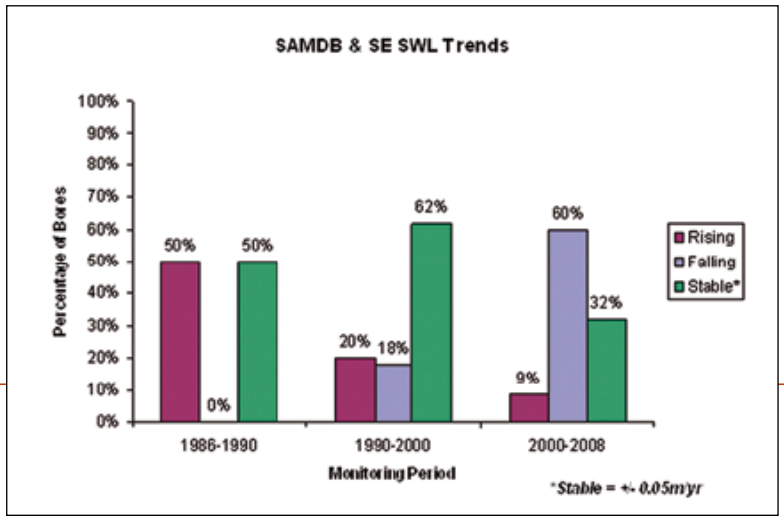


Figure 17: Groundwater trends in the combined SA MDB and South East regions

A steady decrease over time in the in the number of wells with a rising trend is evident. The location of wells used in the trend analysis for the SA MDB and South East regions is shown in Figure 18, along with a spatial representation of the changing trends over time.

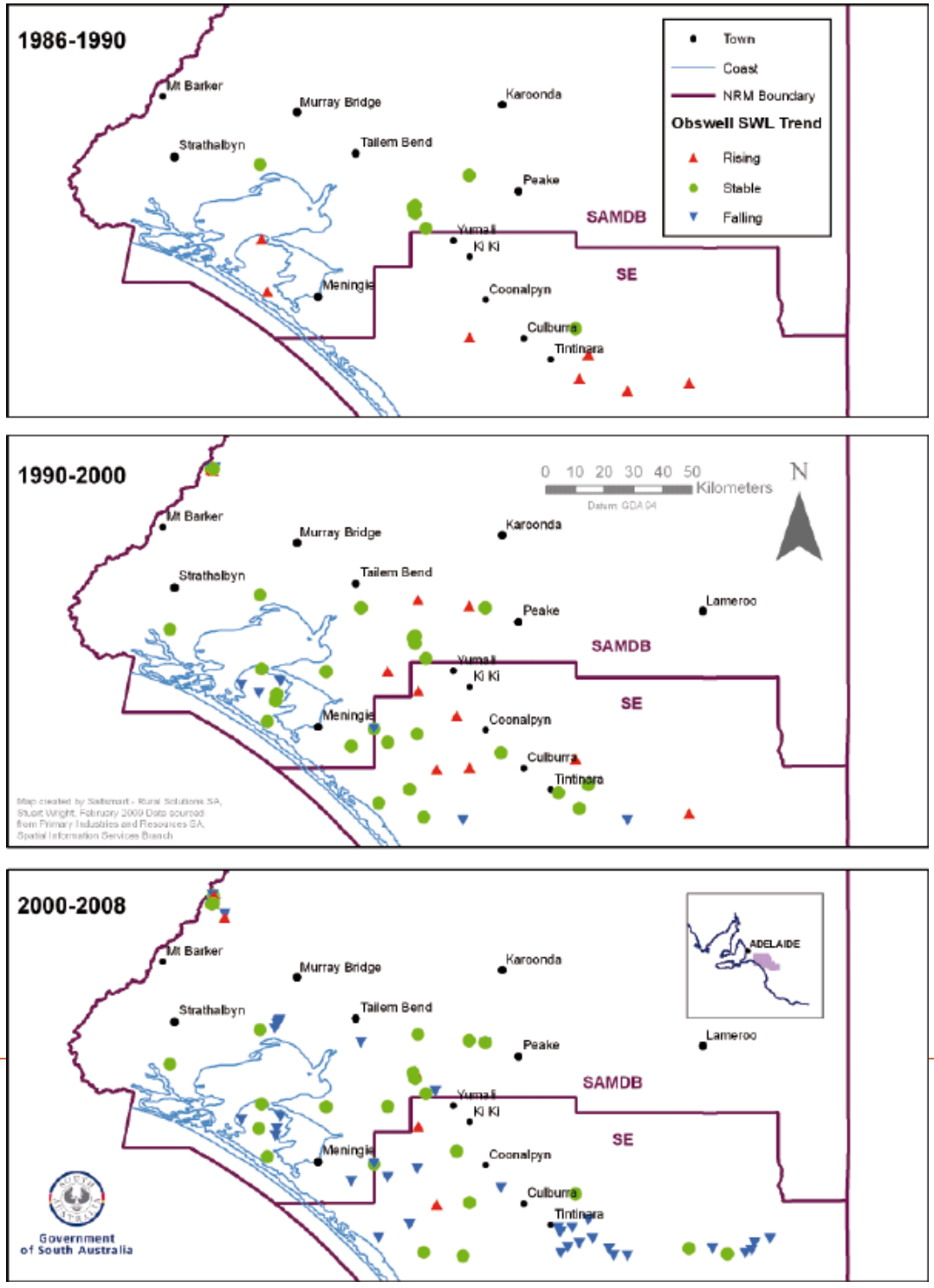


Figure 18: Comparison of combined SA MDB and South East groundwater trends over three decades

UNDERSTANDING SURFACE WATER – GROUND WATER INTERACTIONS TO HELP MANAGE WETLANDS

Before river regulation, the wetlands of the lower River Murray experienced seasonal wetting and drying cycles. This provided an environment that supported a diverse range of plant and animal life. However, many of these wetlands are now permanently inundated and have an increased salt concentration which is detrimentally affecting species diversity.

Wetland managers are attempting to rehabilitate these wetlands, re-introducing cycles of wet and dry spells to return the wetlands to a more natural state. However, many managers are changing the hydrology of the wetlands with a lack of scientific knowledge about the consequences of these changes.

By investigating the interactions between surface water and ground water of three wetlands of the lower River Murray, Water for a Healthy Country scientists (along with contributors from the SA MDB NRM Board and Flinders University) are increasing understanding and helping wetland managers to make informed decisions on the management regimes of wetlands in this region.

The three wetlands considered in this study had very different hydrological regimes:

1) Lake Littra has no connection to the river and relies upon flooding to provide a supply of surface water;

2) Hart Lagoon has a permanent connection to the river through a single inlet/outlet, while a second inlet allows surface water flows through the wetland during floods; and

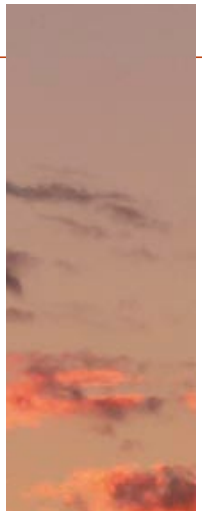
3) Banrock Station wetland has two permanent connections to the river on either side of a lock, this results in a 3 metre difference in river levels between the inlet and outlet and ensures that there is a significant flow of surface water through the wetland.

At all three wetlands electromagnetic surveys were performed to determine areas that were more conductive (these are the areas more likely to be storing salt in the sediments). Surface water levels were also measured and piezometers were used to record groundwater levels. Ground and surface water samples were collected and analysed for anions, cations and stable isotopes of water. Soil samples were analysed for gravimetric water content, chloride concentration and stable isotopes of water. This data was collected from June 2006 through to September 2007.

Analysis of the data showed that when the wetlands were full, Lake Littra and Banrock Station wetland function as recharge wetlands (ie surface water was recharging the groundwater) while Hart Lagoon acts as a flow-through wetland (ie the groundwater discharges to the wetland, and the surface water in the wetland also recharges the groundwater depending upon the location in the wetland).

The study found that when the surface water was removed from each of the wetlands they all behave similarly. In the recharge wetlands groundwater flow was reversed so that it was no longer flowing away from the wetlands but towards them. The flow-through wetland had a similar result in that the gradient of the water flow flattened so that water was not flowing away from the wetland. In all three cases without surface water the wetlands became groundwater discharge features on the floodplain. Being the lowest point of the floodplain, groundwater flowed toward the wetland where it was evaporated, resulting in salt concentration. This shows that removing surface water from wetlands (such as through disconnection from the River Murray) will lead to salinisation.

If the wetlands on the floodplains have their surface water connection to the River Murray severed and forced into a dry spell, the groundwater flow direction will reverse causing the wetlands to act as groundwater discharge features which would lead to salinisation.



Using this knowledge, wetland managers will be better equipped to develop rehabilitation plans that incorporate the risk of salinisation in controlled wetting and drying.

MAJOR MONITORING, EVALUATION, REPORTING AND IMPROVEMENT ACHIEVEMENTS

Regional NRM Plan Monitoring and Evaluation Framework

The first comprehensive Regional NRM Plan (the Plan) for the South Australian Murray-Darling Basin Natural Resources Management Region was launched by the South Australian Minister for the River Murray, the Honourable Karlene Maywald in June 2009 (Figure 19). The Regional NRM Plan is a major step towards fully integrating the management of all natural resources in the Region.

The Plan outlines the desired outcomes for the key natural resource assets of the region, ie people, water, biodiversity, land and atmosphere. The Plan also details long-term (Resource Condition) and intermediate term (Management Action) targets.

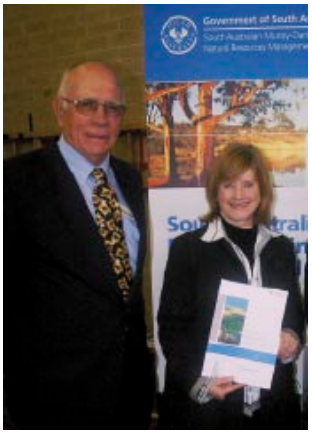


Figure 19:
Presiding Member for the South Australia MDB NRM Board, Mr Bill Paterson, and the Minister for the River Murray, the Honourable Karlene Maywald, at the Regional NRM Plan launch

The participatory processes used to develop the logic of the Plan and set targets are one of the major achievements in the development of the Plan. The result is a more consolidated set of targets over previous plans and there is a clearer distinction and relationship between the long-term and intermediate targets. These target improvements will provide for a much stronger foundation for associated Monitoring, Evaluation, Reporting and Improvement (MERI) activities.

The Plan outlines a number of Resource Condition (RCT) and Management Action (MAT) targets for water, including several related to river salinity. These are shown in Figure 20. Under these targets, numerous actions are detailed which will contribute to achieving the changes expressed in the targets.

The Plan provides a strategic framework for MERI activities and further development of a MERI Implementation plan is under way and will be completed in 2009.

The MERI plan will place a strong emphasis on identifying key evaluation questions of major stakeholders and involving them in evaluative and reporting processes to help ensure that MERI tools and activities are focussed on supporting decision making and continuous improvement.

