Australian Government

MURRAY–DARLING BASIN AUTHORITY

Basin Salinity Management Strategy

2013–14 annual implementation report

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Cover image: Condamine River near Cecil plains on the Darling Downs (photo by Arthur Mostead 2010)

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Acknowledgement of the Traditional Owners of the Murray–Darling Basin

The Murray–Darling Basin Authority acknowledges and pays respect to the Traditional Owners, and their Nations, of the Murray–Darling Basin, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. The MDBA understands the need for recognition of Traditional Owner knowledge and cultural values in natural resource management associated with the Basin.

The approach of Traditional Owners to caring for the natural landscape, including water, can be expressed in the words of Darren Perry (Chair of the Murray Lower Darling Rivers Indigenous Nations) —

> *'the environment that Aboriginal people know as Country has not been allowed to have a voice in contemporary Australia. Aboriginal First Nations have been listening to Country for many thousands of years and can speak for Country so that others can know what Country needs. Through the Murray Lower Darling Rivers Indigenous Nations and the Northern Basin Aboriginal Nations the voice of Country can be heard by all'.*

This report may contain photographs or quotes by Aboriginal people who have passed away. The use of terms 'Aboriginal' and 'Indigenous' reflects usage in different communities within the Murray–Darling Basin.

Foreword

I have pleasure in releasing the 2013–14 annual implementation report of the Basin Salinity Management Strategy (BSMS).

In September 2001, the Murray–Darling Basin Ministerial Council released a 15–year strategy to manage salinity in the Basin. Key obligations of partner governments and the Murray Darling Basin Authority (MDBA) are given effect through Schedule B of the Murray–Darling Basin Agreement (Schedule 1, *Water Act 2007* (Cwlth)). This annual report complies with the Schedule B reporting requirements for the MDBA and includes a broader summary of other aspects of BSMS implementation not explicitly covered by Schedule B.

The BSMS has contributed to the progressive reduction in river salinity over the past 14 years through investment in salt interception schemes and improved land and water management practices. Under the BSMS, the actions taken by partner governments collectively or individually require long–term increases in river salinity to be offset by works or measures that lead to a comparable reduction in river salinity. Investments have also been aimed at achieving the Basin salinity target to maintain the average daily salinity at Morgan, South Australia, at less than 800 EC for at least 95% of the time, simulated over a period that represents both wet and dry climatic sequences.

The river salinity outcomes, as reported for the 12–month period to 30 June 2014, are currently meeting the Basin salinity target. This achievement reflects the successful operation of salt interception works and measures and other actions taken by partner governments.

The Independent Audit Group for Salinity (IAG–Salinity) conducted the 12th audit of the strategy in November 2014. The auditors reviewed the implementation of the strategy by MDBA and the partner governments in accordance with Schedule B and the associated BSMS operational protocols. The executive summary of the *Report of the IAG–Salinity 2013–14* including their recommendations is provided in this report.

Implementation of the BSMS would not be possible without the cooperation of the partner governments and the dedication of their policy and program officers. In particular, their commitment to the delivery of salinity management activities in the valleys across the Basin and the cooperation extended to the MDBA in maintaining a rigorous salinity accountability framework are greatly appreciated.

Rhondda Dickson
Chief Executive
Murray–Darling Basin Authority

Abbreviations

AWRC	Australian Water Resources Council
BSMS	Basin Salinity Management Strategy
BSMAP	Basin Salinity Management Advisory Panel
BSM 2030	Basin Salinity Management 2030
CMA	Catchment Management Authority
CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
CSG	Coal Seam Gas
Cwlth	Commonwealth
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EC	Electrical conductivity (measured as µS/cm)
EoVT	End–of–Valley Target
GABSI	Great Artesian Basin Sustainability Initiative
IAG–Salinity	Independent Audit Group for Salinity
LWMP	Land and Water Management Plan
MDB	Murray–Darling Basin
MDBA	Murray–Darling Basin Authority
MDBC	Murray–Darling Basin Commission
MSM–BigMod	Daily flow and salinity model for the River Murray
NRM	Natural Resource Management
SIMRAT	Salinity Impact Rapid Assessment Tool
SIS	Salt Interception Scheme
RMIF	River Murray Increased Flows
TLM	The Living Murray
WAP	Water Allocation Plan

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Salinity status of the Basin in 2013–14

During the 2013/14 season, rainfall across the northern Basin was below average, whilst in the southern connected Basin, rainfall was generally average or above average. In the southern Basin, the first half of the 2013/14 water year was dry, followed by a return to wetter conditions later in the year. Overall inflows to the River Murray system were below the long term median. This is reflected by the fact that active storage across the Basin was above long term average levels at the commencement of the 2013/14 water year, but moved down to close to average levels by the end of the period.

These conditions had implications for inflows to the system and water demands for consumptive and environmental purposes, which in turn impacts on salinity levels.

The key indicator of the status of salinity within the Murray–Darling Basin is the salinity outcome in the lower Murray at Morgan in South Australia. Consistent with water quality outcomes over the past few years, river salinities recorded at Morgan in 2013-2014 remained relatively low, with an average daily salinity of 355 EC and a peak daily salinity of 650 EC. Given the stated Basin Salinity Management Strategy (BSMS) intention to maintain the salinity at Morgan below 800 EC, this outcome is highly beneficial to the environmental, social and economic values of the Murray River.

A significant part of this achievement is attributable to the improvement of land and water management practices over many years and the operation of salt interception schemes.

Variability in the salinity outcome from year to year is an inevitable characteristic of a dynamic river system in which the magnitude of salinity reductions provided by mitigation works and measures is affected by climate, which delivers variations in dilution flows and changes in catchment salt mobilisation. In the light of this variability and its impact on salinity outcomes, modelling is undertaken to understand how improved land and water management practices and mitigation works and measures deliver salinity benefits over both wet and dry periods.

When considered over the climatic conditions during the 1975–2000 period, mitigation works and measures put in place to 2014 have delivered an average daily salinity outcome at Morgan of less than 800 EC for 98% of the time, compared with an outcome of less than 800 EC for 72% of the time that would have occurred with the works and measures that were in place in 2000. In other words, irrespective of climatic conditions, the incidence of salinity exceedance of 800 EC at Morgan has substantially declined as a consequence of BSMS implementation. The 2013/14 achievement represents the best outcome ever reported under the BSMS indicating the ongoing success of the strategy in achieving sustained salinity reductions.

This outcome is a reflection of the partnership and commitment of the Australian Government and the state and territory governments and the coordination provided by MDBA. Governance and planning are supported by the Basin Salinity Management Advisory Panel, which comprises representatives from the six partner governments: the Australian Government and the governments of Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia.

The Basin Salinity Management Strategy

The BSMS and its forerunner, the Salinity and Drainage Strategy (MDBC 1989), have been effective in the long–term management of land and water salinity through catchment works and measures and through explicit accountability arrangements that require that actions which increase River Murray salinity are offset by actions that decrease salinity elsewhere in the system.

The BSMS (MDBC 2001), established in 2001 as a 15–year strategy, is now nearing maturity. The salt interception construction program is close to completion, and the accountability arrangements are highly effective in ensuring that the river salinity impacts of changes to the landscape are assessed and reported. Building on these achievements, the MDBA and partner governments are currently developing a new salinity strategy to manage salinity risks in the Basin up to 2030.

Key achievements of the BSMS

Throughout 2013-14, the MDBA concentrated on the key tasks of reviewing and updating the salinity registers and associated modelling tools, developing and maintaining salt interception schemes, and undertaking a General Review of Salinity Management in the Basin in preparation for the development of post-2015 salinity management program. Advances were also made on how to apply recent knowledge gains associated with salinity processes in the lower Murray floodplain to modelling tools.

Other highlights in 2013–14 included:

- achievement of the Basin salinity target of an average daily salinity of less than 800 EC for at least 95% of the time at Morgan in South Australia, simulated over the 1975–2000 benchmark period (which represents the occurrence of both wet and dry climatic sequences)
- assessments made by MDBA confirming a net credit balance in the salinity registers by the state contracting governments of NSW, Victoria and South Australia
- the diversion of approximately 398,000 tonnes of salt away from the River Murray through the operation of salt interception schemes
- presentation of outcomes of the General Review of Salinity Management in the Basin to Ministerial Council who agreed to develop an updated salinity management program for the next 15 years (up to 2030)
- compliance with reporting obligations, including the Report of the Independent Audit Group for Salinity 2012–13 (MDBA 2014a) and the Basin Salinity Management Strategy 2012–13 Annual Implementation Report (MDBA 2014b).

Details of these and other MDBA achievements and reporting requirements (which are in Schedule B of the Murray–Darling Basin Agreement) are provided in this report. In addition, companion reports for 2013–14 are available for Basin state and territory governments. The separate state and territory reports provide information on the contribution to salinity management made by jurisdictions, particularly in the areas of catchment planning and on–ground works.

Key priorities for 2014–15

The priorities arise from the obligations in Schedule B of the Murray–Darling Basin Agreement, outcomes of the General Review of Salinity Management in the Basin (completed in 2013-14) and the high-priority recommendations provided by the IAG–Salinity.

In 2014–15, the main priorities for the BSMS program include the following:

1) Deliver Schedule B obligations, specifically:
   - annual reporting
   - the annual independent audit
   - reviews of accountable actions that are itemised on the salinity registers, and the assessment of new actions that may require inclusion on the salinity registers
   - ongoing review and improvements of hydrological models that underpin in–river salinity assessments.
2) Implement the key recommendations of the General Review of Salinity Management in the Basin as agreed by the Ministerial Council to:
   - develop an updated cost-effective salinity management program for the next 15 years, Basin Salinity Management 2030 (BSM2030)
   - review Schedule B of the Murray-Darling Basin Agreement to enable implementation of the BSM2030.
3) Document improvements to the River Murray flow and salinity model (MSM–BigMod) to support its accreditation to:
   - enable the use of the most up–to–date model for determining existing salinity register entries
   - provide an accredited technical basis for simulating the salinity impacts of environmental watering activities and hence enable their inclusion on the salinity register.
4) Develop, operate and maintain the joint works and measures program (the salt interception schemes) established under the BSMS and former Salinity and Drainage Strategy and review the operations of the schemes to develop options to better manage river salinity.

1. The Basin Salinity Management Strategy

The Basin Salinity Management Strategy (BSMS) provides a framework for communities and governments to work together to implement salinity control activities to protect assets and natural resource values across the Murray–Darling Basin. The strategy provides clear and transparent accountability arrangements for partner governments. Its mandatory elements are incorporated into Schedule B of the Murray–Darling Basin Agreement, which is Schedule 1 to the *Water Act 2007* (Cwlth).

1.1 Objectives and elements

The objectives of the strategy are to:

- maintain water quality of shared water resources of the Murray and Darling rivers for all beneficial uses—agricultural, environmental, urban, industrial and recreational
- control the rise in salt loads in all tributary rivers of the Basin and, through that control, protect their water resources and aquatic ecosystems at agreed levels
- control land degradation and protect important terrestrial ecosystems, productive farmland, cultural heritage and built infrastructure at agreed levels Basin–wide
- maximise net benefits from salinity control across the Basin.

The BSMS brings together nine elements to manage salinity and achieve these objectives. The elements are deliberately broad to cover Basin–scale coordination and accountability and provide a joint approach to large–scale works and measures for in–stream salinity management, such as salt interception schemes. They also include regional–scale priorities, such as improving catchment planning, farming systems and vegetation management. The elements are summarised and reported against in Section 2.

1.2 Governance of the BSMS

The state and territory governments have agreed to share responsibility for actions to meet the end–of–valley salinity targets at various valleys and the Basin salinity target at Morgan in South Australia. Specific responsibilities have been assigned to the Murray–Darling Basin Authority (MDBA) and state and territory governments within the Basin.

On behalf of the state and territory governments, MDBA is responsible for whole–of–Basin issues and outcomes associated with implementing the strategy. In partnership with catchment management organisations, state and territory governments are responsible for implementing state and regional components of the strategy and are accountable for catchment actions, assessment and monitoring. Accountabilities are explicit in relation to actions that are expected to have significant salinity impacts on the river.

Together, they deliver:

- within–valley actions and tools to control and predict salinity and salt load trends
- on–ground investment to address salinity risks and their impacts
- assessments of the effects and trade–offs associated with salinity management options

- monitoring and assessment of salinity as part of reporting progress against targets.

The Murray–Darling Basin Agreement was included as Schedule 1 of the *Water Act 2007*, leading to the establishment of MDBA in 2008. MDBA is a statutory body accountable for administering the Murray–Darling Basin Agreement. Under this legislation, MDBA is responsible for coordinating the BSMS as prescribed under Schedule B of the Murray–Darling Basin Agreement. Responsibilities include:

- establishing and maintaining salinity registers to record salinity impacts and to allocate salinity credits and salinity debits to contracting governments
- monitoring, assessing, auditing and reporting on progress in implementing the strategy
- setting and reviewing salinity targets
- constructing and operating joint works and measures and coordinating other actions to reduce or limit the rate at which salinity increases in rivers, tributaries and landscapes within the Basin.

The Australian Government is a contracting government for the Murray–Darling Basin Agreement. Its role in the BSMS and Schedule B is to report on investment programs and activities that may have an impact on salinity management in the Basin.

1.3 Salinity management into the future

A key requirement of the Water Act is the development of the Basin Plan, which was adopted by the Australian Parliament in November 2012. The Basin Plan includes the Water Quality and Salinity Management Plan and the Environmental Watering Plan. The Water Act and the Basin Plan also prescribe requirements for the development of water resource plans by state and territory governments at the regional scale. Each water resource plan will include a water quality management plan that provides in–stream salinity targets and mitigation measures that will assist in progressing towards the achievement of those targets.

The Water Quality and Salinity Management Plan adopts the salinity targets contained in Schedule B of the Murray-Darling Bain Agreement and sets out additional ‘operational’ salinity targets that must be considered when managing river and tributary flows.

In 2013-14, the MDBA and partner governments reviewed salinity management in the Basin which led to Ministerial Council agreeing to develop a new strategy to manage salinity in the Basin up to 2030. Until the new strategy is developed and the Schedule B is revised, the mandatory components of BSMS that are included in the current Schedule B will be carried forward.

1.4 BSMS 2013–14 annual implementation report

This report is a Basin–wide progress report for the 2013–14 financial year. A draft of the report was presented to the Independent Audit Group for Salinity (IAG–Salinity) in November 2014 to enable that group’s assessment of MDBA’s progress in coordinating salinity management across the Basin. In meeting their own reporting obligations, the Australian Government and the state and territory governments of the Basin produce companion salinity reports, which can be obtained from them. Information in the state and territory governments’ reports, provided to MDBA, also supports the preparation of this Basin–scale report.

The suite of state, territory and MDBA reports complies with the statutory reporting obligations of Schedule B. This report satisfies the following requirements of clause 32 of Schedule B by including:

- a consolidated summary of results and recommendations from the *Report of the IAG–Salinity 2013–14*
- a program setting out the timetable for rolling five–year reviews of accountable actions
- an update of the salinity registers as at 30 November 2014
- details of other activities that have been undertaken to meet the objectives of the BSMS since the last annual report
- a report on the operation and implementation of existing joint works and measures and on the progress of any proposed new works or measures
- results of each five–year review carried out by state and territory governments within the reporting period
- a list of MDBA reports related to the management of salinity in the preceding financial year.

2. The BSMS elements

Basin–scale salinity management under the BSMS is guided by nine elements. The elements provide a basis for reporting on progress in strategy implementation during 2013–14. This section provides an overview of each element, key MDBA initiatives (where relevant), and key achievements achieved across the Basin by partner governments.

2.1 Element 1: Capacity to implement

Successful implementation of the BSMS requires capacity development to increase knowledge, improve planning and to acquire the resources to address salinity. The BSMS has substantially increased our biophysical and socioeconomic understanding of salinity impacts, improved the success of our Basin–scale salinity management strategies and underpinned the effective operation of salinity accountability arrangements.

2.1.1 Key MDBA initiatives

In 2013–14, MDBA concentrated on the key tasks of reviewing and updating the salinity registers and associated modelling tools, developing and maintaining salt interception schemes, and undertaking a General Review of Salinity Management in the Basin in preparation for the development of post-2015 salinity management program. Advances were also made on how to apply recent knowledge gains associated with salinity processes in the lower Murray floodplain to modelling tools.

The key recommendations of the IAG–Salinity (MDBA 2014a) were incorporated into planning and the prioritisation of activities to ensure continuity and effective strategy implementation.

The key projects progressed in 2013–14 under Element 1 are discussed below.

General Review of Salinity Management in the Basin

Basin Officials Committee (August 2013) requested a review of joint salinity management activities in light of the emerging and expected significant changes in Basin salinity risks associated with water recovery and use under the Basin Plan and future land and water management activities. The review was also intended to develop an understanding about salinity management arrangements required after the current BSMS program ends in 2015. The terms of reference for the review included following questions:

- What is our understanding of the current salinity risk in the Basin?
- What is our understanding of the future salinity risk as we progress implementation of the Basin Plan and take account of emerging risks?
- What feasible salinity management options are available to meet the objectives of both the BSMS and Basin Plan given the future salinity risk?
- What is the most cost-effective strategy for managing the salinity risk to meet BSMS and Basin Plan objectives?
- What institutional arrangements are required to deliver the proposed strategy efficiently and effectively?

In response to the Basin Officials Committee request, a General Review of Salinity Management in the Basin was undertaken in 2013-14. After considering the key findings of the review, Ministerial Council agreed to:

a) develop an updated cost-effective salinity management program for the next 15 years, Basin Salinity Management 2030 (BSM2030)

b) review Schedule B of the Murray-Darling Basin Agreement to enable implementation of BSM2030.

Assessing environmental watering salinity impacts

The Living Murray (TLM) program, the states and, more recently, the Australian Government have purchased or recovered a significant share of water in the Murray–Darling Basin through water use and/or efficiency measures. This water will be used to maintain and improve the health of water–dependent ecosystems. Changes to the temporal and spatial use of water in the Basin have consequences for salt mobilisation and the dilution regime, resulting in changes in river salinity outcomes. River flow is an important consideration in the evaluation of future salinity risk given the progression towards the delivery of environmental water.

The MSM-BIGMOD model and documentation was updated and peer reviewed in 2014 to include a number of policy changes and works and measures undertaken since 2002 when the model was last documented. The updated model includes detailed modelling of TLM sites, the Chowilla salt inflow model and revised groundwater models for determining changes in salt loads. The reviewer found that the basic structure and layout of the updated model is sound and is a suitable platform for the development of baseline conditions and the assessment of various actions and impacts including environmental watering salinity impacts.