The MERI Plan will be structured to focus on three distinct levels:

- MERI at the Plan level
- MERI at the Target level
- MERI at the Action (project) level

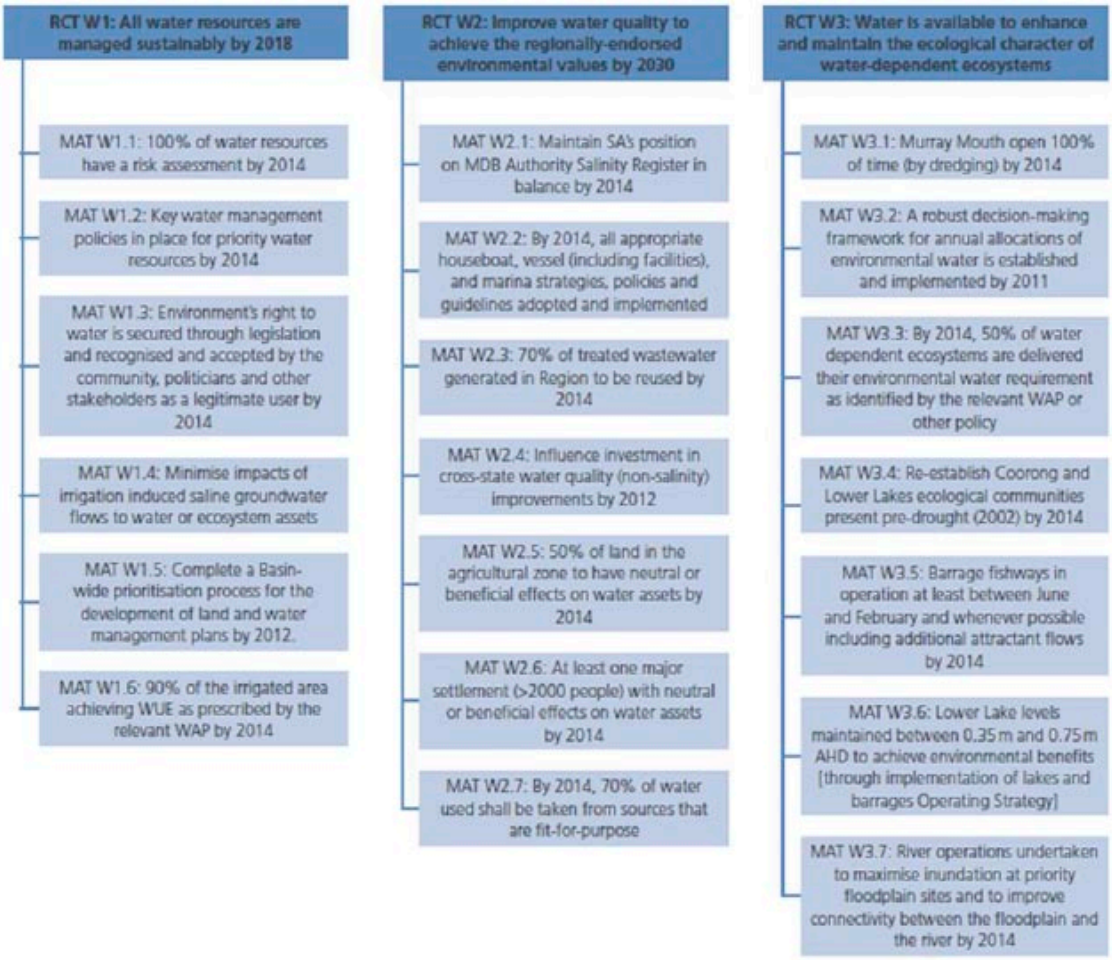


Figure 20: Water asset targets from the Regional NRM Plan

The current MERI plan will build on previous plans and recent evaluation learning activities such as the Performance Story Report that was undertaken in 2009 in the South Australia MDB NRM region in conjunction with the Australian Government. The Performance Story Report is a form of outcome reporting and contribution analysis and has been a beneficial process to understand how multiple lines of evidence can be collated, interpreted and presented.

In 2009, the SA MDB NRM Board will hold a series of 'Reflection and Learning Workshops', which is a key MERI process as part of the grants funding scheme. Individuals and groups undertaking similar projects will be brought together to generate, share and document outcomes, challenges and learnings, which will help inform future project design, funding applications and broader MERI development and improvement.

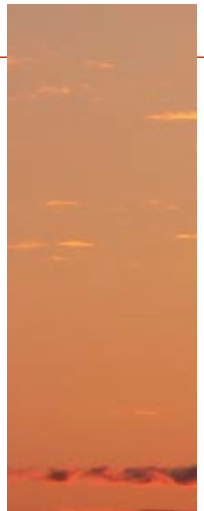
COMMUNITY STREAM SAMPLING

The Community Stream Sampling and Salinity Mapping (CSSSM) project supported communities within the SA MDB region by providing the means to identify areas within catchments that are at risk from salinity. The project concluded in 2008.

The information obtained has been used by groups to better understand their local water resources. In addition, the CSSSM local-scale monitoring can be used to enhance the regional picture. A broad summary was published in the SA MDB NRM Board's State of the Region Report, along with the following graph (Figure 21) that shows an EC comparison between March 2007 and March 2008 for selected CSSSM surface water sites within the SA MDB NRM Board's region.

An evaluation of SA MDB CSSSM projects was undertaken demonstrating the outcomes and benefits of the projects using an "adaptive performance story" evaluation methodology.

A results chart captures the quantitative data and this complements the qualitative insights provided in the stories. These are combined with other information and analysis to evaluate outcomes and generate recommendations. The evaluation technique used is a new way of demonstrating outcomes of projects that then feeds into a process of monitoring, evaluation, reporting and improvement. The evaluation not only indicates project successes measured against the expected outcomes, but will highlight outcomes that were not anticipated at project initiation.



This outcome reporting approach provides an opportunity to promote continuous improvement of the planning and implementation of NRM activities and communicate the value of the project.

The evaluation generated 12 recommendations using a multi-method, adapted 'performance story reporting' (PSR) approach. PSR is being promoted by the Australian Government as a key method in 'reporting by outcomes'.

The CSSSM Projects contributed to numerous Board programs such as Water and Salinity Policy, Land & Water Management, Wetland Management, Biodiversity Protection and Enhancement, Fostering Community Engagement and Monitoring and Evaluation.

Recommendations have now been built into an ongoing board funded community stream sampling project, building on past experiences.

Promotion of community monitoring in an expanded form is continuing through presentations, website updates and community workshops to be delivered over 2009-10.

The Evaluation report on the CSSSM Project can be downloaded from community monitoring page at www.samdbnrm.sa.gov.au.

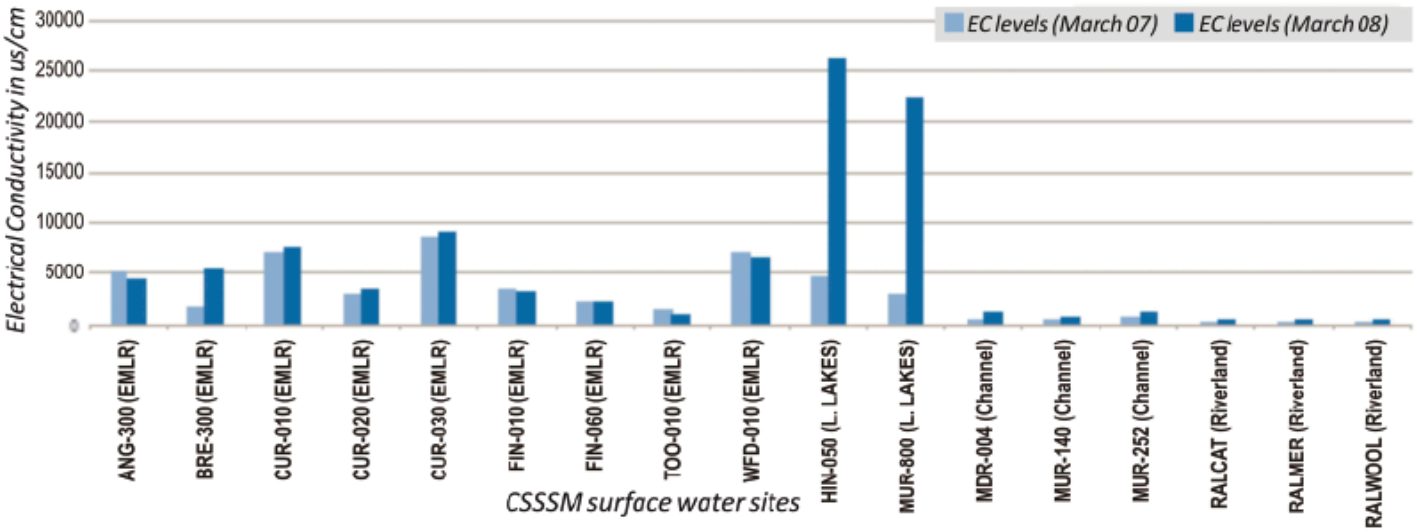
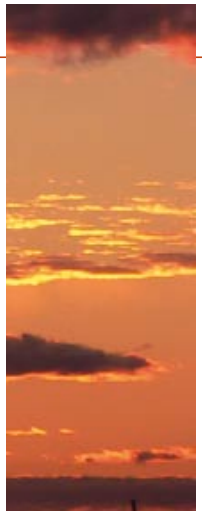


Figure 21: EC comparison between selected CSSSM surface water sites within the SA MDB NRM Board region



1.4 Managing trade-offs

MURRAY FUTURES RIVERINE RECOVERY PROJECT

Murray Futures Riverine Recovery Project is focused on wetlands and floodplains and was previously known as the "Wetlands and Pump Relocation Project". The project concept is to remove irrigators' dependency on the wetlands by relocating their pumps from the wetlands to the main channel of the river and reintroduce a more natural wetting and drying cycles into the River Murray wetlands. Appropriate and targeted wetting and drying of the wetlands will result in better ecological health and water use efficiency.

Along the River Murray in South Australia there are 1 100 wetlands in 250 wetland complexes, nine significant floodplains and several backwaters. These wetlands and floodplains are currently degraded primarily due to impacts of river regulation and low frequency of high flows. The permanent inundation of wetlands and lack of high flows for the floodplains since river regulation has interrupted the natural vegetation regeneration cycles which has lead to a reduction in flora and degraded fauna habitats.

In January 2009, the Commonwealth Government endorsed the Riverine Recovery Project Stage 1 business case. The project will establish a set of regional goals and scalable targets for the management of wetlands and floodplains. It will relocate pumps from selected wetlands and establish an adaptive management system to improve ecology and save water. The adaptive management system will protect "river health" by identifying and protecting the key elements of the river environment during dry years and wet years.

The project will be delivered in three stages over a ten year period. The first stage, approximately 18 months, is predominantly planning activities. However, the first stage will also implement a number of on-ground work packages.

The planning stage will develop six significant plans, as the framework within which the rest of the project will be implemented.

Activities and Status

The project business case was completed in late 2008. A project management team has been established to oversee the development of plans and on-ground works. A funding deed between the State and Commonwealth has been completed. The planning process is underway and includes the activities shown in Table 2.

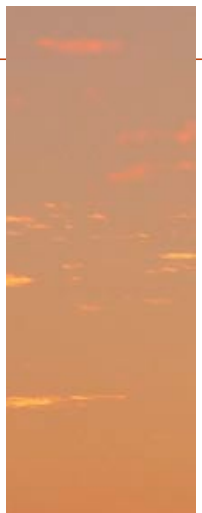
Although substantial progress have been made, the overall planning process and the implementation of on ground works package are about three months behind schedule due to unexpected delays, further discussions and fine-tuning the project concepts. Table 3 shows the approximate dates for completion of the on-ground works package.