The MDBA (2014) undertook modelling to support the General Review of Salinity Management in the Basin. The modelling provided indicative results of likely changes to long-term salinity levels

against the benchmark period related to the potential dilution effect of the Basin Plan environmental water recovery and use and changes to SIS capacity. The MDBA (2014) undertook modelling to support the General Review of Salinity Management in the Basin. The modelling provided indicative results of likely changes to long-term salinity levels against the benchmark period related to the potential dilution effect of the Basin Plan environmental water recovery and use and changes to SIS capacity.

Information coordination and dissemination

A key role for MDBA is to coordinate Basin–scale information on progress towards BSMS implementation. This role includes the publication of BSMS annual reports and other technical reports, providing opportunities to further disseminate information about salinity management in the Basin to the scientific and broader communities.

The following reports were finalised by the MDBA during 2013–14:

- Report of the Independent Audit Group for Salinity 2012–13
- BSMS 2012–13 Annual Implementation Report
- BSMS 2012–13 Summary
- Riverine Plains Salinity Framework – Project overview and summary report
- Assessing the salinity impacts on changes to Irrigation on the Riverine Plains - Phase I report
- Assessing the salinity impacts on changes to irrigation on the Riverine Plains – Phase II Gap Analysis
- Assessing the salinity impacts on changes to irrigation on the Riverine Plains – Phase III and IV reports

2.1.2 Key achievements across the Basin by partner governments

The following key achievements were reported by partner governments:

- SA commenced a project in partnership with the Goyder Institute, Department of Environment, Water and Natural Resources, Flinders University and CSIRO to model salt dynamics on the River Murray floodplain. This project will assist in describing, prioritising and locating the processes most likely to contribute to the mobilisation of floodplain salt
- NSW continued its research project ‘Key Sites’ to monitor salinity and groundwater at six sites. Results from 2013/14 reconfirmed that climate is the driving mechanism in groundwater responses and salt mobilisation
- In QLD, the three regional bodies (Condamine Alliance, Queensland Murray Darling Committee and South West NRM) continue their work engaging with landholders and other stakeholders and taking salinity into consideration when implementing improved land management practices
- A total of 20 sustainable agriculture workshops were held for dryland farming in Victoria, with more than 400 land managers covering 315 farming entities attending. The workshops

focused on maintaining and improving groundcover, maintaining and improving soil structure and improving soil health over more than 2100 ha of farm land

- The Shepparton Irrigation Region Salt and Water Balance Project in Victoria developed a Salinity Risk Management System as an interactive online portal for use by farmers and Government. It will provide targeted and up-to-date information and analysis to optimise the management of salinity threats and sub-surface drainage through groundwater pumping and re-use.

2.2 Element 2: Values and assets at risk

The BSMS seeks to maintain the water quality of rivers and control land degradation while protecting important ecosystems, productive farmland, cultural heritage and infrastructure. Hence, the protection of key values and assets at risk from salinity is fundamental to the BSMS.

Basin partner governments work with communities to identify values and assets that require protection from the impacts of salinity at a local scale.

The BSMS state and territory governments' 2013–14 salinity reports describe progress against this element of the strategy.

2.2.2 Key achievements across the Basin by partner governments

The following key achievements were reported by partner governments:

- SA in partnership with the Australian Government announced a $60 million project to help prevent excessive salinity levels in the Coorong South Lagoon. This will restore inflows by diverting additional water from the Upper South East Drainage Network into the Coorong South Lagoon
- QLD continued a number of groundwater investigations with three reports on temporal trends in groundwater levels in the Border Rivers, Lower Balonne, and Condamine catchment completed. These used data from over 630 monitoring bores
- A new project in QLD to evaluate the role of trees in alleviating the adverse effects of excess deep drainage in irrigation areas is underway in the Border Rivers catchment. This includes installing sap flow meters, analysis of soil properties, vegetation assessment and groundwater sample collection.

2.3 Element 3: Setting salinity targets

Under the BSMS and Schedule B to the Murray–Darling Basin Agreement, salinity targets have been established for the Basin in the River Murray at Morgan in South Australia and for major tributary valleys at end–of–valley target sites (see Section 3).

The Basin salinity target is to maintain the average daily salinity at Morgan at a simulated level of less than 800 EC for at least 95% of the time. This is modelled over the benchmark period (1975–2000) under the current land and water management regime. The benchmark period provides a mechanism for consistently assessing water salinity outcomes over a climatic sequence that includes both wet and dry periods.

End–of–valley targets for major tributary valleys enable assessment of progress towards achieving the strategy's objectives; provide the impetus for catchment actions within the valleys that contribute to achieving the Basin salinity target at Morgan. The Murray–Darling Basin Ministerial Council adopted all the state-based end–of–valley targets in 2004–05; the Australian Capital Territory (ACT) end–of–valley target was adopted in 2010–11.

The end-of-valley targets were reviewed in 2012–13 to determine their adequacy and appropriateness. However, due to the recently completed General Review of Salinity in the Basin and the pending review of Schedule B and the development of a new strategy, actions in response to recommendations of the end-of-valley targets review report will not be fully considered until future directions on the approach to Basin–scale salinity management are resolved.

2.3.1 Measured salinity outcomes at Morgan

While progress against BSMS salinity targets is assessed based on modelled river salinity outcomes over the benchmark period, a series of salinity management actions undertaken over several years under the BSMS and its forerunner, the Salinity and Drainage Strategy (MDBC 1989), have had a notable positive impact on measured, or recorded river salinity.

The Basin community has an interest in understanding the measured salinity outcome, as the duration and extent of peak salinity levels may have day–to–day implications for some aquatic ecosystems and the acceptability of water quality for drinking and irrigation purposes. Accordingly, this section provides an overview of river salinity for 2013–14 compared to long-term river salinities.

Table 1 provides statistics on salinity levels measured at Morgan over four time intervals (1, 5, 10 and 25 years) to June 2014 and enables a comparative assessment of average, median, 95 percentile and peak salinity outcomes for 2013–14.

The measured salinity data presented in Table 1 reflects climatic and river hydrological variations for the respective period, along with the progressive implementation of management interventions In general, the 2013–14 average measured salinity levels at Morgan were lower than the long–term average values over , 10 and 25–year periods. This outcome is a consequence of both the prevailing climatic periods covered by the respective reporting periods and the progressive implementation of the salinity mitigation programs mentioned above. Other points of interest are that the measured 95 percentile salinity has not exceeded 800 EC at Morgan over any of the assessment periods and that the peak river salinity at Morgan has not exceeded 800 EC in the past decade.

Table 1: Summary of measured salinity levels (EC) at Morgan, South Australia

Period	Time interval	Average	Median (EC)	95 percentile (EC)	Peak	% Time more than 800 EC
1 year	July 2013 - June 2014	355	349	590	650	0%
5 years	July 2009 - June 2014	346	327	585	687	0%
10 years	July 2004 - June 2014	390	377	624	768	0%
25 years	July 1989 - June 2014	482	451	780	1087	4%

2.3.2 Impacts of salinity management actions

In addition to climatic factors and river conditions, the cumulative benefits of salinity mitigation works and measures, such as SISs and improvements in irrigation practices and delivery systems, have also contributed substantially to the low salinity levels summarised in Table 1. SISs are highly beneficial to in-stream salinity outcomes during extended periods of low flows.

Figure 1 presents mean daily salinity levels for 2013–14 recorded at Morgan and simulated (modelled) salinity levels representing a 'no further intervention' scenario for the same period. The 'no further intervention' scenario simulates river salinity levels that would have occurred if post–1975 SISs, improved land and water management actions and dilution flows were not undertaken. The word 'further' is used because a number of SISs were operating before 1975, so their effects are not included in the simulated salinity levels. The simulated no further intervention salinity levels are derived from river model runs which can model historical salinity levels with and without intervention activities. The difference between the observed and the simulated no further intervention salinity levels are assumed to be the effect of management interventions.

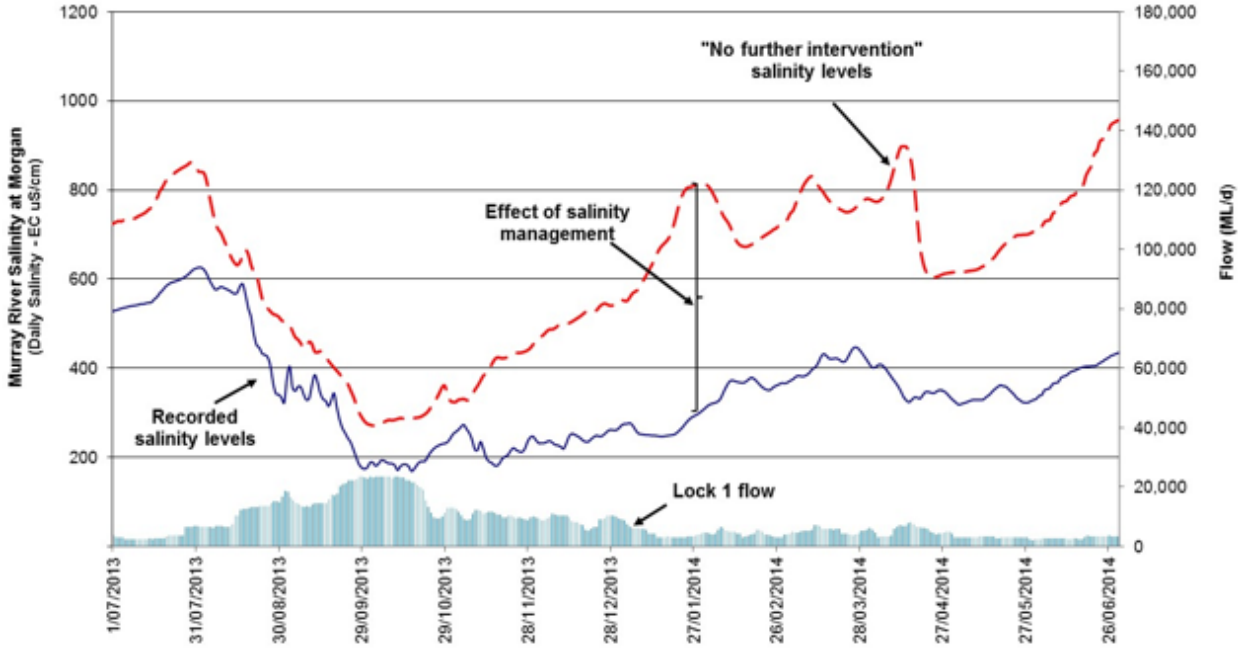


Figure 1 Comparison of mean daily salinity levels at Morgan from July 2013 to June 2014 to modelled 1975 'no further intervention' salinity levels.

Note: Actual salinity levels are compared to modelled salinity levels without salt interception schemes, improved land and water management actions and additional dilution flows ('no further intervention' scenario).

Figure 2 shows the long–term difference over the period from July 1985 to June 2014 between observed mean daily salinity and simulated salinity under the 'no further intervention' scenario. The progressive increase in the difference between the observed and simulated salinity indicates a long–term reduction in salinity (both average trend and peak levels) linked to a number of management interventions (SIS, improved land and water management actions, and dilution flows).

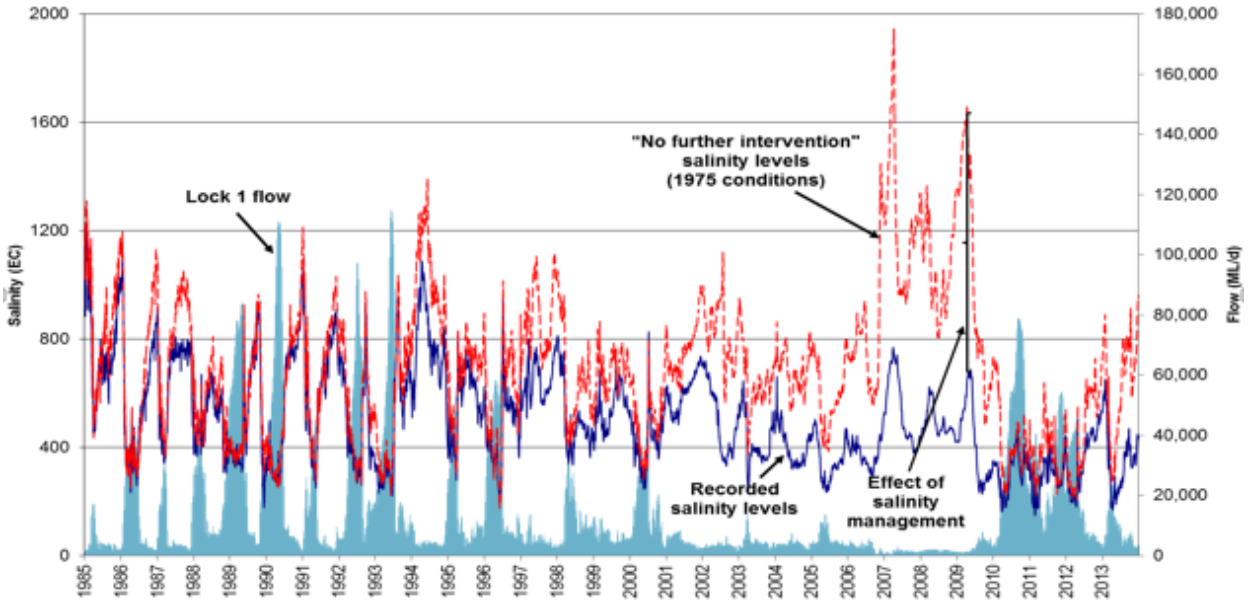


Figure 2 Effect of salinity management in the Murray–Darling Basin at Morgan, South Australia.

Note: Comparison of recorded mean daily salinity levels and modelled salinity levels without salt interception schemes, land and water management actions and additional dilution flows over a 27-year period (July 1985 to June 2014).

River salinity levels increase progressively downstream because of both natural groundwater discharge to the river and accelerated salt mobilisation caused by human development activities. The cumulative effects of these factors result in higher salinity in the lower River Murray. Figure 3 demonstrates this progressive increase in salinity downstream with four datasets at specific reaches along the River Murray. The baseline median line is developed from simulated median values using the baseline conditions for the year 2000. These are baseline salinity levels at Morgan that were set at the beginning of the BSMS and against which future progress could be assessed. For South Australia, New South Wales (NSW) and Victoria, baseline conditions are set at 1 January 1988, while for Queensland and the ACT, baseline conditions are set at 1 January 2000. Also shown in Figure 3 is the median recorded salinity for each of the past three years.

The data illustrates that the median salinity for 2013–14 was lower than the 2000 simulated levels at all sites, including Morgan, South Australia, where the BSMS Basin salinity target is set. The 2013–14 median salinities were also below that achieved in 2012-13 except for the reading at Murray Bridge. This seems to indicate that increased salt mobilisation post-flood from recharged floodplains and near river groundwater systems has not been significant. Salinity below Morgan, and in particular below Murray Bridge, can vary significantly depending on the prevailing salt concentration in the Lower Lakes and flow conditions upstream of Lock 1.

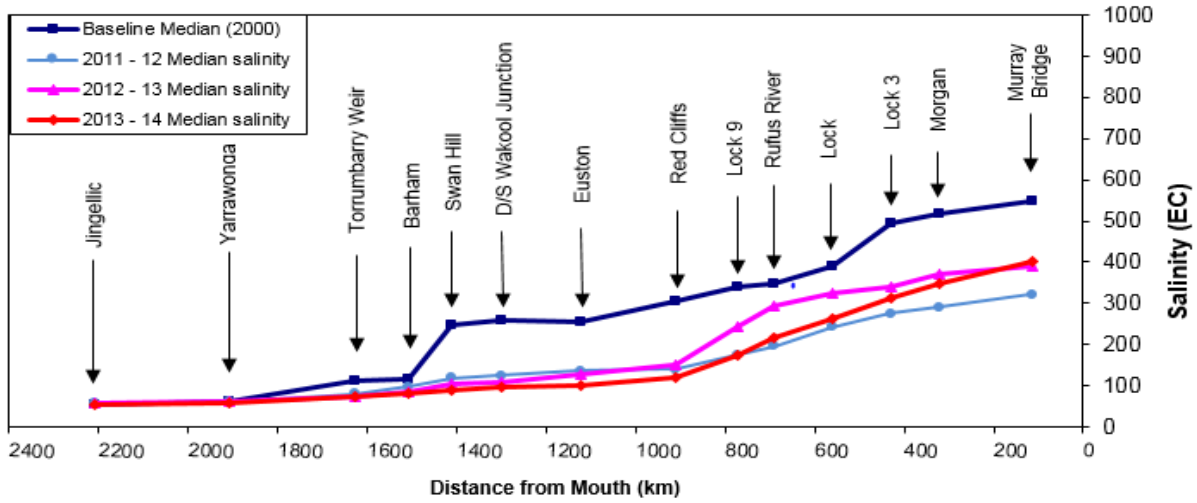


Figure 3 River Murray salinity profile: comparison of median salinity levels of 2013–14 with those of recent past years and the baseline median salinity level for the benchmark period (1975–2000)

2.3.3 Performance against the Basin salinity target

Improvements in the management of salinity to date can be assessed by modelling (over the benchmark period) outcomes for baseline condition levels of development and salinity mitigation, and comparing them with outcomes based on 2013–14 levels of development and salinity mitigation.

As the climatic regime (that is, the benchmark period of 1975 to 2000) is the same for both simulations (baseline and 2013-14), the difference in EC outcome between the two scenarios is the improvements that have been made due to BSMS actions. Table 2 indicates that, based on 2013–14 levels of land and water use (including salinity mitigation), river salinity at Morgan is less than 800 EC for 98% of the time—hence, the strategy has met the target. A comparison of this result with baseline conditions, under which salinity was less than 800 EC for 72% of the time, demonstrates that under the defined variable climatic regime, the incidence of salinity exceedance of 800 EC at Morgan has substantially declined.

Table 2: Simulated salinity (EC) summary statistics at Morgan, South Australia, for baseline and 2014 conditions over the 1975 to 2000 climatic period

Period	Time interval	Average	Median (EC)	95 percentile (EC)	% time greater than 800 EC	% time less than 800 EC
25 years	Modelled baseline conditions in the period 1975-2000	665	666	1058	28%	72%
25 years	Modelled 2013/14 conditions in the period 1975-2000	472	455	721	2%	98%

Note: Baseline conditions are set at 2000. However, salinity impacts arising from development activities between 1988 and 2000 in NSW, Victoria and South Australia are accountable under the BSMS and have been excluded from the baseline. Hence, for NSW, Victoria and South Australia, the baseline represents 1988 conditions.