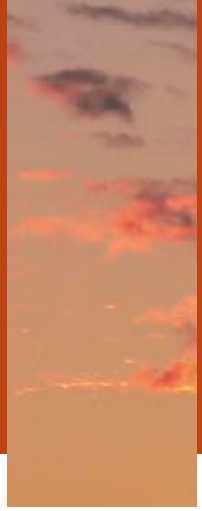
Table 2: Status of key activities

Key Activities	Original Completion Date/ Status	Revised Completion Date
Completion of the Project Business Case (start up)	Dec 2008/Completed	N/A
Completion of Start up funding deed	Feb 2009/Completed	N/A
Scoping of major Plans (Goal Setting Plan, Operations Plan, Infrastructure Plan, Monitoring and Management Plan)	March 2009/Nearing completion	July 2009
First draft of the Plans and a draft Project business case and completion of the Project Management Plan	Nov 2009/Preparations underway	December 2009
Revised Plans and Project Business Case	Dec 2010/Not yet commenced	March 2010
Final Plans and Final Project Business Case for Second Stage of the Project	Jan 2010/Not yet commenced	May 2010
Consolidated Stage Completion Report	Feb 2010/Not yet commenced	June 2010

Table 3: On-ground work package component

Milestone	Completion Date/ Status	Revised Completion Date
1. Completion of on-ground work package business cases and approvals by the Commonwealth	March 2009/Delayed	October /November 2009
2. Commence implementation of on-ground work packages	April 2009/Delayed	November /December 2009
3. Complete implementation of on-ground work packages	Dec 2009	July 2010





1.5 Implementing plans

Salinity management in the SA MDB is recognised as a significant issue for the State as reflected in a range of strategic and management plans. These plans provide the framework to develop policy, identify priorities, implement projects, raise funds and integrate salinity management with other planning processes. In previous years an overview of the relevant plans and their relationship to salinity management has been provided. This year, progress on updates or changes to the relevant plans is reported.

SOUTH AUSTRALIA'S STRATEGIC PLAN

South Australia's Strategic Plan (SASP) was first released in 2004 and following review in 2006 was amended to provide a stronger commitment to sustainable development. The revised plan, released in January 2007, included four additional Attaining Sustainability targets including a River Murray salinity target - T3.11 *South Australia maintains a positive balance on the Murray-Darling Basin Authority salinity register.*

An implementation plan and fact sheet was finalised and released, as reported in 2007-08. The graph from this fact sheet was updated in 2008-09 (Figure 22) to reflect the approved 2008 Salinity Register and project the State's salinity credit balance over time.

The graph displays the State's declining register balance for three scenarios:

- No Action – the modelled prediction of register balance if none of the existing remedial actions had been taken
- Existing Remedial Actions – the current register balance and project future balance incorporating all remedial actions to date with no further irrigation development
- Future Proposed Actions – the indicative register balance with modelled projection of credits from proposed future remedial actions with no further irrigation development

The graph provides a forward estimate of the timeframe for the State's register balance to reach zero to inform future policy directions.

Fact sheets relating to SASP targets can be downloaded at: http://www.saplan.org.au/

OBJECTIVE 3: ATTAINING SUSTAINABILITY

WATER

T3.11 River Murray – salinity: South Australia maintains a positive balance on the Murray-Darling Basin Commission salinity register

KEY MEASURE

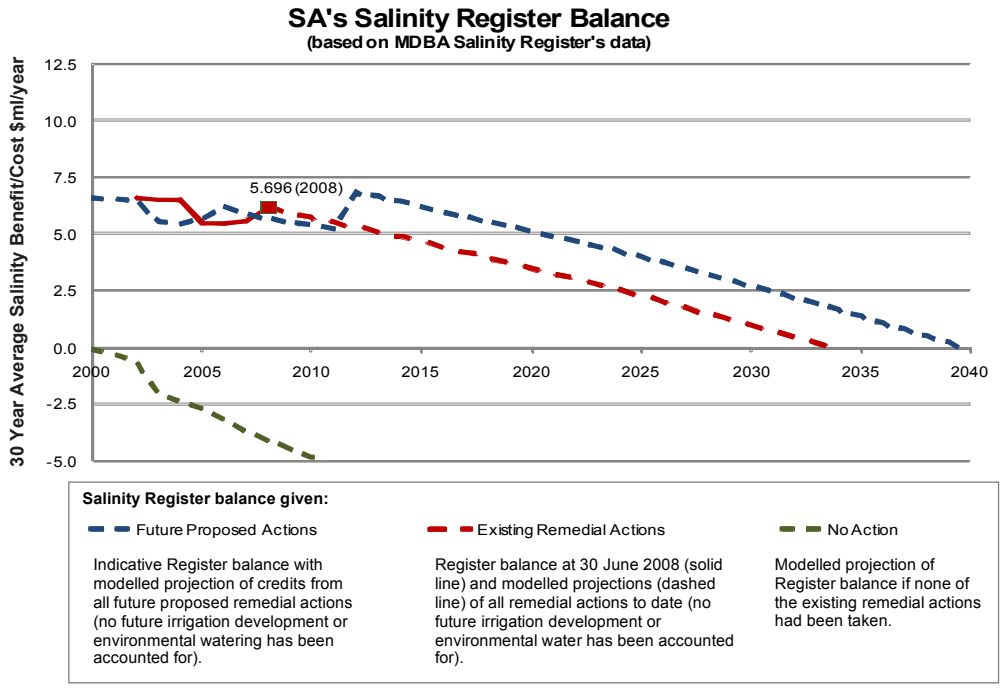
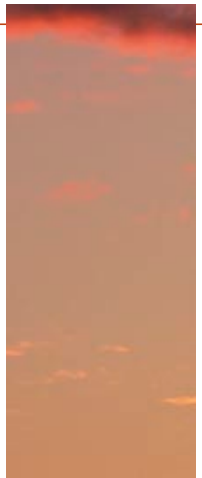


Figure 22: South Australia's Strategic Plan Target 3.11 Fact Sheet 2008-09



SOUTH AUSTRALIAN RIVER MURRAY SALINITY STRATEGY 2001 – 2015

The fifteen-year vision of this Strategy is to maintain salinity in the River Murray in South Australia at current levels (ie when the Strategy commenced). The long-term vision is to reverse the trend and restore a sustainable balance to ensure economic, social and environmental well being of current and future generations of South Australians.

The strategy is now somewhat dated. The 2007 audit of progress against the Strategy's 40 milestones found that 30 were complete, or were progressing to completion by 2010, with the remaining 10 milestones being progressed through other means or are no longer a priority.

While no commitment has been made at this point, it is anticipated that when the Basin Plan is released, the Strategy may be revised and updated to reflect current and future salinity management priorities.

SOUTH AUSTRALIAN MURRAY-DARLING BASIN NATURAL RESOURCE MANAGEMENT PLAN

As referred to in section 1.3 of this report, the Regional Natural Resources Management Plan (the Plan) for the SA MDB provides the strategic framework for regional NRM priorities and investments. The new Regional NRM Plan was adopted on the July 1, 2009 and includes a three year Business Plan. The Plan contains the goal "Water resources that are healthy, valued and supporting of communities and thriving ecosystems" and includes key targets associated with irrigation efficiency and salinity management.

The Resource Condition Targets include:

- W1: All water resources are managed sustainably by 2018
- W2: Improve water quality to achieve the regionally endorsed environmental values by 2030

In terms of the River Murray salinity management aspect of meeting these targets, a number of management action targets have been identified.

In regard to W1, these relate mainly to managing the salinity impacts of irrigation and include:

- W1.4 Minimise impacts of irrigation induced saline groundwater flows to water or ecosystem assets
- W1.5 Complete a Basin wide prioritisation process for the development of land and water management plans by 2012
- W1.6 90% of the irrigated area achieving Water Use Efficiency (WUE) as prescribed by the relevant WAP by 2014

Some of the more relevant programs relating to this target include those outlined in section 1.1 of this report.

In regard to W2 the key management action target is:

- W2.1 Maintain South Australia's position on MDB Authority Salinity Register in balance by 2014.

Delivery against this target relates to all salinity management activities identified in this report. Key actions that have assisted South Australia in maintaining its position on the Salinity Registers in balance to date include salt interception infrastructure and improvements in irrigation practices, including rehabilitation of irrigation infrastructure.

The Plan can be accessed at: www.samdbnrm.sa.gov.au/OurPlans/TheRegionalNRMPlan.aspx

Implementation of the Plan will certainly be challenging for the SA MDB NRM Board not only because of the continuing drought but also due to funding pressures that have arisen due to the changing priorities of Commonwealth Government NRM programs.

Significant achievements in regional and on-farm irrigation management practices and hence the health of the River Murray was generated through the multiple phases of the National Action Plan for Salinity and Water Quality and Natural Heritage Trust (NAP/NHT) funding programs. Unfortunately on-ground land and water management and irrigator capacity building activities are not a part of the Water for the Future program which will make it difficult to consolidate these previous achievements.

However, as far as possible the SA MDB NRM Board will continue to support irrigators with implementing sustainable land and water management planning projects in the coming years.

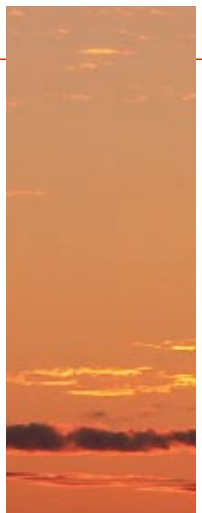
UNBUNDLING WATER RIGHTS

South Australia has commenced the unbundling of water rights by addressing the River Murray Prescribed Watercourse. The *Natural Resources Management (Water Resources and Other Matters) Amendment Act 2007* came into operation on 1 July 2009, together with a range of regulations that support a staged implementation of unbundled water rights across the State. The Water Allocation Plan for the River Murray Prescribed Watercourse (WAP) has been amended via a ministerial amendment, subject to section 89(2) of the *Natural Resources Management Act 2004* to support the unbundled water rights. All River Murray licensees have been notified that they will be issued with their four separate instruments (where appropriate) in August 2009. The four instruments are:

- Water Access Entitlement: this is the ongoing right to a specified share of the water resource;
- Water Allocation: the right to take a specific volume of water for a given period of time, not exceeding 12 months, based on the volume of water available for allocation in that period;
- Water Resource Works Approval: the permission to construct, operate and maintain works for the purpose of taking water at a particular location, in a particular manner; and
- Site Use Approval: the permission to use the water at a particular site in a particular manner.

The water licensing system has been upgraded to administer the unbundled water rights together with an update and review of operational procedures. There has been an extensive communication effort targeting key industry and stakeholder groups, local councils, brokers, banks and licensees.

From a salinity perspective, this means that the salinity impact assessments will shift from water trades to site use approvals from 2009-2010 onwards.



WATER ALLOCATION PLAN FOR THE RIVER MURRAY PRESCRIBED WATERCOURSE

The consultation on the Concept Statement for an amended Water Allocation Plan for the River Murray Prescribed Watercourse (WAP) was completed, but progress on developing the Plan was delayed as a result of the decision to undertake a ministerial amendment of the WAP. This amendment was required to facilitate an accelerated implementation of unbundling of water rights for the River Murray by mid 2009 as requested by the Commonwealth Government. In addition, consideration was given to the alignment of development of the comprehensively amended WAP and the Murray-Darling Basin Plan.

Following the completion of the Ministerial amendment of the WAP in July 2009, the SA MDB NRM Board and DWLBC are now finalising a project plan for the development of a comprehensively amended WAP, to be completed in 2011.

IMPLEMENTATION OF THE SALINITY ZONING POLICY

The Salinity Zoning Policy is implemented through the WAP and establishes the requirements to be fulfilled before approval is given to increase irrigation development in the low salinity impact zone, the high salinity impact (salt interception) zones and the high salinity impact zone. For a detailed summary of the policy please refer to South Australia's 2004-05 and 2005-06 Report to the BSMS.

Prior to 1 July 2009 permanent water trade was assessed for its salinity impact as a surrogate for new irrigation development. Following the unbundling of water rights in South Australia the trade of water allocation and entitlements is no longer linked to the location where the water will be applied. Accordingly, from 1 July 2009 the transfer of water will no longer be the trigger for salinity impact assessment, rather, the application for a new site use approval or to vary an existing site use approval will be the instrument that triggers assessment of salinity impact under the Salinity Zoning Policy.

South Australia will convert existing permanent water entitlement at 1 July 2009 to be the maximum annual volume to be applied for irrigation on the site use approval.

No salinity assessment will be performed on the transitional site use approvals as the salinity impact will have been accounted for as either legacy of history (crops pre 1988) or through the assessment of permanent water trade (1988-2009). Irrigators who have relied on temporary water trade in the past, and have therefore not been assessed for the long-term salinity impact of applying this water, will be transitioned to a site use approval based on their long-term entitlement and not on the maximum volume applied at the site. The irrigator will be required to apply for a variation to their site use approval, or for a new site use approval if no long-term entitlement was held, and undergo salinity assessment and credit allocation. It is anticipated that there will be a significant increase in the uptake of development credits during 2009-10 from irrigators who have adopted the business practise of operating on temporary water that previously hadn't been required to undergo salinity impact assessment and credit allocation.

The concept of assessing site use approval for long-term salinity impact aligns with Victoria's proposed assessment of the salinity impacts of water use licences (the equivalent of South Australia's site use approval) to determine the impact of new irrigation development. South Australia will work closely with Victoria to ensure the alignment of reporting of irrigation development debits and to amend the Register B Operational Protocols.

MARKET-BASED INSTRUMENTS (MBI)

Alternative opportunities to achieve irrigator or district accountability for salinity impacts have been investigated through a National Water Initiative (NWI) funded project exploring the potential to use market-based instruments (MBI) to address salinity impacts of irrigation. A report on a high-level gap analysis and critique of salinity MBI policies and their application to South Australia was completed in 2007-08. In 2008-09, further work was undertaken to complete an options paper for salinity MBI policies for South Australia. A greater understanding of the potential to apply different policy instruments to salinity management has been developed. This will benefit policy makers working in salinity management in the future to explore policy options.

Progression of this work beyond the options paper is dependent upon a number of technical investigations that are still being undertaken by DWLBC and the MDBA. These are discussed briefly in the paper titled "Qualitative Analysis of Policy Instruments for Salinity Management in the River Murray in South Australia".

Complexities arose in developing the project that didn't arise in the scoping phase – other potential work had not been foreseen. A key aspect for consideration in investigation and design of MBIs is the soundness of institutional and legal arrangements to support the operation of future markets.

A key example is that the project has clarified the need to do further work on South Australia's entries on the BSMS salinity registers to add to their robustness, work which is being progressed in 2009-10. The Basin Plan that is to be developed will review current salinity policies and this may also result in changes to salinity management and how BSMS salinity registers entries are calculated. It is anticipated that the investigations may take up to 3-4 years to be completed and will lead to more robust salinity register entries that have greater confidence.

When other projects such as these are finished, there will be an opportunity to build on the outcomes from those and revisit this project.

The project has demonstrated that economic and market based tools aren't simple tools for managing natural resources; ie they don't necessarily translate simply across disciplines so while promotion of efficient water markets may be desirable, the use of market based tools may not be straightforward. For salinity management, this was partly because it is difficult to quantify the costs of salinity in economic terms. Although the BSMS salinity registers attempt to do this, the uncertainty inherent in some of the calculations could make the use of market based instruments unreliable. This is why they are not recommended for application at this point.

As mentioned, the project was not completed but the results to date can still be used by the stakeholders and will be built on through related work. South Australia, through the former MDBC and BSMS Implementation Working Group, was provided with funds in 2008-09 to manage an investigation into the feasibility of using a Cap and Trade system for in-river salinity management within the MDB States. Storm Consulting were contracted by South Australia to complete the work, under the direction of a cross-jurisdictional project steering committee with representatives from NSW, VIC and SA. Within this project, consideration was to be given to how the current salinity accountability arrangements under Schedule B could be built on (or refined) to enable Cap and Trade arrangements. The project was recently completed (June 2009) with the delivery of the final report. In summary, the report recommends that a cap and trade approach to salinity management in the MDB is possible but not recommended due to the spatially varying nature of salinity problem, the high costs of implementing and operating a cap and trade system relative to the benefits and the uncertainties in the required scientific assessment and modelling. In many ways, the project reflected the findings of the NWI project described above.

1.6 Redesigning farming systems

ON GROUND SUPPORT TO ACHIEVE IRRIGATION EFFICIENCY IN THE SA MDB

The SA MDB NRM Board coordinated Improving Irrigation Efficiency Project (IIEP) continued to be implemented in 2008-09 across the SA MDB NRM Board region. This project has been in place since 2001 and continues to attract strong interest from irrigators seeking to optimise on-farm irrigation management practices.

In 2008-09 the IIEP delivered 22 irrigation workshops across the region that attracted 330 irrigators. Despite the belief that the demand for training workshops would decline in the current drought conditions attendance levels have remained high and a further round of workshops is planned for 2009-10.

In 2008-09 the SA MDB NRM Board, in collaboration with the South Australian Research and Development Institute (SARDI) developed a new workshop titled *Salinity Management in Irrigated Horticulture*. This workshop was developed to assist irrigators with managing root zone salinity that poses a real risk under the current reduced water availability conditions and precision irrigation techniques.

Figure 23: Irrigators participating in the Soils Irrigation Management Training Workshop

The SA MDB NRM Board has remained involved in on-farm salinity monitoring trials; however, the trial site in the Lower Lakes irrigation area at Finniss was severely impacted by drought conditions with the vineyard not irrigated during 2008-09. Monitoring at this site is anticipated to restart in 2009-10 when the irrigation pipeline comes on-line.

In 2008-09 the SA MDB NRM Board provided funding towards a joint Almond Board of Australia and SARDI Research trial at Bookpurnong.

This trial is titled *Minimising environmental footprints from irrigated almonds using new tools and methods* and is aimed at optimising both water and fertiliser (nitrogen, phosphorus and potassium) use through measuring and managing the root zone for maximising profitability and minimising the environmental impacts of deep drainage and nutrient leaching into the groundwater and river systems.

In 2009-10 the SA MDB NRM Board will continue working collaboratively with SARDI on a new trial looking at the application of sub surface drip irrigation to generate water savings and to reduce root zone salinity accumulation.

FUTURE FARM INDUSTRIES COOPERATIVE RESEARCH CENTRE

The South Australia Government continues to be involved in the Future Farm Industries Cooperative Research Centre (FFI CRC) The aim of the FFI CRC, is to develop innovative farming systems and new regional industries that reduce salinity and soil erosion, conserve biodiversity and water resources, and contribute to drought and climate change strategies. South Australia has a major role in this partnership through DWLBC, SARDI, CSIRO and The University of Adelaide.

The FFI CRC, through partnerships with DWLBC and SARDI, continues to maintain the key role in the development of woody perennial species suited to new biomass industries that started under the FloraSearch project. Research involves the selection and development of native species with potential for development as broad scale commercial woody biomass crops in the lower rainfall regions of southern Australia including the Murray Mallee. With the advent of the upcoming Carbon Trading System the program, this work is branching out to include more extensive research into carbon biosequestration rates across South Australia.

DWLBC has also been involved with CSIRO and The University of Adelaide on several FFI CRC aligned projects investigating the economic potential of woody biomass crops the State including the South Australia MDB NRM Region.

Using high resolution spatial imaging, economic models and geographic information systems (GIS) in combination regions of Australia have been identified where new woody biomass industries and carbon biosequestration crops are most viable. Their research gives South Australia a credible scientific understanding of the potential for commercial revegetation to provide environmental services, an ability to adapt to climate change and sustain healthy rural industries in our agricultural lands.

The FFI CRC project, Enrich focuses on the development of viable options for the livestock/cropping zone of southern Australia. Led by SARDI with support from DWLBC at its Monarto field site, the aim is to explore the use of a range of native shrubs as a perennial feedbase for grazing. Enrich aims to redesign farm scapes in the livestock-cropping zone to achieve multiple benefits, including improved livestock production and health, environmental management, and production systems that address market pressures for 'healthy' and ethical production systems.

The most promising species from this work are being investigated for their local adaptation at Waikerie in partnership with the FFI CRC project EverCrop.

At Monarto and other sites across southern Australia, Old man saltbush *(Atriplex nummularia)* is undergoing detailed breeding and evaluation experiments for livestock fodder industries (Figure 24).

This work is now being advanced by SARDI with continued support from DWLBC. In addition to the fieldwork now underway, DWLBC staff also conducted a major literature review of this species.

DWLBC has also been leading research into the biodiversity benefits gained from the use of native perennials for production purposes. Initially this has comprised carrying out fauna use comparisons over time between Old Man Saltbush production areas, native vegetation and cropping areas.

Figure 24: Old Man Saltbush breeding and evaluation trials at Monarto

A new website, Saltland Genie (Figure 25) provides farmers, agronomists and other land managers with a variety of information they need to manage saltland. Saltland Genie presents results from almost seven years of research through the Sustainable Grazing on Saline Lands initiative 2001-07. Results are available from a number of South Australia research sites including two sites in the South Australia MDB at Tungkillo in the eastern Mt Lofty Ranges and Meningie.

The website provides advice on the most suitable pasture options for saltland including establishing saltbush, salt-tolerant grasses and legumes. The site features a library containing a large collection of information about Australian dryland salinity.

Saltland Genie is an initiative of the Land, Water and Wool program and the FFI CRC, both of which receive funding from Australian Wool Innovation.

The website can be viewed at: www.saltlandgenie.org.au

Figure 25: The Saltland Genie web interface homepage

A three year project titled *Water, salt and nutrient management under precision irrigation* funded primarily by Land and Water Australia and the South Australia Centre for NRM has been completed.

The project investigated processes contributing to the build-up of root-zone salinity under precision irrigated horticultural crops in winter rainfall zones. In addition, measurements of nutrient movement in the root-zone have been investigated. An output of the project has been the development of a simple root-zone tool and techniques to enable irrigators to measure, monitor trends and manage root-zone salinity levels if required. Growers are now equipped with tools and knowledge to decide whether to leach and, if necessary, how much leaching irrigation to apply during winter.

During the final year, 2008-09, data was analysed from 20 field sites in the Riverland, Sunraysia and the Lower Lakes, technical reports were prepared for project funders, and a number of extension products were developed and delivered to irrigators.