Another illustration of the success of management intervention is the improvement in river salinity due to management actions. This outcome can be captured by modelling (over the 1975–2000

benchmark period) the salinity outcome at Morgan in response to progressive changes in development and mitigation works and measures over time.

The results from these simulations are presented in Figure 4, in which the modelled 95 percentile salinity progressively falls from 1988 to 2013 in response to the progressive implementation of mitigation works and measures. Figure 4 shows that the target of less than 800 EC for 95% of the time was achieved and maintained from 2010 under these simulated conditions. This is a significant outcome and a tangible demonstration of the benefits arising from substantial and cooperative salinity mitigation investment by the Australian, South Australian, Victorian and NSW governments.

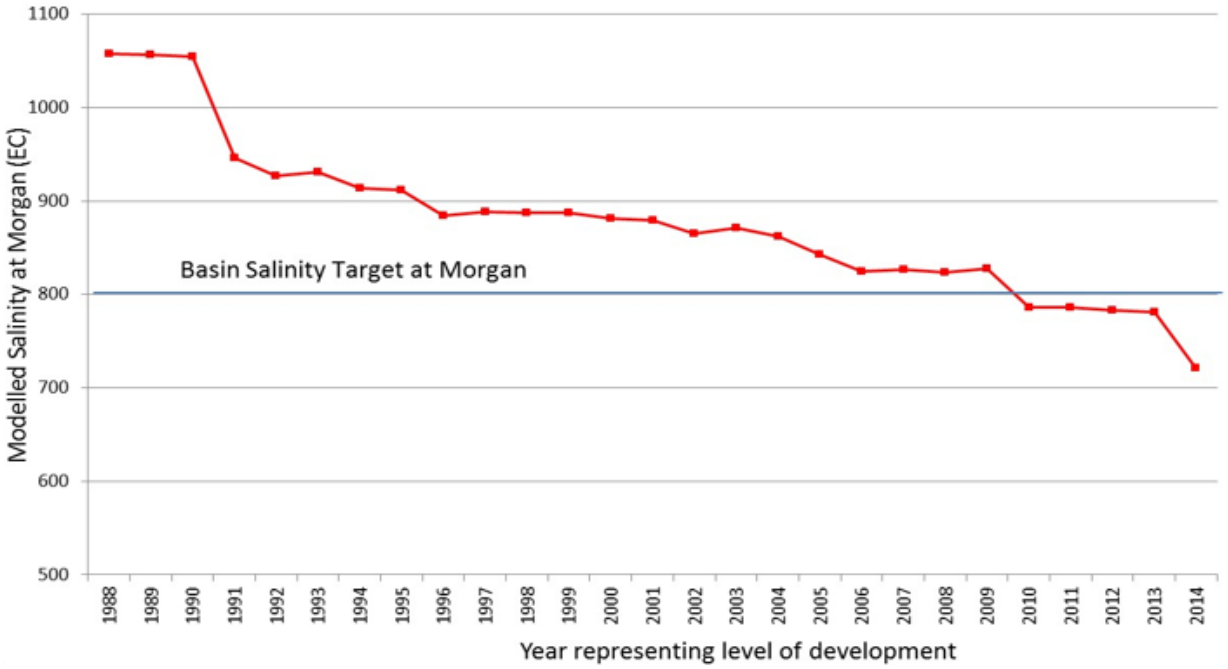


Figure 4 Modelled 95 percentile salinity over the 1975-2000 Benchmark period at Morgan in South Australia due to the implementation of salinity management programs from 1988 to 2014

2.4 Element: 4 Managing trade–offs with available within–valley options

State and territory governments are expected to analyse and review the best mix of land management, engineering, river flow, and 'living with salt' options to achieve salinity targets while meeting other catchment health objectives and social and economic needs. These activities include providing assistance to communities to understand salinity management options and reaching agreement on options with affected groups, industries and people through best-practice planning processes.

2.4.1 Key achievements across the Basin by partner governments

The following key achievements were reported by partner governments:

- SA used its River Murray Annual Operation Plan to achieve 100% compliance with salinity targets. In addition, salinity levels in Lake Albert decreased by approximately 900EC to 2,100 EC

- The Billabong Creek 'green offsets' project continued to operate in NSW, with some 3,000 tonnes of saline groundwater prevented from entering Billabong Creek. This innovative project enables moderately saline water to be discharged to the River Murray with the discharge offset by the Salt Interception Scheme on Billabong Creek
- South West NRM in QLD commenced review of its NRM Plan with stakeholder workshops conducted between November 2013 and January 2014. The Condamine Alliance has created a 29 member Advisory Team to review and guide the development of their 2015 NRM plan
- The Sustainable Agriculture program in Victoria conducted 20 sustainable agriculture workshops for dryland farming. 315 farming entities comprising more than 400 land managers attended these workshops. These workshops managed trade-offs by focusing on management strategies that aimed to maintain and improve groundcover, soil structure and soil health for more than 2100 ha of farm land
- In Victoria, the Mallee CMA's five-year review of the Nyah to South Australia Border Salinity Management Plan established that the salinity impacts associated with irrigation development in the Mallee region are being over-estimated.

2.5 Element 5: Implementation of salinity and catchment management plans

This element encompasses the recognition that communities have made significant contributions to improved land and water management through the development of plans for regions and catchments. Nevertheless, plans and actions that have significant effects on land or water management require assessment and reporting against the end–of–valley and Basin targets and must be recorded on the salinity registers. Continuing support by the Australian Government and state and territory governments for land and water management plans in irrigation regions, and the development and implementation of salinity and catchment management plans in dryland regions, is required in order to fully meet the expectations of the BSMS.

2.5.1 Key achievements across the Basin by partner governments

The following key achievements were reported by partner governments:

- The River Murray Water Allocation Plan (WAP) which contains the principles that minimise salinity impact associated with irrigation is formally being amended. It is proposed to include the South Australia Salinity Zoning Policy and water use efficiency principles within the revised WAP
- NSW established Local Land Services to replace the existing Catchment Management Authorities. Local Land Services will now be responsible for implementing the locally developed Catchment Action Plans
- The Great Artesian Basin Sustainability Initiative (GABSI) continued. As of June 30 2014, some 164 uncontrolled bores have been rehabilitated, and around 8,755 km of bore drains have been replaced with pipelines. This work has resulted in an estimated flow savings of 71,000 ML per annum, and a sizeable reduction in salt mobilisation to streams from bore drains

- Victorian CMAs developed Regional Waterway Strategies in consultation with regional agencies, local communities and stakeholders. They will provide a single planning document for river, estuary and wetland management in each region and a high-level work program to guide investment over an eight-year period Draft strategies were released for public consultation in 2013/14and will be finalised in 2014/15
- ACT drafted its new water strategy 'Striking the Balance' ready for launch in late 2014. This strategy will seek to deliver three outcomes related to healthy catchments and water bodies, sustainable and efficient water supply, and communities that value and enjoy clean and healthy catchments.

2.6 Element 6: Redesigning farming systems

This element considers the improvements needed in farming to control groundwater recharge in dryland cropping and pastoral systems. It also acknowledges the need for research and development to improve farming systems to reduce salinity risk without jeopardising the viability of farming enterprises.

The final report of the BSMS mid–term review (MDBC 2008) stated that:

- A major emphasis should be on irrigated land since it is these areas that are likely to have the greatest impacts on salinity targets. Opportunities for proactive intervention to influence salinity outcomes from new developments and retirement of irrigation should also be contemplated for implementation under this element.

Investments in irrigation practices and improved irrigation delivery infrastructure have delivered significant salinity benefits where there is a large irrigation footprint.

2.6.1 Key achievements across the Basin by partner governments

The following key achievements were reported by partner governments:

- On-farm irrigation efficiency projects continued to be implemented in SA. To date, 150 projects have been assessed for funding, and it is likely that an additional $30 million will be available from the Australian Government for further projects which could save 17,000ML. As well as saving water, these projects reduce deep drainage below the root zone and minimise saline groundwater discharge to the River Murray
- Grazing management and property planning and training activities continued in NSW
- The Healthy Headwaters Water Use Efficiency project in QLD continued with a total of 44 projects now approved for funding by the Australian Government. Of these 24 are currently in construction, and 10 are in contract negotiation. Some 22,000 ML of water will be saved through these projects
- Victorian CMAs continued to provide financial support to landholders to develop whole farm plans, implement drainage reuse systems, conduct soil salinity surveys and undertake other activities to improve farming practices. In the 2013/14 period Whole Farm Plans were completed over nearly 18,000 ha of irrigation and 67,000 ha of dryland properties; reuse systems were constructed to service over 6,500 ha of irrigated land and soil salinity surveys were conducted on 3,650 ha. Irrigation systems upgrades were also completed on 12,000 ha.

2.7 Element 7: Targeting reforestation and vegetation management

This element refers to partner governments' recognition that landscape changes specifically targeted at salinity control may be required in addition to changes to farming systems. Such changes may include native vegetation management, rehabilitation and land stewardship. Commercial planting of short–rotation tree crops may also be considered under this element.

2.7.1 Key achievements across the Basin by partner governments

The following key achievements were reported by partner governments:

- The BushBids program in SA continues to protect and manage existing native vegetation. Across SA some 19,000 ha of native vegetation has been included in the program so far
- The Minister for the Environment in NSW appointed an independent panel to undertake a comprehensive review of the Native Vegetation Act 2003, the Threatened Species Conservation Act 1995, and the related biodiversity legislation
- QLD's vegetation management framework was reformed in December 2013. Significant reforms included the development of new state-wide mapping, and 15 new self-assessable vegetation clearing codes were released
- In Victoria, recharge management improvement works were completed on nearly 120,000 ha of land. This included revegetation activities, protection of existing native vegetation, tree establishment, perennial pastures, lucerne, and improved cropping and grazing regimes.

2.8 Element 8: Salt interception works

The Joint Works and Measures program provided for under Schedule B has focused on the construction and ongoing efficient and effective management of salt interception schemes to maintain water quality in the River Murray for agriculture, environmental, urban, industrial and recreational uses. The BSMS's intention to achieve a 61 EC reduction in average salinity at Morgan by 2007 comprised 31 EC to offset the impact of past actions (pre-1988) and 30 EC shared equally between New South Wales, Victoria and South Australia to offset state accountable actions (post-1988).

New South Wales, Victoria and South Australia, together with the Australian Government, have funded the construction or rehabilitation of fourteen salt interception schemes. During 2013-14 the:

- construction of the Murtho scheme in South Australia was completed
- commissioning work associated with the upper Darling scheme in New South Wales was completed
- first phase of the refurbishment of the Mildura-Merbein scheme in Victoria was finalised.

The total expenditure under the construction program for the 2013-14 year was just over $1,000,000.

With the finalisation of construction of both the Murtho and Upper Darling Schemes, the 61 EC program of Joint Works as agreed to by the Ministerial Council in 2001 will be competed.

2.8.1 Design and construction of new schemes

Upper Darling

Construction of the Upper Darling salt interception scheme (near Bourke, New South Wales) was complete in 2011-12. However as a result of continued flooding in the Darling River, the formal commissioning of this scheme was not finalised until 2013-14.

Murtho

Construction and formal commissioning of the Murtho salt interception scheme was competed during 2013-14.

Mildura–Merbein rehabilitation

The original Mildura-Merbein scheme was decommissioned in 2012. Construction of phase one of the rehabilitation of this Scheme has now been completed. However work has been deferred on phase two of this rehabilitation work until there is agreement as to which disposal location is to be adopted.

Commissioning of phase one of this scheme will be finalised in 2014-15.

2.8.2 Scheme operation and maintenance

Operation of the various salt interception schemes has continued to be highly successful in terms of in-river outcomes. As detailed in Table 3 below, the currently operational salt interception schemes diverted approximately 398,000 tonnes of salt away from the River Murray in 2013-14.

In 2013-14, operation and maintenance of the existing MDBA salt interception scheme assets continued to focus on minimising running costs, in particular the energy costs associated with pumping.

However as a result of limited funding availability, the Rufus River Scheme was mothballed. Although joint funding was also withdrawn from the Upper Darling scheme, the New South Wales Office of Water directly funded commissioning processes during the year.

Table 3: Joint salt interception scheme performance report 2013-14

Salt interception scheme	Volume pumped (ML)	Salt load diverted (tonnes)	Average salinity (EC units)	Performance achieved (percentage of time)	Total power consumption (kWh)
Pyramid Creek	1,155	29,241	40,971	100%	202,753
Barr Creek	5,486	24,165	7,003	100%	100,138
Mildura–Merbein	0	0	N/A	N/A	N/A
Mallee Cliffs	1,566	52,467	52,333	100%	493,365
Buronga	2,175	61,505	44,183	100%	465,864
Pike	421	19,295	56,100	100%	108,021
Bookpurnong	1,036	27,766	41,827	69%	381,095
Loxton	1,009	14,762	24,545	86%	398,473
Woolpunda	4,866	96,606	31,929	94%	3,075,848
Waikerie	3,658	71,932	31,603	88%	1,513,300
Rufus River	0	0	N/A	N/A	N/A
Totals	21,372	397,739			6,738,856

2.9 Element 9: Basin–wide accountability: monitoring, evaluating and reporting

Element 9 covers Basin–wide accountability, focusing on MDBA's responsibility to maintain the salinity registers, which record the salinity effect and cost of accountable actions and delayed ('Legacy of History') salinity impacts. This element also ensures that salinity is monitored appropriately, progress on salinity targets at the Basin–wide scale is reported and an independent audit of the registers and contracting governments' progress in meeting salinity targets and implementing the BSMS is undertaken.

MDBA is supported in this role by significant work by state and territory governments carrying out rolling five–year reviews of salinity register entries and annual reporting, which together enable MDBA to update the salinity registers and provide information for the independent auditors.

2.9.1 Independent audit of the BSMS

Schedule B requires that the Independent Audit Group for Salinity (IAG–Salinity) be appointed by MDBA to carry out an annual audit. Auditing is an integral part of the BSMS, ensuring a fair and accurate annual assessment of the contracting governments' and MDBA's performance against the provisions of Schedule B of the Murray–Darling Basin Agreement.

The IAG–Salinity undertook the 2013–14 BSMS audit in November 2014 and provided its report to MDBA (MDBA 2015). The report included an assessment of the state and territory governments' and MDBA's implementation of the strategy and provided recommendations to support continuous improvement. Progress on activities in response to the audit recommendations is reported to the Ministerial Council in this report (Appendix A).

2.9.2 The BSMS salinity registers

The salinity registers are a critical aspect of the BSMS and are a working example of an effective environmental accountability framework. The registers provide a primary record of jurisdictional accountability for actions that affect river salinity.

The registers are an accounting tool providing a record of the debit and credit balance of accountable actions that significantly affect salinity at Morgan (that is, actions that would result in a change of average daily salinity of at least 0.1 EC within 100 years). This accounting system provides a transparent basis for making decisions on Basin–wide trade–offs on salinity management actions and investments in joint works and measures.

Actions that reduce river salinity are recorded as credits, while actions likely to increase river salinity are recorded as debits. Actions such as new irrigation developments may generate a debit on the salinity register because in some areas they may lead to increased salt loads to the River Murray. Actions such as constructing SISs and improvements in irrigation practices can generate a credit on the salinity register. In addition, actions such as permanent water transfers in or out of an irrigation area may result in a credit or debit on the salinity register.

State and territory governments report annually to MDBA, providing new or updated information on accountable actions. This information is collated and analysed to update the registers each year. The updated registers are then reviewed by the IAG–Salinity. Updating the credits and debits to the River Murray enables changes in river salinity impacts to be tracked over a consistent climatic period. It also provides estimates of the economic costs and benefits arising from these salinity effects.

There are two salinity registers, Register A and Register B:

- Register A records the impacts of each accountable action that occurred after the baseline date (1988 for NSW, Victoria and South Australia, 2000 for Queensland and the ACT) and includes jointly funded works and measures
- Register B accounts for ‘Legacy of History’ or delayed salinity impacts, which have an effect on salinity levels after 2000 but which are the result of actions taken before 1988 (2000 for Queensland and the ACT)
- The success of the BSMS in delivering significant salinity improvements for the Basin stems from jurisdictional agreement both to be accountable for salinity debits and credits on the registers and to undertake actions together that lead to material improvements in river salinity. Such actions include those jointly undertaken under MDBA–coordinated programs (joint works and measures) and those undertaken by two or more states independently of MDBA (shared works and measures). Hence, ‘jointly funded works and measures’ refers to SISs constructed as part of the Salinity and Drainage Strategy (MDBC 1989) and those constructed more recently under the BSMS. State shared works, on the other hand, are driven by jurisdictional initiatives such as adopting targeted river operating rules that provide downstream salinity benefits. ‘Joint works and measures’ and ‘shared measures’ are shown separately on the salinity registers, with the benefits shared between states. They are distinguishable from individual state actions for which the particular state gains either a debit or a credit
- The updated salinity registers, including new and updated entries as at November 2014, are provided in Appendix B and summarised in Table 4.

Register A entries

During 2013–14, MDBA approved the following changes to the Register A entries:

- Added a new register entry for Murtho Salt Interception Scheme as joint works and measures
- Added two new register entries for Stage II of the Reduced Irrigation Salinity Impact from NSW and Victoria for the Colignan to Red Cliffs river reach
- Added a new register entry for Upper Darling Salt Interception Scheme as joint works and measures
- Included salinity impact assessments of The Living Murray and River Murray Increased Flows (TLM-RMIF) as provisional register entries
- Updated the register entry for South Australian Irrigation Based on Site Use Approvals
- Change confidence rating for Nyah to South Australian Border Salinity Management Plan as a result of completion of the 5-year review.

Register B entries

During 2013–14, the MDBA updated the transfers from Register A to B to include the Register B component of Upper Darling and Murtho Salt Interception Schemes.

Table 4: Summary of the 2014 salinity register

Actions	NSW ($m/yr)	Vic. ($m/yr)	SA ($m/yr)	Qld ($m/yr)	ACT ($m/yr)	Commonwealth contribution (EC)
Joint works & measures	3.352	3.352	1.569	0	0	37
State shared works & measures	0.188	0.188	0	0	0	0
State actions	3.514	3.210	3.512	tbd	tbd	1.0
Total Register A	7.054	6.750	5.081	tbd	tbd	39
Transfers to Register B	1.183	0.944	2.739	0	0	0
Total Register B[a]	0.902	0.100	2.422	0	0	0
Balance—Registers A & B	7.956	6.850	7.502	0	0	39

tbd = to be determined.

a -Total includes transfers from Register A.

Positive numbers ($m/year) indicate credit entries; negative numbers ($m/year) indicate debit entries.

Rolling reviews

To support continuous improvement in estimates of the salinity and cost impacts, each accountable action in the salinity register is reviewed every five years. In addition, an independent technical peer review is required to provide rigour to any changes recommended to the salinity register entries. Table 5 and Table 6 summarise the status of rolling five–year reviews and are followed by an overview of specific progress on reviews for both Register A and Register B.

Table 5: Status of rolling five–year reviews for all Salinity Register A entries, as at June 2014

Authority register accountable actions	Last review [a]	Next review date	Comment on status of review
JOINT WORKS AND MEASURES			
Former Salinity and Drainage Works			
Woolpunda SIS	2007	2012	Scheduled to be completed in 2014–15. Model accredited in 2013; awaiting finalisation of 5–year review as part of the review of all Waikerie & Woolpunda SISs.
Improved Buronga and Mildura–Merbein Interception Scheme	2005	2010	Buronga rebuilt; 5–year review expected to be completed in 2014–15. Mildura–Merbein Scheme being refurbished; 5–year review expected following commissioning of refurbished scheme.
New Operating Rules for Barr Creek Pumps	2011	2016	Review not currently required.
Waikerie Interception Scheme	2007	2012	Model accredited in 2012; awaiting finalisation of 5–year review as part of the review of all Waikerie SISs. Scheduled to be completed in 2014–15.
Changed MDBC River Operations, 1988 to 2000	2005	2010	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
Mallee Cliffs SIS	2013	2018	Review not currently required.
Changed Operation of Menindee and Lower Darling	2005	2010	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
Waikerie SIS Phase 2A	2007	2012	Model accredited in 2012; awaiting finalisation of 5–year review as part of the review of all Waikerie SISs. Scheduled to be completed in 2014–15.
Changed MDBC River Operations 2000 to 2002	2006	2011	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
Basin Salinity Management Strategy			
Changed MDBC River Operations after 2002	2005	2010	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
Pyramid Creek Stage 1 (Joint Scheme)	2010	2015	Review not currently required.
Bookpurnong Joint Salt Interception Scheme	2013	2018	Review not currently required.
Improved Buronga Scheme	2006	2011	Scheduled to be completed in 2014–15.
Loxton SIS	2013	2018	Review not currently required.
Waikerie Lock 2 SIS	2010	2015	Model accredited in 2012; awaiting finalisation of 5–year review as part of the review of all Waikerie SISs.

Authority register accountable actions	Last review [a]	Next review date	Comment on status of review
Upper Darling SIS	2014	2019	Review not currently required
Murtho SIS	2014	2019	Review not currently required
The Living Murray Works and Measures and Water for Rivers			
The Living Murray and Water River Murray Increased Flows 570 GL	2014		Provisional entry
The Living Murray Works and Measures	2014		Provisional entry
STATE WORKS and MEASURES			
Shared NSW and Victoria			
Permanent Trade Accounting Adjustment—NSW to Victoria	2006	2011	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
Barmah–Millewa Forest Operating Rules	2006	2011	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
NSW			
Boggabilla Weir	2007	2012	No change to the this assessment since the previous one, the next update will occur after Source models for the Barwon Darling and NSW Border Rivers are completed by 2017
Pindari Dam Enlargement	2007	2012	No change to the this assessment since the previous one, the next update will occur after Source models for the Barwon Darling and NSW Border Rivers are completed by 2017
Tandou Pumps from Lower Darling	2005	2010	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
NSW MIL LWMPs	2010	2015	Review not currently required – due to the significant analysis required, update may be delayed until 2016.
NSW Changes to Edward-Wakool and Escapes	2005	2010	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
Permanent Trade Accounting Adjustment—NSW to SA	2005	2010	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
NSW Sunraysia Irrigation Development 1997–2006	2007	2012	No updates due to no new development approvals.
RISI NSW	2010	2015	Review not currently required.
RISI NSW – Stage 2	2014	2019	Review currently not required
NSW S&DS Commitment Adjustment	n/a	n/a	One–off adjustment; 5–year, review not required.
Victoria			
Barr Creek Catchment Strategy	2013	2018	Review not currently required.

Authority register accountable actions	Last review [a]	Next review date	Comment on status of review
Tragowel Plains Drains at 2002 level	2013	2018	Review not currently required.
Shepparton Salinity Management Plan	2008	2016	Victoria has asked to delay the review until 2016.
Nangiloc–Colignan Salinity Management Plan	2013	2018	Review not currently required.
Nyah to SA Border Salinity Management Plan—Irrigation Development	2014	2019	Review not currently required.
Kerang Lakes/Swan Hill Salinity Management Plan	2010	n/a	This register entry, known as the Lake Charm Outfall Channel 5–year review, was submitted to MDBA in 2010. It is expected that it will be superseded by a new entry (mid–Murray Storages Register A entry).
Campaspe West Salinity Management Plan	2010	2015	Review expected to commence in 2014/15.
Psyche Bend	2011	2016	Review not currently required.
Permanent Trade Accounting Adjustment—Victoria to SA	2005	2010	Review initiated by MDBA; expected to be completed upon approval of updated MSM BigMod model.
Woorinen Irrigation District Excision	2010	n/a	It is expected that this entry will be superseded by a new mid–Murray Storages Register A entry.
Sunraysia Drains Drying Up	2011	2016	Review not currently required.
Lamberts Swamp	2011	2016	Review not currently required.
Churchs Cuts Decommissioning	2010	2015	Review not currently required- to be undertaken as part of Pyramid Creek Stage 1 review.
Mallee Drainage Bore Decommissioning	2013	2018	Review not currently required.
Vic. RISI	2010	2015	Review expected to commence in 2014/15
Vic RISI - Stage 2	2014	2019	Review not currently required.
Victorian S&DS Commitment Adjustment	n/a	n/a	One–off adjustment; 5–year review not required.
South Australia [b]			
SA Irrigation Development Based On Footprint Data	n/a	n/a	To be updated with MODFLOW models when updated for 5–year review. Next update will include Waikerie, Woolpunda and Pike-Murtho areas. Scheduled to be completed in 2014–15.
SA Irrigation Development Due to Water Trade	n/a	n/a	This entry will be replaced by the Irrigation Development Based on Footprint entry as the underpinning MODFLOW models are replaced.
SA Irrigation Development Based On Site Use Approval	n/a	n/a	This entry will be replaced by the Irrigation Development Based on Footprint entry as the underpinning MODFLOW models are replaced.

Authority register accountable actions	Last review [a]	Next review date	Comment on status of review
SA Component of Bookpurnong Scheme	2013	2018	Review not currently required.
SA Component of Loxton SIS	2013	2018	Review not currently required.
Waikerie Lock 2 SA Component	2010	2015	Model accredited in 2012; awaiting finalisation of 5–year review as part of the review of all Waikerie SISs. Scheduled to be completed in 2014–15.
SA Improve Irrigation Efficiency & Scheme Rehabilitation Reg A	2012	2017	To be updated with MODFLOW models when updated at the next 5–year review. Next update will include Waikerie, Woolpunda and Pike-Murtho areas. Scheduled to be completed in 2014–15.
Qualco Sunlands GWCS	2007	2012	Model accredited in 2012. Scheduled to be completed in 2014–15.
Pike Stage I SIS	2012	2017	Review currently not required.
SA Component of Murtho SIS	2014	2019	This entry will be updated when assessment using accredited the Pike-Murtho 2014 model is finalised. Scheduled to be completed in 2014–15.

Note: a The year when the review is formally adopted and included in the salinity registers.

b All South Australian Register A entries, except SIMRAT-based irrigation development entries, comprise multiple MODFLOW model outputs accredited at various times. Therefore, these entries are not reviewed and updated in their entirety in a particular year, but the component models are updated in line with their 5-year review dates

Table 6: Status of rolling five–year reviews for all Salinity Register B entries, as at June 2014

Authority register accountable actions	Last review [a]	Next review date	Comment on status of review
NSW			
Darling Catchment Legacy of History—Macquarie	2010	2015	Review not currently required
Darling Catchment Legacy of History—Macintyre	2010	2015	Review not currently required
Darling Catchment Legacy of History—Gil Gil Ck	2010	2015	Review not currently required
Darling Catchment Legacy of History—Gwydir	2010	2015	Review not currently required
Darling Catchment Legacy of History—Namoi	2010	2015	Review not currently required
Darling Catchment Legacy of History—Castlereagh	2010	2015	Review not currently required
Darling Catchment Legacy of History—Bogan	2010	2015	Review not currently required
Lachlan Legacy of History	2010	2015	Review not currently required

Authority register accountable actions	Last review [a]	Next review date	Comment on status of review
Murrumbidgee Catchment Legacy of History	2010	2015	Review not currently required
NSW Mallee Legacy of History—Dryland	2010	2015	Review not currently required
NSW Mallee Legacy of History—Irrigation	2010	2015	Review not currently required
Victoria			
Campaspe Catchment Legacy of History	2011	2016	Review not currently required
Goulburn Catchment Legacy of History	2013	2018	Review not currently required
Loddon Catchment Legacy of History	2013	2018	Review not currently required
Kiewa Catchment Legacy of History	2011	2016	Review not currently required
Ovens Catchment Legacy of History	2011	2016	Review not currently required
Victoria Mallee Legacy of History—Dryland	2010	2015	Review expected to commence in 2014/15
Victoria Mallee Legacy of History—Irrigation	2010	2015	Review expected to commence in 2014/15
South Australia [b]			
SA Mallee Legacy of History—Dryland	n/a	n/a	To be updated with MODFLOW models when updated for 5–year review. Next update will include Waikerie, Woolpunda and Pike-Murtho areas. Scheduled to be completed in 2014–15.
SA Mallee Legacy of History—Irrigation	n/a	n/a	To be updated with MODFLOW models when updated for 5–year review. Next update will include Waikerie, Woolpunda and Pike-Murtho areas. Scheduled to be completed in 2014–15.
SA Improved Irrigation Efficiency & Scheme Rehabilitation Reg B	n/a	n/a	To be updated with MODFLOW models when updated for 5–year review. Next update will include Waikerie, Woolpunda and Pike-Murtho areas. Scheduled to be completed in 2014–15.
Queensland			
Queensland Legacy of History—Irrigation and Land Use Change prior to 1 Jan 2000	n/a	n/a	The low risk catchment/s are being progressed through the rolling 5 year catchment audits. The Draft Warrego Paroo report addresses this issue and is expected to be provided to MDBA August 2014.
Queensland Irrigation Development—post 1Jan 2000	n/a	n/a	Report formally submitted July 2014 and significance of salinity impacts are yet to be determined.

Note: a The year when the review is formally adopted and included in the salinity registers.

b All South Australian Register B entries comprised multiple MODFLOW model outputs accredited at various times. Therefore, these entries are not reviewed and updated in their entirety in a particular year, but the component models are updated in line with their 5–year review dates.

Register A reviews

- In 2013-14, MDBA received the rolling five–year review of the Victorian state accountable action, Nyah to South Australia Border Salinity Management Plan. This five-year review was accepted by MDBA as 'fit–for–purpose' following a peer review process.

No Register A rolling five–year review reports were received in 2013–14 from other jurisdictions.

Register B reviews

No Register B rolling five–year reviews were received in 2013–14.

2.9.3 Salinity models

MDBA's salinity registers are underpinned by a suite of models that assist in assessing progress against end–of–valley salinity targets and the Basin salinity target at Morgan and in estimating the salinity impacts of accountable actions. The models require periodic review and approval by MDBA as being fit for purpose to ensure continuous improvement in predictions of the impacts of land and water management actions and progress against in–stream salinity targets.

Jurisdictional surface water and groundwater models and other analytical techniques are used to generate estimates of salinity, salt load and flow to the River Murray. Some of these models are used to determine the salinity, salt load and flow regimes at the end–of–valley sites (discussed in Section 3) and have established baseline conditions for the Basin catchments (Appendix C). MDBA uses these datasets as input to MSM–BigMod (the River Murray model). MSM–BigMod is used in the assessment of all register entries. With the aid of cost functions, MDBA is also able to provide estimates of the relative salinity cost effect of progressive increases in salinity along the river. The costs appear in the salinity registers as a $m/year figure for each entry, and are used by the jurisdictions and MDBA to assess the benefits and costs of investment in salinity mitigation works and measures.

Groundwater and surface water processes can be variably complex across the Basin. While models are generally independently peer reviewed to ensure that they are 'fit–for–purpose', the *BSMS operational protocols* (MDBC 2005) provide some guidance on the level of complexity required for a modelling tool: 'the effort required for the assessment of proposals' is to be 'commensurate with the likely extent of potential salinity impacts and their associated uncertainty'.

MSM-BIGMOD model

The MSM-BIGMOD model and documentation was updated and peer reviewed in 2014 to include a number of policy changes and works and measures undertaken since 2002 when the model was last documented. The reviewer found that the basic structure and layout of the updated model is sound and is a suitable platform for the development of baseline conditions and the assessment of various actions and impacts including environmental watering salinity impacts.

Numerical groundwater model for the Pike-Murtho subzone area in Border to Lock 3

This model was peer reviewed to provide advice as to whether the model update and reporting are appropriate and in line with requirements for the BSMS Salinity Registers. The review found that the Pike-Murtho model and related information is considered satisfactory and fit for the purpose of determining salt load impacts on the River Murray with generally high confidence.

Salinity Impact Rapid Assessment Tool (SIMRAT) model – Stage 1

The accredited SIMRAT documentation, including peer review reports was reviewed in 2014 to provide information about the model's current status; and to review its capabilities and limitations. The review recommended progressing to Stage II including software being rewritten in Python for ArcGIS and a review of time lag algorithms and parameters.

2.6.4 Monitoring

Schedule B requires all states and the ACT to monitor end–of–valley target sites. This monitoring supports reviews of targets and analyses of progress towards them. Generally, the required data includes, as a minimum, indicators of daily salinity and flow. Additional interpretation sites are not approved end–of–valley target sites but are highly useful in supporting an understanding of the salt mobilisation and salinity dynamics across the Basin.

Over time, data from both end–of–valley sites and interpretation sites has informed the review of end–of–valley targets and the Register B 'Legacy of History' impacts from tributary valleys.

Monitoring involves the collection, analysis, reporting and use of information to improve BSMS implementation. Monitoring of flow and salinity is critical for assessing real–time salinity levels and current progress towards salinity targets (see Section 2.3).

Table 7 summarises progress in monitoring at BSMS sites over the 14 years from 2000 to 2014. The second column provides the percentage of days for which salinity (EC) measurements have been monitored for each site. The third column provides an indication of flow and available EC, and is expressed as a percentage of time that salt load can be calculated.

Over the past 14 years, the availability of daily salinity measurements increased significantly with a peak of 92% achieved in 2011. Since then salinity measurements have dropped and in 2013-14 the availability was 72%.

Table 7: Availability of monitoring data for all BSMS end–of–valley and interpretation monitoring sites, 2000 to 2014

Year	Aggregate % of days with EC record	Aggregate % of days with flow and EC record
2000	49%	43%
2001	51%	46%
2002	64%	60%
2003	67%	62%
2004	80%	75%
2005	74%	70%
2006	80%	76%
2007	67%	64%
2008	76%	74%
2009	77%	75%
2010	79%	78%
2011	92%	86%
2012	83%	80%
2013	78%	75%
2014	72%	70%

3. Valley reports

The performance of catchment salt loads against end–of–valley targets requires complex modelling over the benchmark period. Therefore, progress is only required to be reported in rolling five–year reviews of valleys for which an end–of–valley target has been set. However, it is useful to provide an indication of actual salinity outcomes over the reporting year for each of the valley sites.

Table 8 is a summary report card of flow and salinity data for each end–of–valley site (see Figure 5 for site locations and Figure 6 for a graphical representation of results). The full details of state and territory government valley actions are provided in the individual governments' reports.

Appendix E compares salinity levels and salt loads in 2013–14 against long–term records. The length of the record varies from site to site. Owing to extended dry conditions across much of the Basin over the past decade, there are some sites where river flows ceased for long periods. For those periods, measurements of salinity and flow are not accurate; therefore, salinity and salt load records may be incomplete.