The extension products and associated delivery from the project included:

- Salinity Management Practice Guidelines, a 15 page glossy brochure published by Land and Water Australia, National Program for Sustainable Irrigation.
- Web-based Leaching Calculator, to be placed on the SARDI website.
- Industry and grower level modules on salinity management in grape-vines, and salinity management under sub-surface drip irrigation. These modules have been prepared for the Grape and Wine Research and Development Corporation, and presented by SARDI at several industry and grower workshops arranged by GWRDC in the Riverland, Sunraysia and the Lower Lakes, and attended by over 150 people.
- Grower pitched hand-out and power point modules on salinity management in a range of horticultural crops, prepared for the SA MDB NRM Board, "Improving irrigation efficiency project". A total of five workshops were presented jointly by SARDI and Board staff, at Paringa, Berri, Waikerie and Parilla. A further workshop for Lower Lakes irrigators was held at Langhorne Creek. A total of an additional 100 irrigators attended these 3 hour workshops, all of whom received a copy of the Salinity Management Guidelines brochure. Over 200 of these brochures have now been distributed to irrigators and key industry people.

The widespread adoption of improved salinity management practices by irrigators will require an education program over a number of years, in much the same way as it has taken many years for adoption of improved water use efficiency. Incorporating salinity management workshops into the overall Improving irrigation efficiency project will be an important vehicle to achieve this. In developing and delivering the SA MDB NRM Board workshops, an additional objective has been to train Board staff to deliver the workshops as part of their on-going project in future years. Board staff took on increasing responsibility for presentations during the workshop series, and are now ready to run workshops next year with minimal input from SARDI.

1.7 Targeting reforestation and vegetation management

To prioritise habitat restoration activities across the South Australia MDB, a goal-based approach to landscape scale restoration site planning are being trialed that divides the landscape into management units and utilises appropriate restoration treatments.

REVEGETATION ACTIVITIES IN THE SA MDB NRM REGION

Large scale revegetation and remnant vegetation protection programs include Bushbids, Northern Bushbids and the Woorinen Recovery Project.

Through the Bushbids Tender nearly 3 000 hectares of private land (consisting of 121 sites and involvement from more than 70 landholders) has been protected, managed and revegetated. This area is equal to nearly 15% of the remaining vegetation on private land within the Eastern Mount Lofty Ranges. Also within this protected area is more than 280 hectares of nationally threatened grassland and habitat for 27 threatened plant and animal species. 84% of the sites have 10 year management or full heritage agreement status, ensuring long-term outcomes.

Northern Bushbids is the next extension of this Tender project. Moving north to between Morgan and Swan Reach and out to the Murray Plains and Rangelands, Northern Bushbids is targeted to protect and actively manage over 1 700 hectares of remnant vegetation over the next 5 years.

The Woorinen Recovery Project is a multi-year project incorporating a strong partnership between the SA MDB NRM Board, Murray Mallee LAP, Greening Australia, Rural Solutions and DEH. To date 660 hectares of Mallee remnant have been protected and over 40 hectare revegetated. Over the next three years the project will aim to restore approximately 150 hectares of triodia dune systems within the Mallee.

Community groups and organizations are an important part of reforestation and vegetation management in the SA MDB. During the 2008-09 year the Riverland West, Eastern Hills and Murray Plains, Goolwa to Wellington and Murray Mallee Local Action Planning groups combined to achieve more than 150 hectares of revegetation and over 700 hectares of remnant vegetation protection.

Other groups such as the Royal Zoological Society of SA, Greening Australia SA, the Conservation Council of SA, Trees for Life, Nature Foundation of SA, Conversation Volunteers Australia and the Nature Conservation Society of South Australia's Threatened Plant Action Group were all responsible for smaller localized revegetation and vegetation management programs.

SUSTAINABLE FARMING VEGETATION MANAGEMENT

In the 2008-09 year the Eastern Hills and Murray Plains, Goolwa to Wellington, Coorong Districts and Murray Mallee LAP groups undertook over 440 hectares of perennial pasture revegetation for soil conservation and salinity control. Over 20 hectares of wind breaks for sustainable farming were also planted.

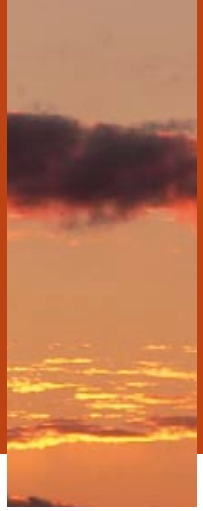
This year the same groups are looking to expand the target to over 1 000 hectares of revegetation for sustainable framing.

THE RIVER MURRAY FOREST

The River Murray Forest project is seeking to establish a total of 3 400 hectares of regionally native vegetation for biodiversity and carbon sequestration outcomes. Forest establishment will involve the use of public and private land within a broad corridor along the River Murray and Coorong in South Australia.

To date a total of approximately 1 000 hectares of plantings have been commissioned on private land, due for establishment over three years subject to seasonal conditions.

The project is jointly delivered by DWLBC and DEH.



1.8 Constructing salt interception works

PIKE RIVER SALT INTERCEPTION SCHEME

As reported in 2007-08, a draft Approval Submission for a salt interception scheme in the Pike River was developed. At this point, it was identified that further investigations were required to address concerns regarding the confidence level of the salt load estimates for the Upper Pike and Lyrup sections of the proposed scheme.

These investigations have been undertaken and the results confirm that the salinity level in these areas is significant and justify the inclusion of these sub sections as part of the overall scheme.

A revised Approval Submission has now been developed for a scheme comprising 59 highland production bores and 28.5 km of collection and disposal pipeline. The intercepted groundwater will be disposed of to the Noora Basin. Groundwater modelling estimates that the Pike SIS will intercept 167.6 tonnes/day of salt, at an average rate of 93 Litres/sec over the 30 year design life of the scheme with an estimated benefit of 35.4 EC at Morgan. Construction costs have been estimated at $25.321 million with a benefit cost ratio of 2.31.

The Approval Submission was submitted to the MDBA for consideration for funding. The Technical Working Group has endorsed the Pike SIS as a technically sound scheme.

MURTHO SALT INTERCEPTION SCHEME

The hydrogeological and engineering design consultancies for the Murtho SIS have progressed well throughout the year with the completion of the second stage of investigation bore drilling completed and the pipeline route confirmed.

SA Water awarded three separate contracts to commence various stages of construction work in 2009-10 for the scheme. The first, for the river crossing between Renmark and Paringa using horizontal direction drilling, work is scheduled to commence in mid July 2009. Pipe supply was undertaken separately to the pipe lay contract and delivery of the 54 km of pipe was received in June 2009 with all pipes on site at selected storage compounds. A pipe lay contract for the installation of the collection and disposal mains has been awarded and construction is scheduled to commence in August 2009.

BOOKPURNONG SALT INTERCEPTION SCHEME

All bores generally operated satisfactorily with no significant issues and with groundwater levels now at or below their targets.

Investigations have continued into the aluminium clogging of the production bores in the ‘quarantined’ section of the Bookpurnong SIS. Preparation of an Approval Submission to construct a SIS in the quarantined section proved that construction would be uneconomic. Routine maintenance carried out on the Bookpurnong SIS salt has indicated that production bores near the quarantined section are now showing signs of aluminium clogging demonstrating that the issue is not isolated.

A proposal has been prepared to undertake a trial of investigation methods, which could mitigate the issue of clogging in constructed SIS throughout the Riverland. The proposal was submitted to the MDBA for consideration for funding. The Technical Working Group endorsed the proposal and funding has been received to undertake the trial in 2009-10.

WAIKERIE SALT INTERCEPTION SCHEME

The Waikerie SIS continues to operate effectively as evidenced by the Run of River salinity surveys.

Construction of the Waikerie Lock 2 SIS progressed very well during the year at an estimated cost of $4.46 million to deliver a benefit of 9.4 EC. The scheme consists of an additional seven bores downstream of the present Waikerie SIS, in between and either side of the three Qualco Scheme bores that are adjacent the river.

By year's end three bores were in operation with the other four scheduled to be operational by the end of August 2009. Total cost to the end of June 2008 was $3.86 million with remaining expenditure of $200 000 anticipated for 2009-10.

WOOLPUNDA SALT INTERCEPTION SCHEME

The scheme continued to operate effectively with no major problems. Further progress was made in developing techniques to rehabilitate bores partially clogged by iron bacteria deposits. Comprehensive rehabilitation was undertaken on four bores with very encouraging results and with their performance being restored to close to as-new condition.

More importantly this recovery has been sustained for up to twelve months after treatment with no signs yet of deterioration becoming evident which would be the trigger for maintenance treatments.

LOXTON SALT INTERCEPTION SCHEME

All 27 floodplain bores and the Cliff Toe Drain operated well with Run of River salinity surveys indicating that the floodplain component of the scheme is very effective and that there is now only a residual salt load of approximately 25 tonnes/day still entering the River Murray in the Loxton area. This is assessed to be originating from the highland or cliff areas that directly abut the river where the hydrogeological setting initially precluded the installation of conventional bore pumps along their full extent.

Investigations continued in the highland areas into the feasibility of using conventional bore pumps in selected areas. The results were quite encouraging and at year's end proposals were being finalised to equip two areas accordingly as well as extend the Cliff Toe Drain and undertake minor works to further enhance interception on one floodplain.

A total of $16.5 million of the allocated $19.2 million had been spent on the construction of Loxton SIS to the end of the 2008-09 financial year with the remaining $2.7 million anticipated to be spent in 2009-10.

QUALCO-SUNLANDS GROUNDWATER CONTROL SCHEME

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 continued to drop slowly so the scheme is being operated on a care and maintenance basis. Most pumps are running for only two hours per day, the exception being three bores adjacent the river.

As in the previous year, at the request of the Qualco-Sunlands Groundwater Control Trust, the South Australia Government funded the operating and maintenance costs of the scheme for 2008-09.

RIVERLAND SALT DISPOSAL MANAGEMENT PLAN

Work under the Riverland Salt Disposal Management Plan (RSDMP) has focused on managing the Noora Basin in a sustainable manner to ensure its continued use as a salt disposal basin. The Noora Basin currently receives disposal water from the Bookpurnong and Loxton SIS, from the Murtho SIS once operational and potentially from the Pike SIS if this is constructed in the future.

Investigations have been undertaken into the rehabilitation work required at the Noora Basin and plans to carry out that work are scheduled for 2009-10.

1.9 Basin-wide accountability

In 2008-09 the accredited SIMRAT model was utilised to assess the salinity impacts arising from permanent water trade. As has been the trend for the past several years, reliance on temporary trade as a business practise continued in 2008-09 (Table 4), with a continuing decline in the trade of permanent water entitlements.

Table 4: Volumes of Water Traded for Irrigation 2001-2009

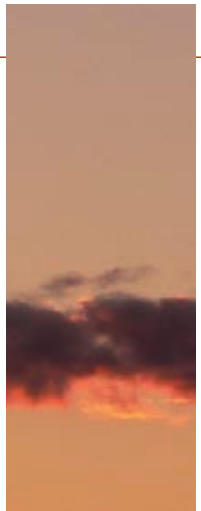
Year of Trade	Volume of Permanent Trade (ML)	Volume of Temporary Trade (ML)*	Total Volume Traded (ML)
2001	10 461	50 525	60 986
2002	12 966	54 420	67 386
2003	11 868	30 751	42 619
2004	10 509	77 456	87 965
2005	10 112	53 898	64 010
2006	18 958	33 625	52 583
2007	28 456	243 502	271 958
2008	8 655	387 519	396 174
2009	6 782	144 385	151 167

* Note that temporary trade includes repeat water trade to the same land parcel

SOUTH AUSTRALIA'S ENTRY ON THE BSMS SALINITY REGISTER 2008-09

In 2008-09, permanent water trade totalled 6 782 ML, however, only 7 permanent water trades were required to undergo assessment for salinity impact. The cumulative impact of these trades was 0.004 EC (30 year average impact at Morgan), however, the impact at 2100 is 0.245 EC at Morgan and therefore constitutes an accountable action (Table 5). Figures 26 and 27 show the locations of assessed trade and associated impacts. All of the accountable permanent trades related to water purchased from within South Australia (intrastate trades). A more detailed breakdown of the figures to support the update of South Australia's position on the BSMS Salinity Registers is provided in Appendix A.