Table 8: End–of–valley summary report card 2013–14

Site	AWRC No.	No. of days with salinity records	No. of days with flow records	Days with flow above zero	Mean Salinity (µS/cm)	Median Salinity (µS/cm)	80%ile Salinity (µS/cm)	Peak Salinity (µS/cm)	Mean Flow (ML/day)	Median Flow (ML/day)	80%ile Flow (ML/day)	Peak Flow (ML/day)
All Partner Governments												
River Murray at Morgan [a]	426554	359	365	365	356	353	589	650	8133	6295	11830	22689
South Australia												
SA Border [b]	426200	365	365	365	239	226	295	520	9709	7798	14394	25640
Lock 6 to Berri [c]	426514	364	343	343	303	298	371	587	9073	7698	12764	29380
River Murray at Murray Bridge [d]	426522	365	NA	NA	393	401	509	668	NA	NA	NA	NA
NSW												
Murrumbidgee at Balranald	410130	365	365	365	153	121	214	300	953	863	1364	4123
Lachlan at Forbes	412004	365	364	364	474	433	617	838	1086	927	1707	3091
Bogan at Gongolgon	421023	267	339	202	449	540	663	775	52	2	39	953
Macquarie at Carinda	421012	198	341	305	615	614	655	873	28	17	46	144
Castlereagh at Gungalman Bridge	420020	74	339	67	751	744	805	851	10	0	0	139
Namoi at Goangra	419026	365	332	317	479	468	662	899	143	67	162	3998
Mehi at Bronte	418058	327	255	231	429	266	759	986	59	30	60	678
Barwon at Mungindi	416001	320	365	319	300	271	407	508	214	88	393	1429
Darling at Wilcannia	425008	225	365	360	877	460	1407	3245	513	380	1081	1406
River Murray at Heywoods	409016	354	365	365	55	55	56	61	11916	15266	19436	30293
River Murray at Red Cliffs [e]	414204	52	NA	NA	136	130	160	280	NA	NA	NA	NA
Flow to SA	426200	365	365	365	239	226	295	520	9709	7798	14394	25640
Victoria												
Wimmera at Horsham Weir	415200 D	365	365	365	1229	1042	1449	2643	45	37	63	189

Site	AWRC No.	No. of days with salinity records	No. of days with flow records	Days with flow above zero	Mean Salinity (µS/cm)	Median Salinity (µS/cm)	80%ile Salinity (µS/cm)	Peak Salinity (µS/cm)	Mean Flow (ML/day)	Median Flow (ML/day)	80%ile Flow (ML/day)	Peak Flow (ML/day)
Avoca at Quambatook [f]	408203B	130	365	108	10152	8796	13083	25417	2	0	3	32
Loddon at Laanecoorie	407203B	365	365	365	713	675	799	1020	140	115	185	597
Campaspe at Campaspe Weir [g]	406218A	365	365	365	484	490	511	616	174	111	220	2889
Goulburn at Goulburn Weir [h]	405259A	365	365	365	76	61	100	178	1775	975	2502	7813
Broken at Casey's Weir [i]	404217B	365	365	365	125	126	141	159	413	111	532	5990
Ovens at Peechelba East	403241	365	365	365	59	54	73	134	3823	1470	5439	30232
Kiewa at Bandiana	402205	365	365	365	41	40	48	86	1592	815	3078	6316
River Murray at Heywoods	409016	354	365	365	55	55	56	61	11916	15266	19436	30293
River Murray at Swan Hill	409204	354	365	365	100	90	120	356	8642	6470	13079	20169
Flow to SA	426200	365	365	365	239	226	295	520	9709	7798	14394	25640
Queensland												
Barwon River at Mungindi	416001	320	365	319	300	271	407	508	214	88	393	1429
Moonie at Fenton	417204A	51	365	51	140	152	155	166	43	0	0	3398
Ballandool at Hebel—Bollon Rd	422207A	150	365	150	250	226	304	394	8	0	3	214
Bokhara at Hebel	422209A	53	365	53	205	203	230	253	10	0	0	238
Briarie at Woolerbilla—Hebel Rd	422211A	0	365	0	NA	NA	NA	NA	0	0	0	0
Culgoa at Brenda	422015	175	365	175	236	241	277	353	91	0	28	3333
Narran at New Angledool 2	422030	45	365	46	214	232	240	327	21	0	0	1128
Paroo at Caiwarro	424201A	164	365	164	85	83	102	118	367	0	74	13859
Warrego at Barringun No 2 [j]	423004	0	365	2	NA	NA	NA	NA	0	0	0	6.7
Cuttaburra at Turra	423005	11	365	11	104	100	115	176	0	0	0	16.1
ACT												

Site	AWRC No.	No. of days with salinity records	No. of days with flow records	Days with flow above zero	Mean Salinity (µS/cm)	Median Salinity (µS/cm)	80%ile Salinity (µS/cm)	Peak Salinity (µS/cm)	Mean Flow (ML/day)	Median Flow (ML/day)	80%ile Flow (ML/day)	Peak Flow (ML/day)
Murrumbidgee at Hall's Crossing	410777	365	365	365	245	227	303	417	1283	808	1390	37615

[a] *The 95%ile is reported here as the BSMS salinity target at Morgan. Also note that flow data is measured at site 426902 (River Murray at Lock 1)*

[b] *Salinity measured at site A4261022 (Murray @ Old Custom House)*

[c] *Salinity measured at site 426537(Berri Pumping Station)*

[d] *Site with no flow*

[e] *Flow data stops in October 1994*

[f] *Spot salinity data ends in Sep 2008 and continuous recording starts in Sep 2013*

[g] *Used flow data for 405200A (Campaspe at Rochester)*

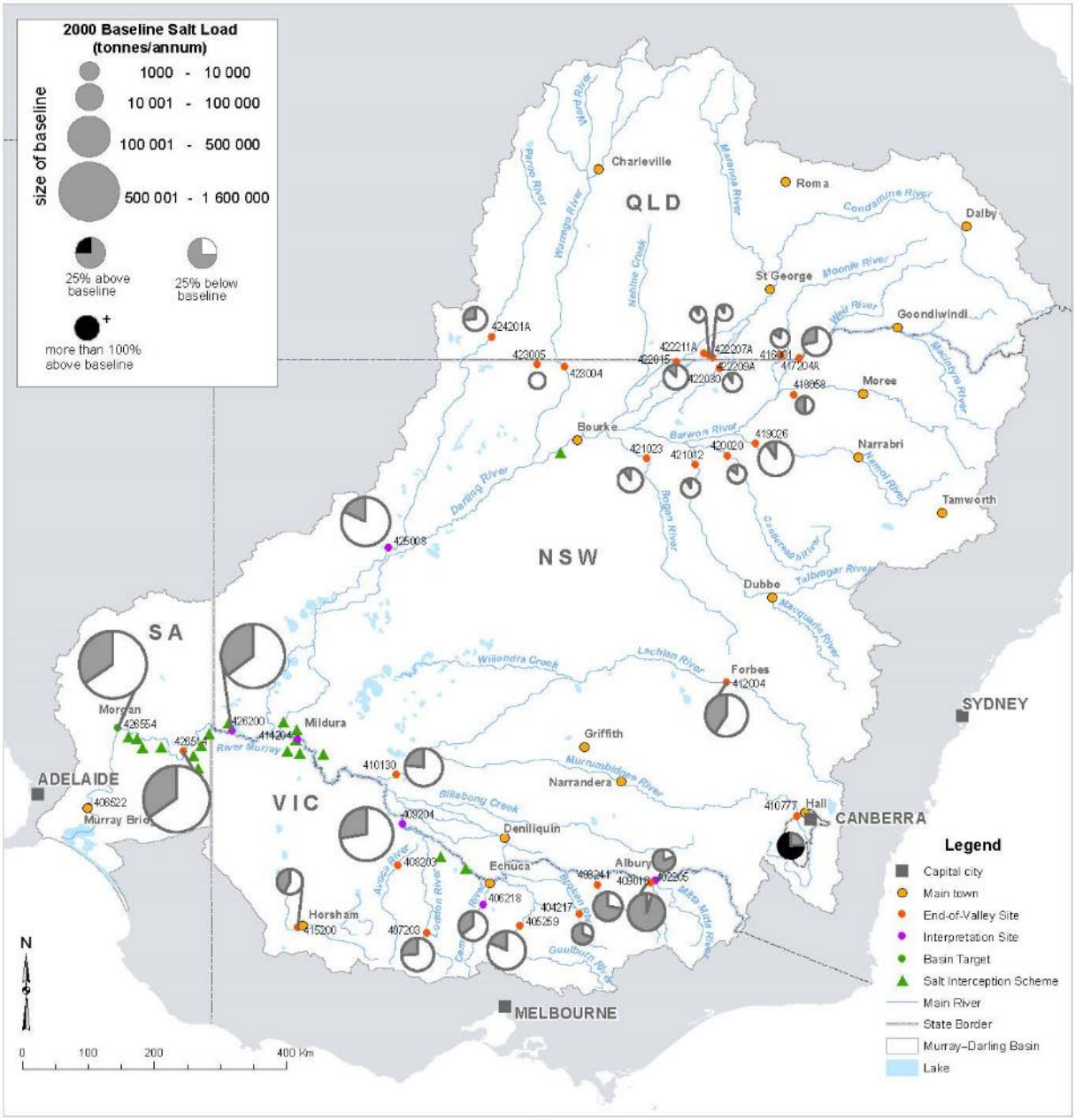
[h] *Used flow data for 405200A (Goulburn River at Murchison)*

[i] *Used salinity data for 404224B (Broken River at Gowangardie)*

[j] *Salinity data stops in September 2012*

NA Data not available

Salt load is determined using the following calculation: salt load (t/d) = flow (ML/d) x salinity (EC) x 0.0006

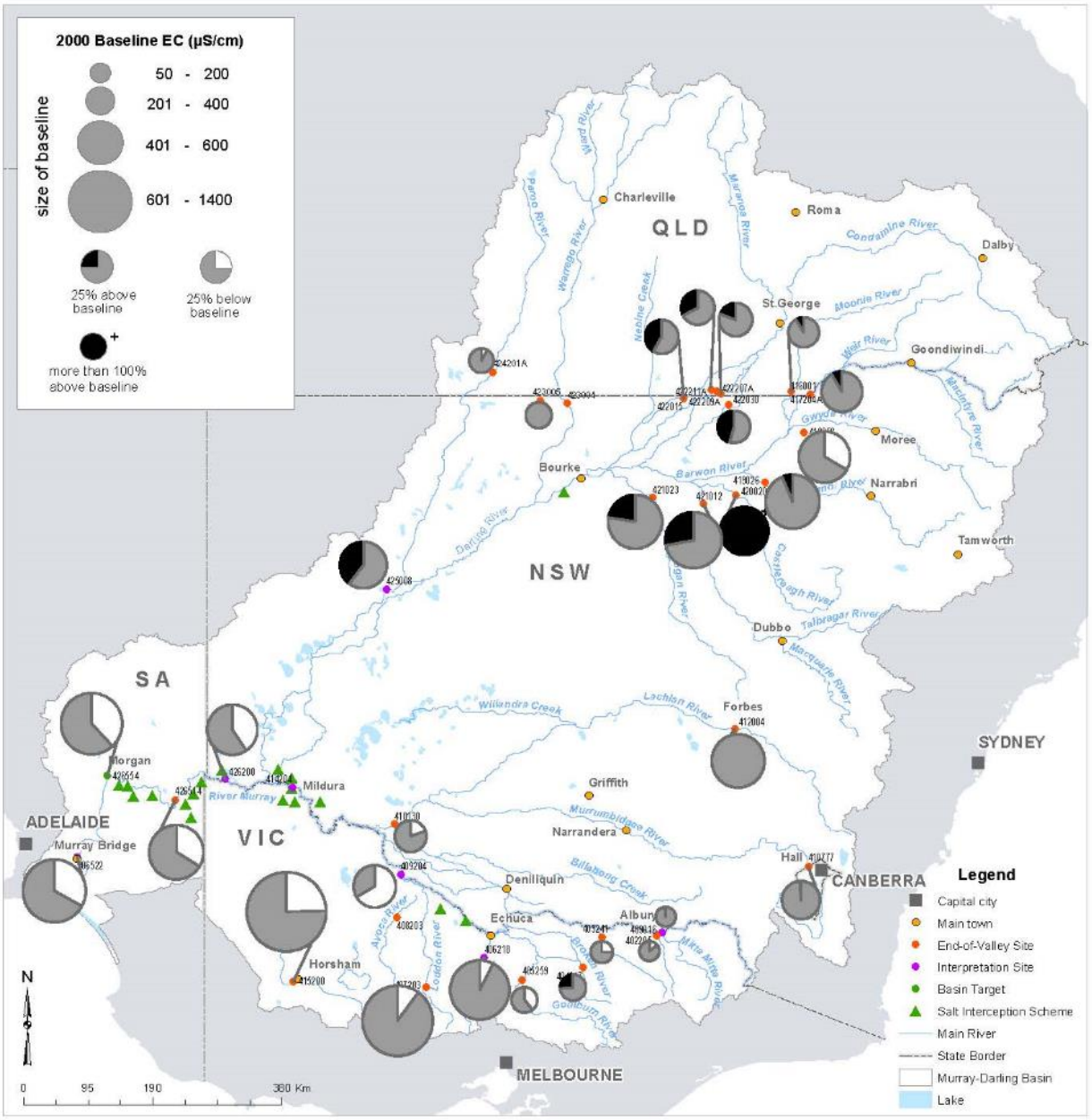


AWRC No	Site Name	Valley
402205	Kiewa at Bandiana	Kiewa
403241	Ovens at Peechelba East	Ovens
404217	Broken Ck at Casey's Weir *	Broken
405259	Goulburn at Goulburn Weir	Goulburn
406218	Campaspe at Campaspe Weir *	Campaspe
407203	Loddon at Laanecoorie	Loddon
408203	Avoca at Quambatook *	Avoca
409016	Murray at Heywoods	NSW/VIC Upper Murray
409204	Murray at Swan Hill	Vic Riverine Plains
410130	Murrumbidgee at Balranald	Murrumbidgee
410777	Murrumbidgee at Hall's Crossing	ACT
412004	Lachlan at Forbes	Lachlan
414204	Murray at Redcliffs	NSW Riverine Plains
415200	Wimmera at Horsham Weir	Wimmera
416001	Barwon at Mungindi	NSW Border Rivers
417204A	Moonie at Fenton	Moonie
418058	Mehi at Bronte	Gwydir

AWRC No	Site Name	Valley
419026	Namoi at Goangra	Namoi
420020	Castlereagh at Gungalman	Castlereagh
421023	Bogan at Gongolgon	Bogan
422015	Culgoa at Brenda	Condamine Balonne
421012	Macquarie at Carinda	Macquarie
422030	Narran at New Angledool	Condamine Balonne
422207A	Ballandool at Hebel–Bollon Road	Condamine Balonne
422209A	Bokhara at Hebel	Condamine Balonne
422211A	Briarie at Woolerbilla–Hebel Road	Condamine Balonne
423004	Warrego at Barringun	Warrego
423005	Cuttaburra at Turra	Warrego
424201A	Paroo at Caiwarro	Paroo
425008	Darling at Wilcannia	Barwon-Darling
426200	Murray at Lock 7 (flow) Lock 6 (EC)	NSW/VIC Mallee Zone
426522	Murray at Murray Bridge *	Below Morgan
426514	Murray at Lock 4 (flow) Berri Pumping Station (EC)	Lock 6 to Berri
426554	Murray at Morgan	Lock 6 to Morgan

* Data not available to report on Salt Load confidently

Figure 5 Salt load (tonnes/year) for 2013-14 at end–of–valley sites compared to the Baseline



AWRC No	Site Name	Valley
402205	Kiewa at Bandiana	Kiewa
403241	Ovens at Peechelba East	Ovens
404217	Broken Ck at Casey's Weir *	Broken
405259	Goulburn at Goulburn Weir	Goulburn
406218	Campaspe at Campaspe Weir	Campaspe
407203	Loddon at Laanecoorie	Loddon
408203	Avoca at Quambatook *	Avoca
409016	Murray at Heywoods	NSW/VIC Upper Murray
409204	Murray at Swan Hill	Vic Riverine Plains
410130	Murrumbidgee at Balranald	Murrumbidgee
410777	Murrumbidgee at Hall's Crossing	ACT
412004	Lachlan at Forbes	Lachlan
414204	Murray at Redcliffs	NSW Riverine Plains
415200	Wimmera at Horsham Weir	Wimmera
416001	Barwon at Mungindi	NSW Border Rivers
417204A	Moonie at Fenton	Moonie
418058	Mehi at Bronte	Gwydir

AWRC No	Site Name	Valley
419026	Namoi at Goangra	Namoi
420020	Castlereagh at Gungalman	Castlereagh
421023	Bogan at Gongolgon	Bogan
422015	Culgoa at Brenda	Condamine Balonne
421012	Macquarie at Carinda	Macquarie
422030	Narran at New Angledool	Condamine Balonne
422207A	Ballandool at Hebel–Bollon Road	Condamine Balonne
422209A	Bokhara at Hebel	Condamine Balonne
422211A	Briarie at Woolerbilla–Hebel Road	Condamine Balonne
423004	Warrego at Barringun	Warrego
423005	Cuttaburra at Tuma	Warrego
424201A	Paroo at Caiwarro	Paroo
425008	Darling at Wilcannia	Barwon-Darling
426200	Murray at Lock 7 (flow) Lock 6 (EC)	NSW/VIC Mallee Zone
426522	Murray at Murray Bridge	Below Morgan
426514	Murray at Lock 4 (flow) Berri Pumping Station (EC)	Lock 6 to Berri
426554	Murray at Morgan	Lock 6 to Morgan

* Data not available to report on Salinity confidently

Figure 6 Instream salinity (EC) for 2013-14 at end–of–valley sites compared to the Baseline

4. Response to the Independent Audit Group for Salinity

In 2013–14, MDBA, with advice from the Basin Salinity Management Advisory Panel, progressed some of the key recommendations in the *Report of the Independent Audit Group for Salinity 2012–13 (MDBA 2014).* The audit recommendations that are applicable to MDBA are itemised and progress is reported in Table 9.

Table 9: MDBA's response and progress to the 2012–13 audit recommendations

IAG–Salinity recommendations	MDBA response to Ministerial Council (August 2014)	Progress
Recommendation 1: BSMS review *In regard to the General Review of Salinity Management in the Basin, the IAG–Salinity considers that the following features should be continued in the future salinity management arrangements:* · *The Basin salinity target at Morgan is a target connected to assets at risk and agreed actions are implemented to ensure that the target is met.* · *There is a Basin–wide focus for salinity management as a major water quality issue for the Basin.* · *Data and knowledge of the system continually improve and support good decision–making.* · *Knowledge of the system and the models are upgraded every seven years through 'fit–for–purpose' model development, providing increasing surety about the outcome.* · *The intent of Schedule B in providing the register system is maintained, given that it focuses the management of salinity and provides for trade–offs that cater for changing circumstances in each jurisdiction.* · *The SISs provide surety in meeting the salinity target at Morgan.* · *The governance arrangements for the BSMS (annual reviews, the joint jurisdictional programs and advisory group, the mid–term review and the independent audit of the registers and activities) have worked well.* *There are areas of the BSMS that could not deliver as originally expected and need further consideration:* · *The upstream End of valley Targets (EoVTs) were unrelated to upstream assets and were set as targets relevant to the Morgan target. However, there was little upstream community ownership or agreed management actions in the catchments to achieve those targets.* · *The broadacre agriculture and revegetation elements, while delivering local benefits, have not provided joint outcomes at the Basin scale that could be accounted for at Morgan.*	The MDBA welcomes this recommendation and in response will endeavour to consider all of the features listed in this recommendation while undertaking the General Review of Salinity Management in the Basin which is currently underway. The MDBA recognises that the Water Quality and Salinity Management Plan of the Basin Plan is not a direct substitution for achieving salinity management objectives of the current Basin Salinity Management Strategy (BSMS). It is the view of the MDBA that renewed salinity management strategy will be required, in addition to the Water Quality and Salinity Management Plan, when the current term of the BSMS expires in 2015. The MDBA views that the next generation salinity management strategy could usefully include: · achievement of objectives of the Water Quality and Salinity Management Plan and the relevant objectives and targets of the current BSMS; · management of current and future salinity risk of Basin-scale assets and shared water resources; · clearly articulated responsibilities of all jurisdictions.	The MDBA and the Partner Governments completed a General Review of Salinity Management in the Basin in 2013-14 with guidance from an inter-jurisdictional steering committee. This review considered all the recommendations of the IAG-Salinity and reported on the key findings to the Ministerial Council who considered the findings of the review and agreed to: o develop an updated cost-effective salinity management program for the next 15 years, Basin Salinity Management 2030 (BSM2030); and, o review Schedule B of the Murray-Darling Basin Agreement to enable implementation of BSM2030. The final reports of the review have been endorsed by the Basin Officials Committee and will be published in due course as foundation documents informing the development BSM2030.