Temporary water trade is not currently assessed for its long-term salinity impact due to uncertainty in the recurrence of the trade from year to year (and hence uncertainty in the continuity in irrigation) and the inability of the SIMRAT model to account for the associated variance in rootzone drainage rates over time.



As discussed at section 1.5, from 1 July 2009 irrigators who have primarily operated on temporary water trade will not have this volume transitioned to a site use approval and will be required to undergo salinity assessment to increase the maximum volume permitted on the site use approval for the purpose of irrigation. Accordingly, South Australia expects a significant uptake of development credits in 2009-10.

Table 5: Permanent water trade assessed by reach in 2008-09

Reach	Number of Licences	Total Volume (ML)	30-Year Average Salt tonnes/day	30-Year Average EC @ Morgan	Impact @ 2100 Salt tonnes/day	Impact @ 2100 EC @ Morgan
Border to Lock 5	1	1.9	0.000	0.000	0.009	0.002
Lock 5 to Lock 4	0	0.0	N/A	N/A	N/A	N/A
Lock 4 to Lock 3	1	4.0	0.001	0.000	0.013	0.003
Lock 3 to Lock 2	2	244.6	0.018	0.004	1.033	0.240
Lock 2 to Morgan	0	0.0	N/A	N/A	N/A	N/A
Morgan to Lock 1	0	0.0	N/A	N/A	N/A	N/A
Lock 1 to Murray Bridge	3	531.0	0.012	0.000	0.655	0.000
Murray Bridge to Mouth	0	0.0	N/A	N/A	N/A	N/A
Total	**7**	**781.6**	**0.030**	**0.004**	**1.711**	**0.245**

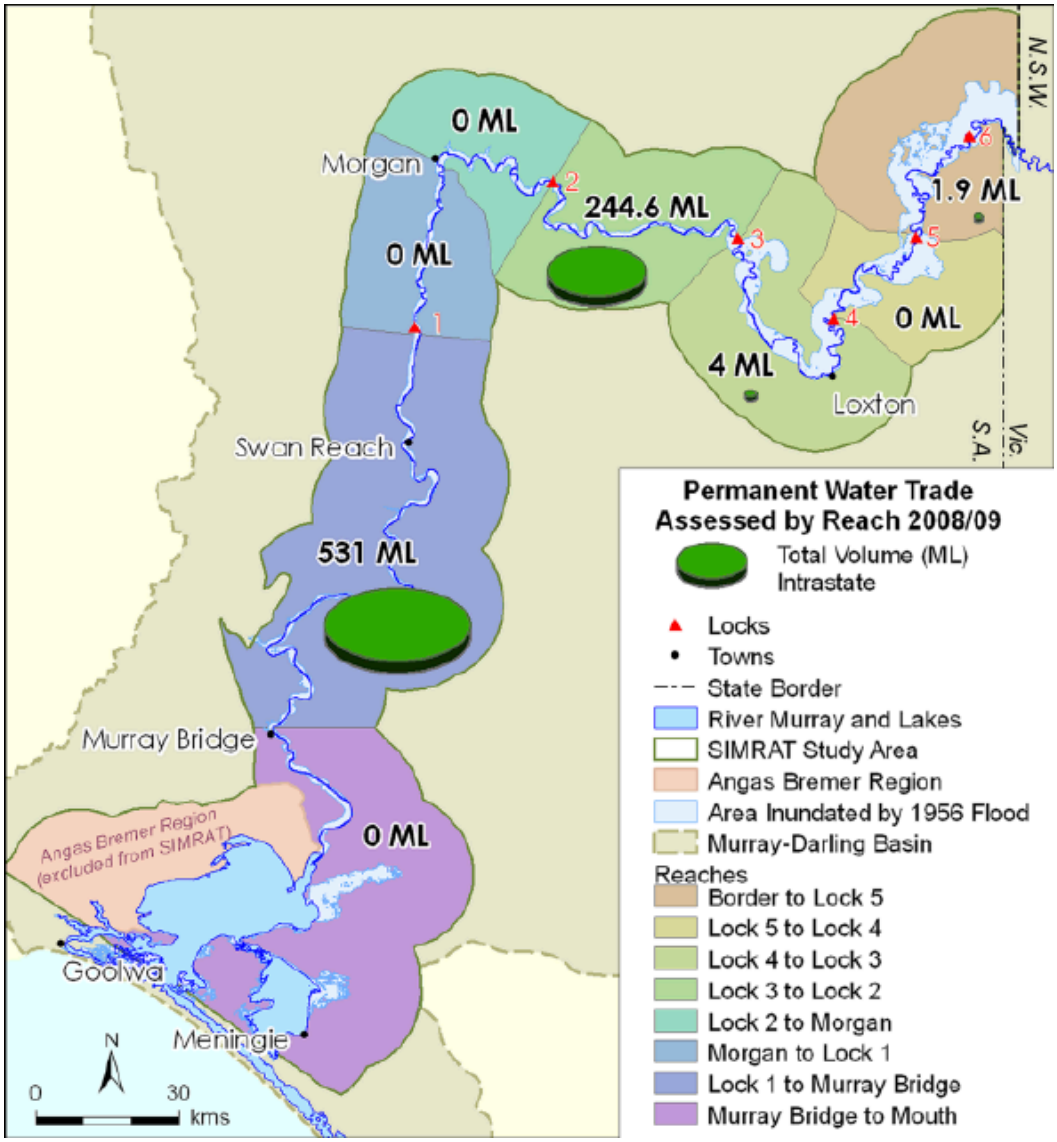


Figure 26: Volume of Permanent Water Trade by Reach 2008-09

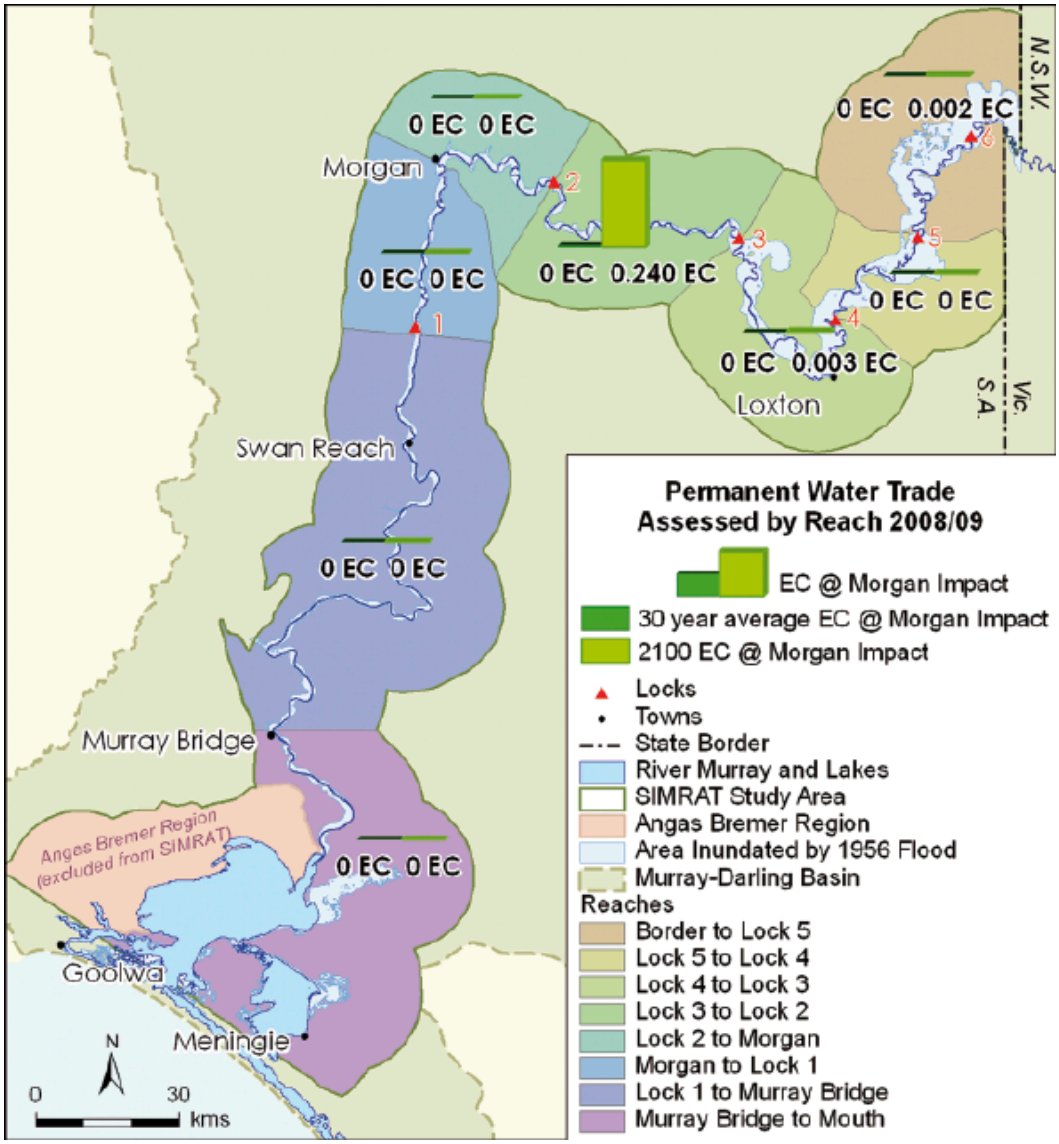


Figure 27: Impact of Permanent Water Trade by Reach 2008-09

GROUNDWATER MODELS IN SOUTH AUSTRALIA

In 2008-09, South Australia continued the development of a series of MODFLOW groundwater models. All models in this series utilise a consistent methodology and the same set of modelling scenarios. The aim is to have a consistent basis for assessing the impact of all irrigation related accountable actions and related entries on the BSMS Salinity Registers. Table 6 summarises the current status of MODFLOW model development. For further information on each regional model, refer to South Australia's 2006-07 Report to the BSMS.