IAG–Salinity recommendations	MDBA response to Ministerial Council (August 2014)	Progress
Recommendation 2: Environmental Water *(a) Three new register items should be added to the registers with notional values to cover:* *i. Environmental Water Recovery* *ii. Use of Water for Environmental Purposes* *iii. Environmental Works and Measures (covering initially the TLM works).* *(b) The policy principles for environmental watering and use of environmental works should be evaluated through modelled scenarios of salinity and dilution impacts and be undertaken by the Commonwealth Environmental Water Office (CEWO), the Basin States/Territory and the MDBA.* *(c) The Basin–wide plan and policy framework for managing impacts and responsibility for reporting the accountable actions from environmental watering and use of environmental works as required under Schedule B be settled between the Commonwealth, the MDBA and the operating jurisdictions.*	The MDBA supports this recommendation. The MDBA is supportive of reporting on notional values of salinity impacts of environmental water recovery and use and The Living Murray woks salinity impacts. However, including the notional values in the Registers may require resolution of issues identified in parts (b) and (c) of this recommendation. The MDBA is willing to facilitate development of policy principles and a framework to ensure accountability for salinity impacts of environmental watering by all jurisdictions and the Commonwealth Environmental Water Office.	The MDBA assessed the salinity impacts of TLM and the River Murray Increased Flows (RMIF) based on preliminary salinity impact assessments of Works and Measures under the TLM. The outcomes of the assessment have been included as two separate provisional entries in the 2014 salinity registers to reflect the dilution effects of using the water and impacts of salt mobilised by operation of the Works and Measures. The data and information provided to the MDBA are currently not sufficient to determine the impacts of water recovery for TLM and RMIF. The policy framework for managing salinity impacts of other environmental watering activities and responsibility for reporting on their impacts are being considered as part of the development of BSM2030.
Recommendation 3: Monitoring Reviews *(a) In reviews of monitoring sites conducted by jurisdictions, the reviews:* · *Need to be made available to the IAG–Salinity.* · *Show they meet the jurisdictional BSMS reporting obligations.* · *Be based on a risk approach to match the management regime for data collection and improvement in models.* · *Adopt a scientific approach to minimise the loss of information content in the monitoring network.* *(b) The agreed protocols for collecting salinity data need to be updated and adopted.* *(c) Queensland has salinity hazards arising from CSG and irrigation and requires a better combined monitoring network if it is to analyse them.*	The MDBA supports this recommendation as quality assured data are essential for assessment of progress against targets and improvement of salinity models which are used for decision making and assessment of progress against targets.	The MDBA response to the Ministerial Council in relation to this recommendation stands.

IAG–Salinity recommendations	MDBA response to Ministerial Council (August 2014)	Progress
Recommendation 5: End-of-Valley Target *(a) In the future salinity arrangements, catchment End-of-Valley Targets should be based on requirements of upstream and downstream assets (as detailed in the End–of–Valley Target Review). On this basis targets should be representative of the salinity regime that will impact on the agreed assets, which should not be constrained to the threshold and exceedance percentiles. This will assist in making the link between targets and community driven management of potential asset impacts.* *(b) Salt load requirements should only be required as part of End-of-Valley Targets where they are relevant to assets.*	This recommendation is consistent with the findings of the End–of–Valley Targets review conducted by the MDBA in 2013-14. The findings of the review will be taken into consideration when reviewing the targets in the Schedule B of the Murray-Darling Basin Agreement.	The role of the End-of-Valley Targets and how they can be incorporated into the BSMS2030 will be considered as part of the new strategy development which is currently under way.
Recommendation 7: Modelling *(a) By the end of the BSMS, the MDBA should assess how closely the benchmark period matched the 2000–2015 actual climate (on average), and the magnitude of the difference between recorded and dynamically modelled Morgan salinity.* *(b) A risk-based approach should be applied to model improvement as part of the seven year review process with the principle that further investment in model development should be driven by the salinity risk and the level of data available.* *(c) That priority be given to understanding and modelling physical linkages between river, floodplains and groundwater.*	The MDBA supports this recommendation. However, implementation of part (c) of this recommendation will be dependent on the resources and data available to the MDBA for conducting the modelling work. In relation to parts (a) and (b) of the recommendation, the MDBA views the appropriate timing for implementation is when the decisions about post-BSMS salinity management arrangements are taken and the Schedule B is being reviewed to reflect those arrangements.	The MDBA response to the Ministerial Council in relation to this recommendation stands. Consistent with the MDBA response the Ministerial Council, the key findings of the General Review of Salinity Management in the Basin also support the timing of addressing this recommendation in relation to parts (a) and (b).

Note: Recommendations 4 and 6 do not relate to the MDBA and therefore have been omitted from this table

5. Key priorities for 2014–15

The priorities arise from the obligations in Schedule B of the Murray–Darling Basin Agreement, outcomes of the General Review of Salinity Management in the Basin (completed in 2013-14) and the high-priority recommendations provided by the IAG–Salinity.

In 2014–15, the main priorities for the BSMS program include the following:

1. Deliver Schedule B obligations, specifically:
    a) annual reporting
    b) the annual independent audit
    c) reviews of accountable actions that are itemised on the salinity registers, and the assessment of new actions that may require inclusion on the salinity registers
    d) ongoing review and improvements of hydrological models that underpin in–river salinity assessments.

2. Implement the key recommendations of the General Review of Salinity Management in the Basin as agreed by the Ministerial Council to:

    a) develop an updated cost-effective salinity management program for the next 15 years, Basin Salinity Management 2030 (BSM2030)

    b) review Schedule B of the Murray-Darling Basin Agreement to enable implementation of the BSM2030.

3. Document improvements to the River Murray flow and salinity model (MSM–BigMod) to support its accreditation to:

    a) enable the use of the most up–to–date model for determining existing salinity register entries

    b) provide an accredited technical basis for simulating the salinity impacts of environmental watering activities and hence enable their inclusion on the salinity register.

4. Develop, operate and maintain the joint works and measures program (the salt interception schemes) established under the BSMS and former Salinity and Drainage Strategy and review the operations of the schemes to develop options to better manage river salinity.

These priorities require substantial resources from the BSMS program of MDBA and the partner governments. Current capacity in the BSMS program as a whole may not be sufficient to deliver all of these priorities within the 2014–15 financial year. As a result, parts of these priorities may be progressed in 2015-16.

Appendix A: Extract from the Report of the IAG–Salinity 2013–14

Executive Summary and Recommendations

Introduction

In August 2001, the Murray–Darling Basin Ministerial Council (MDBMC) launched the Basin Salinity Management Strategy (BSMS) (MDBC 2001). In December 2008, the Murray–Darling Basin Commission was succeeded by the Murray–Darling Basin Authority (MDBA). Schedule C to the Murray–Darling Basin Agreement, which set down the legislative framework for the implementation of the BSMS, became Schedule B to the Murray–Darling Basin Agreement, which is Schedule 1 to the *Water Act 2007* (Cwlth).

Schedule B provides for the appointment of 'independent auditors for the purpose of carrying out an annual audit', whose task is to review progress in implementing the BSMS.

The terms of reference for the IAG–Salinity and Schedule B require the IAG–Salinity to review progress on the BSMS both broadly and in terms of the steps laid down in the schedule and focusing on the specific measurement and recording of progress with the BSMS and the outcomes at 30 June each year. In this year, the penultimate year of the BSMS, the terms of reference also included providing a perspective, looking back and forward**.** The auditors were requested to look back over the audit process and forward to consider the requirements of the next BSMS period (2015 – 2030) and make suggestions about suitable audit arrangements for the next 15 years. This has been the major focus of this Audit report for 2013-14.

The three members of the present Independent Audit Group for Salinity (IAG–Salinity) were appointed in November 2014. This report presents their consensus view in undertaking the audit covering the 2013–14 financial year. The state contracting governments, the Australian Capital Territory (ACT) and MDBA submitted reports on their activities, valley reports, the status of five-year rolling reviews, and BSMS salinity register entries or adjustments. The Australian Government (Department of the Environment) also submitted a report related to environmental watering activities.

The audit process adopted by the IAG–Salinity included a review of the annual jurisdictional reports and the salinity registers, followed by meetings with representatives of the jurisdictions and with members of MDBA. The recommendations were developed and jurisdictions were given an opportunity to provide factual comments on the audit report.

The 2013-14 Context for BSMS Implementation

In 2013-14, with the Basin Plan in place and the BSMS in its penultimate year, the jurisdictions and the MDBA undertook the General Review of Salinity Management in the Basin (MDBA 2014). Key drivers for the Review included expected changes in Basin salinity risk arising from water recovery and use under the Basin Plan and knowledge gained from 30 years of experience in managing salinity in the Basin.

Key conclusions from the General Review included:

- Actions taken under the BSMS have been successful in improving salinity levels in the river with the modelled Morgan target being met for the previous four years (i.e. at August

2014). This progressive improvement in salinity is directly attributable to mitigation works and measures

- Improvements in knowledge over the life of the BSMS have shown that:
  - Whilst all parts of the Basin contribute some salt to the rivers, the Mallee and parts of the Riverine Plains are the landscape areas which are the major sources of salinity
  - Groundwater levels in the dryland areas seem to be in a dynamic equilibrium reflecting wet-dry sequences. The degree of the long-term upward trend in most catchments that was predicted in the 1990s was not as dramatic as thought at the time and based on updated assessment in the late 2000s over an order of magnitude less in many catchments
- The recovery and use of Environmental Water under the Basin Plan will provide significant dilution benefits that would mean the delayed salinity impacts of current levels of development, under the current BSMS controls, would not affect the Morgan target until ~2080. This means there is a very significant safety buffer in the next phase of the BSMS
- Even with the dilution benefits provided by the environmental water, salt interception schemes (SISs) remain a critical part of the BSMS actions, particularly in periods of low flow and over extended dry periods. However, it appears that it is possible to operate the SISs at a reduced level of utilisation and meet the Morgan target over the period of the next phase of the BSMS (i.e. 2015 – 2030).

The outcomes of the General Review of Salinity Management in the Basin, the arrangements for the implementation of the Basin Plan and the utilisation of large volumes of environmental water are key factors that provide the context for the development of the next phase of the Basin Salinity Management (i.e. BSMS 2030), currently being undertaken and due for completion in 2015. The final critical issue is the budget pressures that all Governments are currently under and the consequent need to ensure that salinity management is cost-effective and efficient and balanced against salinity risk.

These issues were also a key factor dominating the implementation of the BSMS in its penultimate year. In 2013-14, the IAG-Salinity noted a number of key outcomes including:

- The Morgan target was met for the fifth year in a row. The modelled 2013-14 conditions showed that salinity remained under the Morgan target for 98% of time. This represents the best outcome ever reported under the BSMS
- All three states are in credit on the combined salinity registers (7.956, 6.850 and 7.502 $M/year for NSW, Victoria and South Australia respectively)
- The target of a 61EC reduction at Morgan was reached with the completion of the Murtho Scheme in South Australia, the commissioning of the upper Darling Scheme in NSW and the finalisation of the first phase of the Mildura-Merbein refurbishment
- The operation and maintenance of SISs focused on minimising running costs, in particular, the energy costs associated with pumping and the least efficient SIS, the Rufus River Scheme was left in standby mode after the 2011 high flow event. Even with this more efficient management approach, the SISs were responsible for the diversion of ~398 000 tonnes of salt away from the river

- For the first time, provisional entries were made on Register A for environmental water delivery and works and measures. The provisional entries comprise a credit of 24.4 EC for 570 GL water provision and a debit of 4.6 EC for the environmental works and measures associated with The Living Murray (TLM) project. The new provisional register entries for TLM alone are now accounting for about 13% of the full SIS benefit
- The Commonwealth Environmental Water Office reported delivery of 558GL of Commonwealth environmental water to the Lower Murray which contributed to maintaining salinity levels below the Morgan target
- All Jurisdictions were implementing major projects to meet their water recovery obligations under the Basin Plan. In addition, significant work was undertaken in redesigning farming systems across the Basin as part of the Australian Government's Water for the Future On–Farm Program. All jurisdictions were dealing with funding reductions in catchment management activities as a result of changing priorities at the state and federal government levels.

In 2013-14, jurisdictions were all starting to look forward to BSMS 2030 and giving priority to areas of implementation needed to be carried forward in the new strategy and identifying where activity was no longer needed or could be reduced and where activity could be sensibly modified to fit into the emerging implementation requirements.

In line with this and with the terms of reference for the 2013-14 Audit, the Auditors have focused their recommendations on key issues that will be a priority for consideration in the development of BSMS 2030. The rationale for these recommendations is covered in detail in Section 4.

Response to the Independent Audit Group for Salinity of the report. In addition, summaries of progress in 2013-14 and issues under each of the key elements are provided in Section 5. Key priorities for 2014–15 of the report.

Overview of 14 years of BSMS Implementation

The BSMS, which is now in its 14th year, has been highly successful, as has been shown in the General Review of Salinity Management in the Basin (2014) and demonstrated by the Morgan target being met for the past five years. This success may be attributed to both the run of climatic events and the implementation of the BSMS.

In the view of the IAG–Salinity, the BSMS has delivered the following benefits:

- A clear focus on providing good water quality at Morgan to provide for downstream assets, which has been successful
- Clear accountability of all jurisdictions for meeting the Morgan target
- A joint program of investment, which:
  - improved the quality of water in the River Murray to meet the target established at Morgan and protected most downstream assets from expected damage from salinity
  - enabled irrigation development to continue to occur with no further deterioration in salinity
  - enabled the water market to operate, allowing water to move to its highest value use with no further deterioration in salinity

- An agreed process for the allocation of benefits and costs between the joint venture and individual jurisdictions.

Table 10: Summary of measured salinity levels (EC) at Morgan, South Australia

Period	Time interval	Average	Median (EC)	95 percentile (EC)	Peak	% Time more than 800 EC
1 year	July 2013 - June 2014	355	349	590	650	0%
5 years	July 2009 - June 2014	346	327	585	687	0%
10 years	July 2004 - June 2014	390	377	624	768	0%
25 years	July 1989 - June 2014	482	451	780	1087	4%

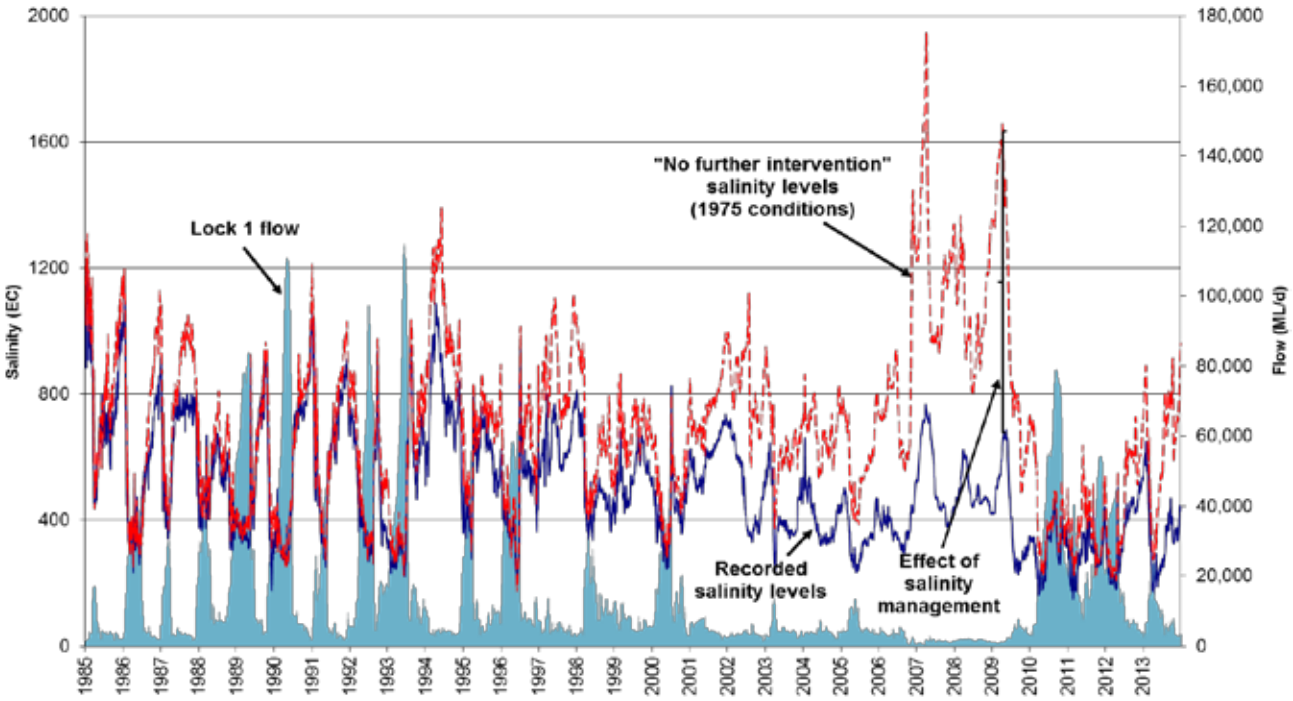


Figure 7 Effect of salinity management in the Murray–Darling Basin at Morgan, South Australia.

Note: Comparison of recorded mean daily salinity levels and modelled salinity levels without salt interception schemes, land and water management actions and additional dilution flows over a 27-year period (July 1985 to June 2014)

The strategy was designed to be adaptive to new knowledge and its governance and review processes ensured that this was undertaken seriously and successfully. The BSMS has provided a focus for the continuation of a collaborative joint effort between jurisdictions, which was maintained even through the highly charged period of Basin Plan development. The strategy has the confidence of the jurisdictions and their communities because of the transparency of the registers and the annual audit process.

However, the IAG-Salinity considers that, given the changing context for the next phase of the BSMS 2030, there are a number of important areas that should be retained, others which can be improved and a number where there is potential for stream-lining and more efficient processes. The IAG-Salinity offers the following recommendations for consideration in the development of the BSMS 2030.

These recommendations have been developed through discussions with the jurisdictions and the MDBA and the CEWO and review of their reports.

Recommendations

Recommendation 1: Communication

In the final year of the BSMS, in the lead-up to the endorsement by the Ministerial Council of the new BSMS 2030, jurisdictions and the MDBA should:

a) *develop a succinct summary of the success of the BSMS covering both environmental benefits and the economic benefits including the level of regional development which was made possible by the BSMS*

b) *hold a forum where the MDBA, jurisdictions and their delivery partners can showcase key achievements of their BSMS implementation programs.*

Recommendation 2: General Approach to BSMS 2030

In the development of BSMS 2030, the following key points should be considered:

a) *The benefits provided by the BSMS should be built upon and not lost*

b) *The BSMS 2030 should be built around the Basin salinity target at Morgan as a target for the shared water resources with the EoVTs acting as watch points for tributary inflows and incorporated into Water Resource Plans (WRPs)*

c) *A risk-based, cost-effective and adaptive approach should be undertaken in reviewing BSMS elements including:*

   i) *SIS operations*

   ii) *continuous improvement arrangements for modelling, data and knowledge generation*

   iii) *audit and reporting.*

d) *The salinity registers are the agreed 'point of truth' providing a clear statement of the agreed impacts of measures and actions taken by jurisdictions that will either mitigate salinity or increase it and its likely future effects. They should be retained in Schedule B as a key element in the BSMS 2030 and include all relevant and material actions*

e) *In designing reporting, review and auditing arrangements, consideration should be given to ensuring these are cost-effective but frequent enough to require knowledgeable and ongoing capability within jurisdictions and the MDBA, providing the basis for 'institutional memory' given the long term cyclical nature of salinity*

f) *Uncertainty in our knowledge of the salinity and management processes should be recognised and where cost-effective, knowledge should be improved.*

Recommendation 3: BSMS 2030 Operational Protocols

Following the development of BSMS 2030, the BSMS Operational Protocols are revised to ensure they give effect to the new policy framework. In this revision, particular attention should be given to the appropriateness of the benchmark period, the baseline, the use of models and defining risk and uncertainty.

Recommendation 4 – Environmental Water

a) *separate register entries on Register A for all Basin Plan water recovery projects which are likely to have a salinity impact as per the normal processes under the BSMS*

b) *a provisional entry on Register A for the delivery of environmental water recovered to date under the Basin Plan. Further work would then be undertaken over the next five year period to finalise the register entry including updating the final volume as required*

c) *a process for adding separate register entries for any additional significant environmental works that are built as a result of the operation of the adjustment mechanism*

d) *that BSMS 2030 includes the policy framework for the ownership and accounting of salinity debits and credits associated with environmental water recovery, delivery and works operation.*

Recommendation 5 – Salt Interception Schemes

In the development of BSMS 2030, consideration is given to taking a risk-based, responsive approach to the management of SISs that aims to reduce the operational costs of the management of SISs whilst still providing confidence in meeting the Morgan target over the long-term. This should take into account:

a) *the efficiency of schemes and the consequences of closing systems down for periods of time*

b) *the costs of running the scheme versus its effectiveness in reducing salinity impacts*

c) *the costs and timeliness of restarting systems versus the potential impacts over time of not operating the system*

d) *the practicality of running SIS in a responsive way.*

Recommendation 6 - Redefining EoVTs for BSMS 2030

The EoVTs provide useful reference points for salinity management and understanding and:

a) *EoVTs should continue into the future but should be revised for BSMS 2030 in light of a better understanding of salinity within valleys and where appropriate should be linked to requirements of local assets, which is consistent with a risk based approach*

b) *The EoVTs should be included, in some form, in water resource plans (WRPs)*

c) *The protection of local catchment assets should be considered in WRPs. Assets located in high salinity impact sub-catchments should be identified and included as part of the reporting process, noting that additional salinity monitoring sites may need to be included to support this reporting*

d) *The effectiveness of EoVTs should be reviewed on a 5 yearly basis and where required adjusted.*

Recommendation 7 - Implementing a risk-based approach to Register entries

a) *To support a risk based salinity assessment, register entries should include a qualitative uncertainty assessment*

b) *Recognising the uncertainty in register entries, new register entries including their supporting models should be reviewed in 5 years*

c) *Review of established debit and credit register entries (post initial 5 year review) including their supporting models should be reviewed on the following basis:*

   i) *For high risk entries (i.e. entries with high impact (1 EC or more) and high uncertainty) where there is a change in salinity processes or there is new data - retain the 5 year review*

   ii) *For high risk entries (i.e. entries with high impact (1 EC or more) and high uncertainty) where there is no change in salinity processes or no new data - move to a 7 year review*

   iii) *For all other entries (i.e. low risk entries with small impact (<1 EC) or high risk entries with low uncertainty) – require internal reporting and consider the need for reviews as part of a major program review of BSMS 2030.*

d) *Consolidation of small stable register entries.*

Recommendation 8 - Benchmark period

The BSMS benchmark period should be reviewed prior to the commencement of BSMS 2030 and a decision made by BOC as whether the benefits of changing the benchmark period outweigh the costs.

Recommendation 9 - BigMod model review

In the review of BigMod:

a) *The MDBA provide advice on the way that cumulative actions are configured in BigMod. Particular consideration should be given to:*

   i) *The chronological order of entries and alignment with the current BSMS operational protocols (MDBC, 2005)*

   ii) *Detail how reviews in register entries are implemented in the model.*

b) *Given that the BSMS Operational Protocols (March 2005) are not clear on how to include reviews of salinity actions in the register, the model review should consider the sensitivity to the following interpretations of how to implement the register review changes:*

   i) *Initial entry updated for the change (Chronological order not changed)*

   ii) *Change included at the time of the review (Chronological order maintained for the change)*

   iii) *Revised salinity included at the time of the review (Chronological order changed to review date).*

c) *Given the likelihood of changes to operational practices of SISs in the future, the model review should provide advice on the adequacy of BigMod to be used for operational decisions, in particular the adequacy of the results from the model to inform the operation of salinity interception schemes*

d) *The BigMod Review should be made transparent to the IAG-Salinity auditors.*

Recommendation 10 - BSMS Baseline

In the development of BSMS 2030, consideration is given as to whether there is a need to set a new Baseline date at the commencement of BSMS 2030, and potentially at the commencement of any future BSMS stages.

Recommendation 11 - Coordinated development of models to support BSMS 2030

BSMS 2030 provides some overall direction on the development of the next generation of models for salinity management to facilitate a consistent approach to model development and their underlying conceptual basis.

Recommendation 12 - Monitoring

In the development of BSMS 2030, consideration is given to requiring jurisdictions to identify monitoring stations that are critical in providing data for:

a) *BSMS 2030 reporting*

b) *Modelling reviews*

c) *Improving understanding of salinity processes in high priority areas of the Basin and that these stations are provided with policy status to ensure they are maintained as jurisdictions review their monitoring networks in the future.*

Recommendation 13 – Audit and Reporting Processes

In the development of BSMS 2030, consideration is given to:

a) *Maintaining annual reporting on the registers through to the Ministerial Council*

b) *Moving, in principle, to a biennial Independent Audit process (noting there may be utility in some annual audits over the early transition period)*

c) *Changing the format of the audit process to provide a shared jurisdiction session for continuous improvement processes*

d) *Holding a jurisdictional workshop biennially to share information, issues and best practice*

e) *Stream-lining reporting between the BSMS 2030 and the Basin Plan.*

Recommendation 14 – 2015 BSMS Audit

a) *the Terms of Reference for the final audit in 2015 should ensure that it is aimed only at closing off the BSMS and is not as detailed as previous audits*

b) *consideration given to linking it to a forum where the MDBA, jurisdictions and their delivery partners can showcase key achievements of their BSMS implementation programs.*

Recommendation 15 – Maintaining Institutional Memory, Capacity and Capability

The IAG-Salinity recommends that in the development of the BSMS 2030, consideration is given to embedding processes and incentives that will ensure that capacity and capability in salinity management is maintained within the MDBA and the jurisdictions.

Recommendation 16 - CSG Salinity Impacts

a) *in BSMS 2030, potential is provided to ensure that the impacts of CSG development on salinity within the Basin are broadly monitored and if and where necessary, are able to be managed within the new framework for salinity management*

b) with respect to CSG water in Queensland:

i) In the next review of their Beneficial Use policy, Queensland should address a policy gap that omits salinity from consideration in approvals of new irrigation development

ii) Queensland should adequately monitor potential salinity hazards arising through irrigation associated with CSG which will require a better combined monitoring database

iii) The potential cumulative impacts of irrigation associated with CSG in Queensland needs to be assessed to determine if it is a threat to the Basin salinity program.

The IAG-Salinity's opinion on the balance of salinity credits and debits for each state

Schedule B, Clause 16 (1) provides as follows:

16(1) A State Contracting Government must take whatever action may be necessary:

(a) to keep the total of any salinity credits in excess of, or equal to, the total of any salinity debits, attributed to it in Register A.

(b) to keep the cumulative total of all salinity credits in excess of, or equal to, the cumulative total of all salinity debits, attributed to it in both Register A and Register B.

Register A currently shows NSW, Victoria and South Australia to be in net credit, while Register B shows NSW and South Australia to be in net credit with Victoria slightly in credit but close to neutral. For the combined registers, all three states are in credit. Queensland and the ACT do not have register entries.

Opinion on register balances

The IAG–Salinity has examined the registers as provided for this audit and has come to the opinion that NSW, Victoria and South Australia are in a net credit position.

Opinion on MDBA's accuracy in maintaining the registers

The IAG–Salinity found no inaccuracies in MDBA's maintenance of the registers as provided for incorporation into this report.

The audit did not identify any requirement to update individual entries in the registers incorporated in this report.

Response to Recommendations from 2012-13 Audit

The jurisdictions and the MDBA outlined their responses to the recommendations of the 2012-13 audit recommendations. The IAG-Salinity noted that the MDBA and jurisdictions were generally supportive of the intent and direction of the recommendations and that many of the recommendations had been considered as part of the General Review of Salinity Management in the MDB (August 2014). All had been progressed to some extent and all were being further considered in the development of the BSMS 2030.

Appendix B: BSMS salinity registers 2014

The BSMS salinity registers 2014 present individual accountable actions as credits and debits expressed both in EC impacts and as cost effects in dollar values.

Register A includes accountable actions taken after the baseline conditions date (1988 for NSW, Victoria and South Australia, 2000 for Queensland and the ACT) and joint–funded works and measures. Accountable actions that are predicted to cause increases in salinity are referred to as debits and are shown in as a positive number. Accountable actions that result in a decrease in salinity levels are referred to as salinity credits and are shown as a negative number. Salinity debits can be offset by credits arising from joint works and other credit generating actions, such as improved land and catchment management practices.

Register B accounts for 'Legacy of History' or delayed salinity impacts that continue to appear after the baseline conditions were adopted but are the result of actions that occurred before the date of baseline conditions. As with Register A, salinity debits can be offset by salinity credits (green).

Explanation of the BSMS salinity registers

Table 4 is a summary of the BSMS salinity registers 2014. Table 11 and Table 12 are the actual salinity registers, which provide more detail on the credits and debits of specific actions. This section explains the broad groups of register entries.

Joint works and measures

The first line summarises the economic benefits in the river arising from joint works and measures for each state and the Commonwealth.

Joint works and measures refer to salt interception schemes constructed as part of the Salinity and Drainage Strategy (MDBC 1989) and those developed under the BSMS. The registers demonstrate the benefits of the shared schemes between the investing states. The Australian Government has provided significant financial input to the schemes, which is reflected in the right–hand column showing a salinity benefit equivalent to that contribution. A proportion of credits generated by the joint works and measures program is assigned to individual states to offset the debts recorded in Register B. In the registers summary (Table 4), these transfers are shown as 'Transfers to Register B'.

State shared works and measures

Some states have carried out actions, such as adopting targeted river operating rules that provide downstream salinity benefits. These benefits are shown as 'shared measures' in the salinity registers.

State actions

The individual state actions reflect the land and water use salinity costs and benefits to the river. Typical examples of activities that increase salinity costs include new irrigation developments, the construction of new drainage schemes that mobilise salt to the river and wetland flushing. Offsetting activities include improved irrigation efficiencies and improved river operations.

Total Registers A and B

The overall cumulative accountability for salinity impacts on the river in 2013–14 is summarised in the ‘Total Register A’ and ‘Total Register B’ rows. Register A maintains accountability for actions after 1 January 1988 for NSW, Victoria and South Australia, and after 1 January 2000 for Queensland and the ACT. The ‘Total for Register A’ reflects the sum of the salinity cost of the state actions offset by ‘Joint works and measures’ or ‘State shared works and measures’ shown in the preceding lines. Register B accounts for actions that occurred before the baseline year but for which the impacts were not experienced until after the baseline year because of the slow movement of groundwater and salt to the river. There have been significant improvements in confidence ratings for Register A items in recent years; however, many of the Register B items continue to have medium or low confidence ratings. This suggests relatively wide uncertainty bands around the Register B totals compared with Register A totals.

Balance Register A & B

The register balance provides an overall assessment of whether each Basin partner is in net credit or debit. This balance needs to be interpreted in the light of the different levels of confidence in individual register entries provided by Register B. Uncertainty bands associated with the lower confidence in the Register B entries are incorporated into the overall balance for Register A and Register B items.

Table 11: 2014 Salinity Register A

	AUTHORITY REGISTER A (Accountable Actions)	Type	Date Effective	Provisional Salinity Credit ($m/yr)	Current Impact on Morgan 95%ile Salinity (EC)	Impact on Flow at Mouth (GL/y))	Salinity Effect^ (EC at Morgan)					Salinity Credits# (Interpolation to Current Year Benefits $m/year)							Commonwealth Contribution (EC)	5 Year Rolling Review			Confidence	
							2000	2015	2050	2100	Modelled Current Conditions (Interpolation to Current Year)	NSW	Vic	SA	Qld	ACT	Total			Latest Review	Next Review	Status	Rating	Comment
	JOINT WORKS & MEASURES																							
	Former Salinity & Drainage Works																							
1	Woolpunda SIS	SDS	Jan 1991		-87	0	-47.4	-47.4	-47.4	-47.4	-47.4	0.729	0.729				3.890	1	11.8	2007	2012		High	Based on Salt loads in river
2	Improved Buronga and Mildura/Merbein IS	SDS	Jan 1991		-6	0	-3.0	-3.0	-3.0	-3.0	-3.0	0.140	0.140				0.748	2	0.8	2005	2010		Medium	Based on Salt loads in river
3	New Operating Rules for Barr Creek Pumps	SDS	Jul 1991		-8	0	-4.9	-4.9	-4.9	-4.9	-4.9	0.225	0.225				1.198	3	1.2	2011	2016		High	Rules need to be revisited 2007
4	Waikerie SIS	SDS	Dec 1992		-19	0	-12.8	-12.8	-12.8	-12.8	-12.8	0.198	0.198				1.057	4	3.2	2007	2012		High	Based on Salt loads in river
5	Changed MDBC River Operations 1988 to 2000	SDS	Apr 1993		-1	4	-1.6	-1.6	-1.6	-1.6	-1.6	0.150	0.150				0.797	5	0.4	2005	2010		High	
6	Mallee Cliffs SIS	SDS	Jul 1994		-17	0	-11.4	-11.3	-11.3	-11.3	-11.3	0.512	0.512				2.733	6	2.8	2013	2018		High	Based on 2012 Groundwater model
7	Changed Operation of Menindee and Lower Darling	SDS	Nov 1997		3	8	0.9	0.9	0.9	0.9	0.9	-0.146	-0.146				-0.776	7	-0.2	2005	2010		High	
8	Waikerie Phase 2A SIS	SDS	Feb 2002		-14	0	-8.0	-8.2	-10.7	-8.9	-8.2	0.113	0.113				0.602	8	2.1	2007	2012		High	
9	Changed MDBC River Operations 2000 to 2002	SDS	Feb 2002		-2	-1	-1.4	-1.4	-1.7	-1.9	-1.4	-0.139	-0.139				-0.740	9	0.3	2006	2011		High	
	Sub Total - Former Salinity & Drainage Works				-151	11	-89.6	-89.8	-92.6	-91.0	-89.8	1.783	1.783	0.000	0.000	0.000	9.508		22.4					
	Basin Salinity Management Strategy																							
10	Changed MDBC River Operations after 2002	BSMS	Dec 2003		1	7	-0.2	-0.2	-0.4	-0.4	-0.2	0.021	0.021	0.021			0.130	10	0.1	2005	2010		High	
11	Pyramid Ck GIS	BSMS	Mar 2006		-6	0	-5.1	-5.1	-5.2	-5.2	-5.1	0.230	0.230	0.230			1.402	11	1.3	2010	2015		High	Remodelled 2010
12	Bookpurnong SIS	BSMS	Mar 2006		-20	0	-8.2	-11.2	-16.0	-17.0	-11.1	0.207	0.207	0.207			1.266	12	2.8	2013	2018		Low	Reviewed 2013
13	Improved Buronga SIS	BSMS	Mar 2006		-1	0	-0.6	-0.5	-0.5	-0.5	-0.5	0.021	0.021	0.021			0.127	13	0.1	2006	2011		High	Remodelled 2006
14	Loxton SIS	BSMS	Jun 2008		-17	0	-10.5	-10.8	-11.1	-12.0	-10.8	0.206	0.206	0.206			1.255	14	2.7	2013	2018		High	Reviewed 2013
15	Waikerie Lock 2 SIS	BSMS	Jun 2010		-17	0	-12.7	-10.3	-11.3	-11.8	-10.3	0.115	0.115	0.115			0.700	15	2.6	2010	2015		High	
16	Upper Darling SIS	BSMS	Jun 2014		-4	0	-4.5	-4.6	-4.5	-4.5	-4.6	0.241	0.241	0.241			1.468	16	1.1	2014	2019		Low	Based on a reduction of 37.5t/d
17	Murtho SIS	BSMS	Jun 2014		-50	0	-13.7	-17.3	-29.8	-31.1	-17.2	0.529	0.529	0.529			3.226	17	4.3	2014	2019		Low	Based on 2006 Groundwater model
	Sub Total Joint Works under BSMS				-113	6	-55.5	-59.9	-78.8	-82.5	-59.8	1.569	1.569	1.569	0.000	0.000	9.572		14.9					
	Joint Works Sub Total				-264	17	-145.1	-149.7	-171.4	-173.6	-149.6	3.352	3.352	1.569	0.000	0.000	19.081		37.4					
	The Living Murray Works and Measures and Water for Rivers**																							
18	TLM-RMIF 570 GL	TLM	Jun 2014	3.696	-47	346	-24.4	-24.4	-24.4	-24.4	-24.4							18						Provisional (MDBA Technical report No 2014/12)
19	TLM Works and Measures	TLM	Jun 2014	-0.902	5	0	4.6	4.6	4.6	4.6	4.6							19						Provisional (MDBA Technical report No 2014/12)
	TLM Sub Total			2.794	-42	346	-19.8	-19.8	-19.8	-19.8	-19.8													
	STATE WORKS & MEASURES																							
	Shared New South Wales and Victorian Measures																							
20	Permanent Trade Accounting Adjustment - NSW to Victoria	50N50V	Jun 2006		0	0	0.0	-0.1	-0.1	-0.1	-0.1	0.000	0.000				0.000	20	0	2006	2011		High	No permanent trade since 2006
21	Barmah-Millewa Forest Operating Rules	50N50V	Mar 2002		-2	33	-1.9	-2.0	-1.9	-2.3	-2.0	0.188	0.188				0.376	21	0	2006	2011		High	
	Shared Measures Sub Total				-2	33	-2.0	-2.1	-2.0	-2.3	-2.1	0.188	0.188	0.000	0.000	0.000	0.376		0					
	New South Wales																							
22	Boggabilla Weir	NSW	Dec 1991		0	0	-0.1	-0.1	-0.1	-0.1	-0.1	0.042					0.042	22	0	2007	2012		Medium	Remodelled 2007
23	Pindari Dam Enlargement	NSW	Jul 1994		0	-17	0.7	0.7	0.7	0.7	0.7	-0.121					-0.121	23	0	2007	2012		Medium	
24	Tandou pumps from Lower Darling	NSW	Sep 1994		2	-3	-0.1	-0.1	-0.1	-0.1	-0.1	0.034					0.034	24	0	2005	2010		Medium	
25	NSW MIL LWMP's	NSW	Feb 1996		-4	57	-4.0	-4.0	-4.0	-4.0	-4.0	0.684					0.684	25	0	2010	2015		High	
26	NSW Changes to Edward-Wakool and Escapes	NSW	Jan 1990		-2	4	-2.0	-2.1	-2.0	-2.0	-2.1	0.368					0.368	26	0	2005	2010		High	
27	Permanent Trade Accounting Adjustment - NSW to SA	NSW	Jun 2006		-3	1	-0.5	-0.4	-0.4	-0.5	-0.4	0.108					0.108	27	0	2005	2010		High	No permanent trade since 2006
28	NSW Sunraysia Irrigation Development 1997 to 2006	NSW	Jul 2003		1	0	0.0	0.9	4.5	6.1	0.8	-0.187					-0.187	28	0	2007	2012		High	
29	RISI Stage 1	NSW	Jun 2010		-5	0	-2.7	-3.9	-4.1	-4.1	-3.8	0.830					0.830	29	0	2010	2015		Medium	Red Cliffs to Wentworth river reach
30	RISI Stage 2	NSW	Jun 2014		-4	0	-3.6	-3.8	-3.9	-3.9	-3.8	0.845					0.845	30	0	2014	2019		Medium	Colignan to Red Cliffs river reach
31	NSW S&DS Commitment Adjustment	NSW	Nov 2002		0	0	0	0	0	0	0	0.910					0.910	31	0					
	New South Wales Works and Measures				-15	43	-12.4	-12.9	-9.4	-8.0	-12.9	3.514					3.514		0					