Table 6: Current status of MODFLOW model sub-zones in SA

Regional Model	Sub-zone	Status	Report and results	Future Work
Chowilla	Chowilla Floodplain	Base flow model completed in 2004	DWLBC Report 2004/65	Additional document for MDBA to indicate direction for future works
		Flood simulations in 2007	DWLBC Report 2007/28	
		Six tasks (~25 scenarios) for SA MDB NRM Board in 2007/2008		
		Three tasks for SA MDB NRM Board in 2008/2009		
Border to Lock 3	Loxton – Bookpurnong	Completed in 2004	DWLBC Report 2005/17	Re-run scenarios and new report after more information gained from operating SIS
		Accredited in 2005		
		Scenarios run in 2008 for Bookpurnong SIS in Aluminium clogging area		Upgraded Model for five year review
	Pike - Murtho	Accredited in 2006	DWLBC Report 2006/26	Upgraded Model for five year review
		Scenarios run in 2008 for Pike SIS submission report		
	Renmark - Berri	Completed in 2007	Draft report to MDBC in OCT 2007	Currently being reviewed by MDBA for accreditation
				Complete editing and publishing
	Pyap, New Residence, Moorook & Kingston	Completed in 2008	DWLBC Report 2008/19	Currently being reviewed by MDBA for accreditation
Lock 3 to Morgan	Woolpunda, Waikerie, Qualco Sunlands & Cadell	Completed in 2005	Aquaterra (August 2005)	Determine if model needs to be upgraded, re-built and/or split in two
		Accredited in 2005	Aquaterra (June 2007)	
		Scenarios re-run in 2007		Source funding
Morgan to Wellington	Morgan to Lock 1, Lock 1 to Mannum, Mannum to Murray Bridge, Murray Bridge to Wellington	Accepted by MDBC in 2006 without irrigation scenarios	PIRSA Report 2000/45	Review by MDBA for accreditation
		Update and run irrigation scenarios in 08-09	DWLBC Report 2006/08	
			DWLBC Report 2009/TBA	

Update of the Morgan to Wellington model

In 2008-09, the existing Morgan to Wellington model was upgraded using:

- the most recent hydrogeological information (eg structural surfaces, potentiometric surface and groundwater salinity);
- the best understanding of the conceptual model (eg irrigation on reclaimed swamps);
- further calibration and validation using recent monitoring data;
- use of actual river level in the calibration and predictions; and
- comparison between modelled salt load and in-stream Run of River data.

Following the updating and recalibration of the model, scenarios were run to produce estimates of the groundwater fluxes (and resultant salt loads) entering the River Murray resulting from irrigation and management actions in the Morgan to Wellington area. Subject to independent review outcomes, the model results can be used for BSMS Salinity Register entries.

With the update of this model, DWLBC will have completed a set of numerical groundwater models that cover the entire run of river in SA.

SALINITY ASSESSMENT OF WETLAND MANAGEMENT ACTIONS

The River Murray Environmental Manager Unit (RMEM) resides in the SA MDB NRM Board and has the responsibility for management, allocation and delivery of environmental water to ecological assets of the River Murray in SA. The RMEM intends to utilise the Salinity Impact Assessment Framework for Wetlands in the River Murray which consists of a three-stage assessment process of salinity impacts of wetlands:

Stage 1: a rapid assessment approach to assess the likelihood and severity of salinity risk to the River Murray.

Stage 2: identifies the magnitude of salinity risk to different wetlands through a more detailed assessment involving Wetland Salinity Assessment Tool (WSAT) modelling.

Stage 3: If the WSAT modelling determines the wetland to have a very high salinity risk, then a project-based assessment of the wetland to quantify the potential salinity impacts may be completed.

In 2008-09, the intention was to trial WSAT on Banrock Lagoon. This wetland is considered to have a potential high risk to in-river salinity as it straddles Lock 3. It is understood that the difference in height between the weir pools on either side of the lock could allow water entering the wetland on the upstream side of the lock to pass through the wetland and flush salt into the river on the downstream side of the lock. There is also a significant amount of baseline data for this site to allow validation of modelled results. Unfortunately, staff changes resulted in a loss of the technical expertise required to operate the model. An attempt was made to complete the modelling external to DWLBC, however, due to the considerable complexity of coding in the model, this could not occur.

In 2009-10, investigations will be made to assess whether further effort should be made to complete and apply the WSAT model or whether an alternative model for assessing the salinity impacts of wetland action should be developed. The coordination of management actions for wetlands, the determination of the associated salinity impacts and development of processes to bring entries for such actions to the BSMS Salinity Registers will be pursued in 2009-10.

2 Valley Reports

Under the BSMS, South Australia does not have any End-of-Valley targets defined. However, the BSMS Basin Salinity Target is located within South Australia at Morgan. South Australia is committed to contributing towards meeting this and has also adopted it as a State target under the South Australian River Murray Salinity Strategy 2001-2015 (SARMSS). In addition, under SARMSS South Australia undertakes monitoring at a number of sites and this may give an ongoing indicator of likely performance against the Basin Salinity Target. These monitoring sites have been allocated salinity targets, derived from the Basin Salinity Target (Table 7).

Table 7: SARMSS 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% of the time

The Independent Audit Group - Salinity has previously acknowledged that the End-of-valley Summary Report Card is not entirely suitable for SA, as it does not make provision for downstream targets, actions or reporting. However, South Australia has completed the relevant fields of the End-of-valley Summary Report Card (Table 8). The Independent Audit Group - Salinity also recognised South Australia's aspiration to report on reach-by-reach targets. The SA MDB NRM Board is currently reviewing South Australia's monitoring site targets and the outcomes of this review may feed into any other future work towards developing reach-by-reach targets. In addition, as mentioned previously, South Australia will contribute to the MDBA review of the suite of BSMS Targets planned for 2009-10 as part of the development of the Water Quality and Salinity Management Plan.

Riverbank slumping below Lock 1, April 2009

2.1 End-of-Valley Report Card

Table 8: South Australia's End-of-valley Summary Report Card for 2008-09

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 Effect at Morgan (Equivalent EC)	
								Current Year 08/09	2015 Outlook	2050 Outlook	2100 Outlook	Morgan "A" Items	Morgan "B" Items
	Salinity		Salt load	(Shared resource sites shown in italics)	End of Valley: Flow, Salinity, Salt Load			End of Valley: Salinity, Flow, Salt Load	End of Valley: Flow, Salinity, Salt Load	End of Valley: Flow, Salinity, Salt Load	End of Valley: Flow, Salinity, Salt Load	Morgan: Flow, Salinity, Salt Load	Morgan: Flow, Salinity, Salt Load
South Australia	Median	95%ile	Average										
Lock 6 to Morgan	Tba	800 EC	Tba	Murray at Morgan			800 *EC	632 EC (Max) 7601 EC (95 %ile) 2 220 ML/Day Max Flow					
Monitoring Sites	Median	80%ile	Average										
Below Morgan	Tba	770 EC	Tba	Murray at Murray Bridge			770 EC	990 EC (Max) 818 EC (80 %ile) No flow data available					
SA Border	Tba	412 EC	Tba	Murray at SA Border			412 EC	823 EC (Max) 712 (80 %ile) No flow data available					
Berri	Tba	543 EC	Tba	Murray at Berri			543 EC	457 EC (Max) 385 EC (80 %ile) 3 530 ML/Day Max Flow					

*for at least 95% of the time during the benchmark period

2.2 Summary of monitoring sites

BORDER (A4261022)

Electrical Conductivity (EC)

The pontoon-mounted salinity monitoring equipment located at the South Australian-Victorian border continued to operate reliably. The new instrumentation and communication package enabled daily polling of this site and has significantly enhanced the reliability of data recorded.

Flows

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.

There is a new Acoustic flow gauging station in the River Murray downstream of Lock 7, however data from this site has not yet been made available.

BERRI (A4260537)

Electrical Conductivity (EC)

The salinity monitoring equipment located at the Berri Irrigation Pumping Station continued to operate reliably, with 99% of data of "good" quality in 2008-09.

Only minor spiking of data was recorded indicating minimal EC variation from bank accessions during this period

Flows

Flows for this site are calculated at Lock 4 (A4260515, 8kms downstream of Berri), up to a stream-flow of 40 000 ML/day. Above 40 000 ML/day the high-flow gauging site at Lyrup (A4260663, 12kms upstream of Berri) is used. Flows at Lock 4 were quality coded "good" for 100% of record for 2008-09.

MORGAN (A4260554)

Electrical Conductivity (EC)

The salinity monitoring equipment located at the Morgan Pumping Station pontoon operated reliably, with 100 % of data coded "good" quality in 2008-09. Morgan instrumentation is now telemetered and is available to river operators on a daily basis.

Flows

Flow data for Morgan is calculated from flows at Lock 2 (A4260519) and Lock 1 (A4260903). Both sites had "good" quality flow data for 2008-09.

A new installation (A4261110) measuring continuous flow has been commissioned, 3.5 kms downstream of Morgan as detailed in Section 1.3.

MURRAY BRIDGE (A4261003)

Electrical Conductivity (EC)

The daily sampling of EC at Murray Bridge continued to provide "good" quality coded data in 2008-09.

A new water level and EC monitoring installation (A4261162) at Long Island (5 km downstream of the current site) has been commissioned. Data for this report is a combination of "Daily" (up to 6 Jan 2009) and "Continuous" data. Future Murray Bridge data will come from the new site.

Flows

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

Riverbank slumping below Lock 1, April 2009

3 Response to Independent Audit Group

3.1 Response to the Independent Audit Group (IAG)-Salinity Recommendations 2007–08

In 2007-08, the IAG-Salinity made a number of recommendations that were relevant to South Australia:

Recommendation #1: Flood recession salt risks

That the MDBA Office urgently facilitate development of a conceptual model of flood recession salt mobilisation in the floodplains and operational response management plans in preparation for the next high flow event.

South Australia's Response

South Australia agrees with the recommendation. Although this recommendation is targeted for action at the MDBA Office, South Australia recognises this as a very important issue and therefore has been negotiating with the Office for initial funding to commence investigations as soon as possible to further understand how salt is accumulated and mobilised from the floodplain, particularly following flooding events.

Work should also investigate the economic, social and environmental risks associated with various flooding scenarios and how the risks can be mitigated.

South Australia's Progress during 2008-09

- South Australia wrote to the MDBA (March 2009) indicating interest in progressing a co-funded floodplain salinity data and modelling investigations project.
- South Australia is investigating whether it needs to pursue separate work for specific floodplains such as Pike and Chowilla in recognition of the significant salt risk these floodplains pose.

Recommendation #2: Financial and human resources for BSMS implementation

That all Contracting Governments recognise the importance of continuing to manage salinity in the MDB, the gains that have been made, and the threats that still exist; and that they continue their investment following the conclusion of the NHT and NAP for Salinity and Water Quality.

South Australia's Response

South Australia agrees with the recommendation. South Australia is well aware of the need to manage salinity in the MDB, particularly to manage the high growth of saline inflows that are predicted to arrive later this century and to mitigate the impacts of high salinity levels in the River Murray when salt is mobilised from the floodplains following future flooding events.

While South Australia is currently seeking resources from state budgets for some of the work, it is likely that funding will also be required from external sources including the MDBA.

Loveday wetland, November 2008

South Australia's Progress during 2008-09

- South Australia continues to support this recommendation noting that funds and resources have been more limited since 2008-09 with the conclusion of the National Action Plan for Salinity and Water Quality (NAPSWQ) program.
- In addition, State budgetary pressures and other priorities have reduced the number of South Australia personnel working on BSMS related work.
- While it is expected some additional resources will be appointed in 2009-10, it will be important for South Australia to work with the MDBA and other jurisdictions where possible to continue to progress salinity management initiatives and pursue other external funding opportunities.

Recommendation #4: Salinity targets below Morgan

That salinity targets below Morgan be provided to protect the significant assets and populations that may be affected by high salinity below Morgan. These targets should include targets set to aid real time operations, as peaks in salinity which can be accommodated in the current Morgan target may be unacceptably high for critical human needs or for agricultural and ecological requirements.

South Australia's Response

South Australia agrees with the recommendation. The Basin Target at Morgan is a modelled salinity level over the benchmark period (1975-2000). While it is possible for the Basin Target to be met, it does not address the significant risk of real time, or actual, salinity levels which could spike to very high level for periods of time and cause severe damage to industrial, domestic and agricultural users. Accordingly, targets that address real time issues and real time river operations are highly desirable. In addition, the Basin Target site at Morgan does not inform the Authority on the acceptability or otherwise of real time water quality at locations downstream from Morgan (including Adelaide) that will be at higher salinity levels (up to two to three times higher during periods of low flow) and that will incur the greatest economic cost.

Furthermore, South Australia has recognised that the risk of high salinity levels in the River Murray following future flooding events is high, with the potential to cause significant economic, social, political and environmental impacts (see recommendation 2). This is a high priority for South Australia and DWLBC expects to be engaged in the review of salinity targets, as described in Section 1.2.

South Australia's Progress during 2008-09

- South Australia is conducting research into a set of salinity targets for South Australia that complement the existing Basin Salinity Target and facilitate management of real time river salinity (including water quality for Critical Human Water Needs).
- It is anticipated that this research will assist in South Australia providing input to the MDBA Water Quality and Salinity Management Plan that is currently under development.

Recommendation 6: End-of-valley salinity-flow interpretations/salinity hot spots:

That further use be made of the end-of-valley target monitoring data to identify in-valley processes operating with changed flow conditions that, in combination with within-valley targets, can identify salinity 'hot spots' for management intervention. The BSMS MDBA Office should work with the BSMS IWG to develop appropriate techniques for data interpretation.

South Australia's Response

South Australia supports the recommendation.

South Australia's Progress during 2008-09

South Australia continues to support this recommendation and during 2008-09 conducted the following work to assist in the identification of salinity hotspots:

- the 18th large-scale Run of River survey of salt accessions to the River Murray, from Lock 6 to Lock 1, over a 2 week period;
- detailed EC cross section mapping from Lock 1 to Wellington to identify hot-spot locations of groundwater discharge to river;
- 3-monthly gaugings of flows at Lock 1 using the Acoustic Doppler Current Profiler (ADCP) technology to accurately measure low water velocities required for salinity modelling in the lower reach of the river;
- installed new salinity, flow and level sites at Morgan, Swan Reach, Mannum, Murray Bridge, Tailem Bend, Wellington and several sites in the Lower Lakes and Coorong areas;
- increased installation of telemetered monitoring sites to significantly increase the availability and accuracy of South Australia's salinity data; and
- progressed the Morgan to Wellington numerical groundwater model to include impacts of irrigation development.

Recommendation #7: Finalising Register entries currently with low confidence ratings

That the work be completed to finalise the remaining large entries in the Salinity Registers that currently have low confidence ratings. This includes for Register B the "SA Mallee Legacy of History – Irrigation", and the shared "NSW and Victoria Mallee Legacy of History" entries. Model development is under way and this should be completed, accredited and applied. The South Australian entries in Register A "Improved Irrigation Efficiency" and "Irrigation Scheme Rehabilitation" should be split between Registers A and B.

South Australia's Response

South Australia agrees with the recommendation. South Australia is progressing the update of key register entries (including the "Improved Irrigation Efficiency" and "Irrigation Scheme Rehabilitation") using the South Australian suite of MODFLOW models, subject to the Murray-Darling Basin Authority endorsing the use of the groundwater model results for this purpose. It is anticipated that this work will be completed in the next 18 months.

South Australia's Progress during 2008-09

- South Australia has commenced a project to analyse the rationale and investigate risks behind South Australia's current entries on the Salinity Registers. The project will include discussions with MDBA seeking agreement on current model methods, peer review process and accreditation. It is anticipated that outcomes of the project will assist in resolving confidence of existing entries and addressing the outstanding entries and is on track to be completed by June 2010.
- South Australia has indicated it supports in principle to the proposed methodology to split the entries for "Improved Irrigation Efficiency" and "Irrigation Scheme Rehabilitation" between Registers A and B.

Recommendation #8: Living with salinity

That research and development associated with the concept of "Living with salt" be encouraged so that enterprises that can use the large quantities of moderately saline ground and surface water in the Basin can be promoted.

South Australia's Response

South Australia agrees with the recommendation. South Australia will continue to promote new options for dealing with salinity such as using saline groundwater from salt interception schemes for aquaculture. However, without a significant and ongoing research investment, progress towards viable and sustainable strategies that can utilise water of higher salinity levels will remain slow.

South Australia's Progress during 2008-09

- South Australia continues to support this recommendation and to be involved in the Future Farm Industries Cooperative Research Centre (FFI CRC).
- The aim of the FFI CRC, is to develop innovative farming systems and new regional industries that reduce salinity and soil erosion, conserve biodiversity and water resources, and contribute to drought and climate change strategies. South Australia has a major role in this partnership through DWLBC, SARDI, CSIRO and the University of Adelaide.

Recommendation #9: Within-valley salinity targets

That all state and ACT contracting governments develop within-valley complementary targets for catchments with end-of-valley targets where salinity assessed as EC is greater than a decided level, commencing with those where EC increases with increasing flow to identify the processes contributing to the mobilisation of salt.

South Australia's Response

South Australia agrees with the recommendation. This links with the work that South Australia is progressing in developing salinity targets below Morgan (recommendation 1), and on the proposed investigations to understand salt accumulation and mobilisation from the floodplain (recommendation 2).

South Australia's Progress during 2008-09

- South Australia continues to support this recommendation as indicated by the targets work referred to elsewhere in this response.

Recommendation #10: Synergies in activities and funding

That criteria for assessing projects submitted to the Australian Government from areas within the Murray-Darling Basin should include an assessment of the alignment with strategies and desired outcomes of the MDBA, in order to achieve synergies and efficiencies and adopt the most recent scientific advances.

South Australia's Response

South Australia agrees with the recommendation. Any MDB projects that South Australia submits to the Australian Government will be assessed against the relevant strategies, plans and desired outcomes of the MDBA to achieve synergies and efficiencies, and to adopt the most recent scientific advances.

South Australia's Progress during 2008-09

- South Australia continues to support this recommendation.

Recommendation #12: Market-based instruments (MBI)

That to fulfil the promise of MBI to provide an incentive-based environment that may aid in irrigator and district accountability, and further improve salinity management, the investigation of market based approaches be continued, following up on work started in 2007-08 in South Australia.

South Australia's Response

South Australia agrees with the recommendation. South Australia is progressing two projects relating to market-based instruments:

- investigation of the potential for a cap and trade system across the Murray-Darling Basin. South Australia is managing this project on behalf of Victoria, New South Wales and the MDBA. The project is due to be completed by mid 2009; and
- investigation of the potential for policy instrument tools, including market-based instruments, to manage salinity in SA. The outcomes will help inform how South Australia can best invest in future salinity management and to ensure that it keeps its Salinity Register in balance. An assessment report is due by mid-2009.

South Australia's Progress during 2008-09:

Both of these projects were completed in 2008-09. A full update is provided in Section 1.5.7 of this report.

Recommendation #15: Harmonisations of methods of calculating entries in the Salinity Registers

That the MDBA Office conduct a trial to harmonise Register A and B calculation methods and assess whether any jurisdictions might be disadvantaged or treated inequitably should a common currency be adopted for the Salinity Registers.

South Australia's Response

South Australia supports the recommendation.

South Australia's Progress during 2008-09

- South Australia's register balance was used as the case study during trials conducted by MDBA in 2008. South Australia has indicated in principle support to the proposed methodology to harmonise Register A and B calculation methods.

3.2 Response to Past IAG-Salinity Recommendations

In 2007-08, the IAG-Salinity made two recommendations regarding the implementation of their previous recommendations (from their 2006-07 report) that remain relevant to SA.

1. Long-term increase in salinity due to growth of new irrigation in SA

That South Australia considers supplementing its Salinity Zoning Policy with measures to contain the high growth in saline inflows that will arrive later this century (IAG-Salinity 2006-07 report, page ix).

South Australia's Response

South Australia agrees with the recommendation.

The outcomes of the investigation of policy instrument tools will inform how the salinity zoning policy could be refined to address the high growth in saline inflows that are estimated to arrive later this century. Any proposed changes to the salinity zoning policy will need to be implemented through amendment of the Water Allocation Plan for the River Murray Prescribed Watercourse.

South Australia's Progress during 2008-09

- South Australia continues to support this recommendation.
- South Australia is currently undertaking a project investigating risks and potential changes to entries on the Salinity Registers to quantify whether the high inflows will eventuate as predicted. This will allow selection of the most appropriate management actions.

2. Salinity Impact Zoning

That NSW establish a salinity impact zoning policy for Sunraysia, that Victoria consider extending its zoned areas upstream. SA, Vic and NSW cooperate so zoning policies are consistent. (IAG-Salinity 2006-07 report, page xii).

South Australia's Response

South Australia agrees with the recommendation. South Australia is currently separating water rights for the River Murray Prescribed Watercourse, and has consulted Victoria on how it has implemented the salinity zoning policy under separated water rights to ensure consistency between the states.

South Australia's Progress during 2008-09

- From 1 July 2009 South Australia has separated River Murray water licences into four instruments.
- South Australia is in the process of amending operational salinity zoning policy to reflect the unbundled environment.
- South Australia will continue to cooperate with Victoria and NSW to ensure consistency of zoning policies and in the reporting of irrigation salinity impacts to the Salinity Register.

Appendix A

Detailed breakdown of submission for BSMS Salinity Registers

Table 9: Salinity Impact (EC at Morgan) of Permanent Water Trade Assessed 2008-09

Reach	Total Volume (ML)	30-Year Average	Impact @ 2010	Impact @ 2011	Impact @ 2012	Impact @ 2013	Impact @ 2014	Impact @ 2015	Impact @ 2030	Impact @ 2050	Impact @ 2100
Border to Lock 5	1.9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Lock 5 to Lock 4	–	–	–	–	–	–	–	–	–	–	–
Lock 4 to Lock 3	4.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003
Lock 3 to Lock 2	244.6	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.035	0.240
Lock 2 to Morgan	–	–	–	–	–	–	–	–	–	–	–
Morgan to Lock 1	–	–	–	–	–	–	–	–	–	–	–
Lock 1 to Murray Bridge	531.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Murray Bridge to Mouth	–	–	–	–	–	–	–	–	–	–	–
Total	**781.5**	**0.004**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.004**	**0.036**	**0.245**

Loveday wetland, November 2008

Table 10: Salinity Impact (tonnes of salt/day) of Permanent Water Trade 2008-09

Reach	Total Volume (ML)	30-Year Average	Impact @ 2010	Impact @ 2011	Impact @ 2012	Impact @ 2013	Impact @ 2014	Impact @ 2015	Impact @ 2030	Impact @ 2050	Impact @ 2100
Border to Lock 5	1.9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.009
Lock 5 to Lock 4	–	–	–	–	–	–	–	–	–	–	–
Lock 4 to Lock 3	4.0	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.006	0.013
Lock 3 to Lock 2	244.6	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.145	1.033
Lock 2 to Morgan	–	–	–	–	–	–	–	–	–	–	–
Morgan to Lock 1	–	–	–	–	–	–	–	–	–	–	–
Lock 1 to Murray Bridge	531.0	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.307	0.655
Murray Bridge to Mouth	–	–	–	–	–	–	–	–	–	–	–
Total	**781.5**	**0.031**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.048**	**0.460**	**1.710**

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