	AUTHORITY REGISTER A (Accountable Actions)	Type	Date Effective	Provisional Salinity Credit ($m/yr)	Current Impact on Morgan 95%ile Salinity (EC)	Impact on Flow at Mouth (GL/y))	Salinity Effect^ (EC at Morgan)						Salinity Credits# (Interpolation to Current Year Benefits $m/year)							Commonwealth Contribution (EC)		5 Year Rolling Review				Confidence	
							2000	2015	2050	2100	Modelled Current Conditions (Interpolation to Current Year)		NSW	Vic	SA	Qld	ACT	Total				Latest Review	Next Review	Status		
	Victoria																									
32	Barr Creek Catchment Strategy	Vic	Mar 1991		-12	0	-7.7	-7.7	-7.7	-7.7	-7.7			1.963				1.963	32	0		2013	2018		High	Reviewed 2013
33	Tragowel Plains Drains at 2002 level	Vic	Mar 1991		1	1	0.2	0.2	0.2	0.2	0.2			-0.022				-0.022	33	0		2013	2018		High	Reviewed 2013
34	Shepparton Salinity Management Plan	Vic	Mar 1991		0	24	1.4	1.4	1.5	1.5	1.4			-0.383				-0.383	34	0		2008	2016		Low	Exclude private pumps
35	Nangiloc-Colignan S.M.P.	Vic	Nov 1991		-1	1	0.4	0.4	0.4	0.4	0.4			-0.102				-0.102	35	0		2013	2018		High	Reviewed 2013
36	Nyah to SA Border SMP - Irrigation Development	Vic	Jul 2003		21	0	13.8	13.8	13.7	13.7	13.8			-3.250				-3.250	36	0		2014	2019		Medium	Data updated to 2013, Entry represents the upper bound of salinity impact
37	Kerang Lakes/Swan Hill Salinity Management Plan	Vic	Jan 2000		2	4	1.1	1.6	1.1	0.9	1.6			-0.370				-0.370	37	0		2010	2015		High	Remodelled 2006
38	Campaspe West SMP	Vic	Aug 1993		1	0	0.4	0.3	0.4	0.3	0.3			-0.077				-0.077	38	0		2010	2015		High	
39	Psyche Bend	50V50C	Feb 1996		-4	0	-2.1	-2.1	-2.1	-2.1	-2.1			0.237				0.474	39	1.0		2011	2016		Medium	
40	Permanent Trade Accounting Adjustment - Victoria to SA	Vic	Jun 2006		0	2	-0.7	-0.8	-0.8	-1.0	-0.7			0.184				0.184	40	0		2005	2010		High	No permanent trade since 2006
41	Woorinen Irrigation District Excision	Vic	Sep 2003		0	-2	1.3	0.8	1.0	1.2	0.8			-0.229				-0.229	41	0		2010	2015		High	
42	Sunraysia Drains Drying up	Vic	Jun 2004		-2	-4	-2.1	-2.2	-2.1	-2.1	-2.2			0.637				0.637	42	0		2011	2016		Medium	
43	Lamberts Swamp	Vic	Jun 2004		-5	0	-3.0	-3.0	-3.0	-3.0	-3.0			0.625				0.625	43	0		2011	2016		High	
44	Church's Cut decommissioning	Vic	Mar 2006		1	0	-0.4	-0.3	-0.3	0.0	-0.3			0.097				0.097	44	0		2010	2015		High	Remodelled 2010
45	Mallee Drainage bore decommissioning	Vic	Jun 2008	0.057	0	0	-0.1	-0.3	-0.3	-0.3	-0.3								45	0		2013	2018		Low	Reviewed 2013
46	RISI Stage 1	Vic	Jun 2010		-8	0	-2.0	-5.5	-6.8	-7.1	-5.4			1.249				1.249	46	0		2010	2015		Medium	Red Cliffs to Wentworth river reach
47	RISI Stage 2	Vic	Jun 2014		-6	0	-4.4	-4.7	-5.0	-5.1	-4.7			1.051				1.051	47	0		2014	2019		Medium	Colignan to Red Cliffs river reach
48	Victorian S&DS Commitment Adjustment	Vic	Nov 2002		0	0	0.0	0.0	0.0	0.0	0.0			1.600				1.600	48	0						
	Victoria Works and Measures				-14	25	-3.8	-7.9	-10.0	-10.3	-7.8			3.210				3.447		1.0						
	South Australia																									
49	SA Irrigation Development Based on Footprint Data*	SA	Jul 2003		7	0	-3.6	5.8	33.9	72.8	5.4				-0.633			-0.633	49	0		2015	2020		Low	
50	SA Irrigation Development Due to Water Trade	SA	Jun 2006		0	0	0.1	0.5	16.2	32.2	0.5				-0.149			-0.149	50	0		2003	2008		High	
51	SA Irrigation Development Based on Site Use Approvals	SA	Jun 2010		0	0	-0.1	0.3	16.9	93.0	0.3				-0.055			-0.055	51	0		2013	2018		High	Based on Site Use Approval up to 2014
52	SA Component of Bookpurnong SIS	SA	Mar 2006		-7	0	-3.0	-4.1	-5.9	-6.3	-4.1				0.462			0.462	52	0		2013	2018		High	Reviewed 2013
53	SA Component of Loxton SIS	SA	Jun 2008		-1	0	-0.8	-0.8	-0.8	-0.9	-0.8				0.095			0.095	53	0		2013	2018		High	Reviewed 2013
54	SA component of Waikerie Lock 2 SIS	SA	Jun 2010		-1	0	-1.2	-0.7	-2.0	-2.6	-0.7				0.047			0.047	54	0		2010	2015		High	
55	SA Improved Irrigation Efficiency and Scheme Rehabilitation Reg A*	SA	Jan 2000		-36	0	-20.2	-22.1	-26.3	-21.3	-22.0				2.931			2.931	55	0		2012	2017		Low	
56	Qualco Sunlands GWCS	SA	Sep 2004		-5	0	-1.8	-4.0	-6.5	-7.5	-3.9				0.265			0.265	56	0		2007	2012		High	
57	Pike Stage 1 SIS	SA	Jun 2012		-5	0	-1.4	-3.2	-3.3	-3.4	-3.1				0.481			0.481	57	0		2012	2017		High	
58	SA Component of Murtho SIS	SA	Jun 2014		-1	0	-0.3	-0.4	-0.6	-0.6	-0.4				0.066			0.066	58	0		2014	2019		Low	
	South Australia Subtotal				-47	0	-32.2	-28.7	21.5	155.3	-28.8				3.512			3.512		0						
	Queensland																									
59	Land Clearing Post 2000	Qld	Jul 2005	TBD															59			2013				
60	Irrigation Development Post 2001	Qld	Jul 2005	TBD															60			2013				
	Queensland Subtotal				0	0																				
	Balance - Register A				-342	119	-195.6	-201.4	-171.2	-38.8	-221.0		7.054	6.750	5.081	0.000	0.000	25.064		39						

Registers Explanatory Notes

TBD - To be determined

^Salinity Effect - Increase or decrease in average salinity at Morgan in EC

#Salinity Credits - Unit of account of Salinity and Drainage Strategy = Reduction in Salinity Costs ($m/year March 2005 values)

* These entries are comprised of multiple MODFLOW model outputs accredited at various times. As such they are not reviewed and updated in their entirety in one year but the component models are updated in line with their 5 year review dates. The review year reflects the latest model review.

Some of the totals are affected by rounding

** Assessments based on preliminary reports. Further work is required on how these assessments are presented in the register. Salinity impacts not included in the totals.

Total Register A of $25.064m/yr excludes transfers to Register B

Table 12: 2014 Salinity Register B

	AUTHORITY REGISTER B (Delayed Salinity Impacts)	Type	Year of Predictions	Provisional Salinity Credit ($m/yr)	Current Impact on Morgan 95%ile Salinity (EC)	Impact on Flow at Mouth (GL/y))	Salinity Effect^ (EC at Morgan)						Salinity Credits (Interpolation to Current Year Benefits $m/year)							Commonwealth Contribution (EC)		5 Year Rolling Review				Confidence	
							2000	2015	2050	2100	Modelled Current Conditions (Interpolation to Current Year)		NSW	Vic	SA	Qld	ACT	Total				Latest Review	Next Review	Status		Rating	Comment
	Transfers from Register A												1.183	0.944	2.739	0.000	0.000	4.866									
	New South Wales																										
61	Darling Catchment Legacy of History - Macquarie	NSW	Jan 2000		0	0	0	0.1	0.3	0.4	0.1		-0.032					-0.032	61			2010	2015	In Progress		Medium	
62	Darling Catchment Legacy of History - Macintyre	NSW	Jan 2000		0	0	0	0	0	0	0		0.000					0.000	62			2010	2015	In Progress		Medium	
63	Darling Catchment Legacy of History - Gil Gil Ck	NSW	Jan 2000		0	0	0	0.0	0.0	0.0	0.0		-0.001					-0.001	63			2010	2015	In Progress		Medium	
64	Darling Catchment Legacy of History - Gwydir	NSW	Jan 2000		0	0	0	0.0	0.0	0.0	0.0		-0.002					-0.002	64			2010	2015	In Progress		Medium	
65	Darling Catchment Legacy of History - Namoi	NSW	Jan 2000		0	0	0	0.2	0.4	0.5	0.2		-0.047					-0.047	65			2010	2015	In Progress		Medium	
66	Darling Catchment Legacy of History - Castlereagh	NSW	Jan 2000		0	0	0	0.0	0.0	0.1	0.0		-0.006					-0.006	66			2010	2015	In Progress		Medium	
67	Darling Catchment Legacy of History - Bogan	NSW	Jan 2000		0	0	0	0.1	0.2	0.3	0.1		-0.024					-0.024	67			2010	2015	In Progress		Medium	
68	Lachlan Legacy of History	NSW	Jan 2000		0	0	0	0	0	0	0		0.000					0.000	68			2010	2015	In Progress		Medium	Little connection to Murrumbidgee
69	Murrumbidgee Catchment Legacy of History	NSW	Jan 2000		0	0	0	0.1	0.2	0.2	0.1		-0.017					-0.017	69			2010	2015	In Progress		Medium	
70	NSW Mallee - dryland	NSW	Jan 2000		0	0	0	0.3	1.3	3.6	0.3		-0.061					-0.061	70			2010	2015			Low	
71	NSW Mallee - Pre 88 Irrigation	NSW	Jan 2000		0	0	0	0.4	1.2	2.3	0.4		-0.091					-0.091	71			2010	2015			Low	
	Victoria																										
72	Campaspe Catchment Legacy of History	Vic	Jan 2000		0	0	0	0.1	0.2	0.3	0.1			-0.025				-0.025	72			2011	2016			Medium	
73	Goulburn Catchment Legacy of History	Vic	Jan 2000		1	-5	0	0.5	1.1	1.6	0.5			-0.108				-0.108	73			2013	2018			Medium	Reviewed 2013
74	Loddon Catchment Legacy of History	Vic	Jan 2000		1	-1	0	1.0	1.5	2.3	0.9			-0.232				-0.232	74			2013	2018			Medium	Reviewed 2013
75	Kiewa Catchment Legacy of History	Vic	Jan 2000		1	0	0	0.1	0	0.0	0.1			-0.037				-0.037	75			2011	2016			Medium	
76	Ovens Catchment Legacy of History	Vic	Jan 2000		0	0	0	0	0.6	1.3	0			0.000				0.000	76			2011	2016			Medium	
77	Victorian Mallee - dryland	Vic	Jan 2000		1	0	0	0.6	2.2	5.9	0.6			-0.133				-0.133	77			2010	2015			Low	
78	Victorian Mallee - Pre 88 Irrigation	Vic	Jan 2000		3	0	0	1.4	4.7	8.3	1.3			-0.309				-0.309	78			2010	2015			Low	
	South Australia																										
79	SA Mallee Legacy of History - Dryland*	SA	Jan 2000		7	0	0	4.1	14.5	32.8	4.0				-0.400			-0.400	79			2012	2017			Medium	
80	SA Mallee Legacy of History - Irrigation*	SA	Jan 2000		78	0	0	46.6	86.9	113.3	45.0				-5.917			-5.917	80			2012	2017			Low	
81	SA Improved Irrigation Efficiency and Scheme Rehabilitation Reg B*	SA	Jan 2000		-83	0	0	-49.6	-93.8	-115.4	-47.9				6.000			6.000	81			2012	2017			Low	
	Queensland																										
82	Queensland Legacy of History	Qld	Jan 2000	TBA															82			2007					Low Impact - Long lag times
83	Queensland Irrigation Development pre 1 Jan 2000	Qld	Jan 2000	TBA															83								Modelling required
	Balance - Register B			0.000	8	-6	0.0	6.0	21.5	57.9	5.8		0.902	0.100	2.422	0.000	0.000	3.424									
	Balance - Registers A & B				-334	113	-195.6	-195.4	-149.7	19.1	-215.2		7.956	6.850	7.502	0.000	0.000	28.488									
	Modelled Current Status				721	5,085	471	472	535	710	472																

Registers Explanatory Notes

TBD - To be determined

^Salinity Effect - Increase or decrease in average salinity at Morgan in EC

#Salinity Credits - Unit of account of Salinity and Drainage Strategy = Reduction in Salinity Costs ($m/year March 2005 values)

* These entries are comprised of multiple MODFLOW model outputs accredited at various times. As such they are not reviewed and updated in their entirety in one year but the component models are updated in line with their 5 year review dates. The review year reflects the latest model review.

Some of the totals are affected by rounding

** Assessments based on preliminary reports. Further work is required on how these assessments are presented in the register. Salinity impacts not included in the totals.

Total Register A of $25.064m/yr excludes transfers to Register B

Appendix C: Baseline conditions

The BSMS baseline conditions are the agreed suite of conditions in place within the catchments and rivers of the Basin on 1 January 2000. They include land use (level of development); water use (level of diversions); land and water management policies and practices (including the Murray–Darling Basin cap agreements); river operating regimes; salt interception schemes; run–off generation; salt mobilisation processes; and groundwater status and condition.

The baseline conditions have been set for all end–of–valley target sites as shown in Table 13.

Table 13: BSMS end–of–valley baseline conditions

Valley	Salinity (EC) Mean (50%ile)	Salinity (EC) Peak (80%ile)	Salt load (t/y) mean	Valley reporting site	AWRC site number
All partner governments					
Murray–Darling Basin	570	920 (95%ile)	1,600,000	Murray R at Morgan (Salinity)	426554
				Murray R at Lock 1 (Flow)	426902
South Australia					
SA Border	380	470	1,300,000	Flow to SA	426200
Lock 6 to Berri	450	600	1,500,000	Murray R at Lock 4 (Flow)	426514
Below Morgan	600	820	1,600,000	Murray R at Murray Bridge	426522
New South Wales					
Murrumbidgee	150	230	160,000	Murrumbidgee R d/s Balranald Weir	410130
Lachlan	430	660	250,000	Lachlan R at Forbes (Cottons Weir)	412004
Bogan	440	490	27,000	Bogan R at Gongolgon	421023
Macquarie	480	610	23,000	Macquarie R at Carinda (Bells Bridge)	421012
Castlereagh	350	390	9,000	Castlereagh R at Gungalman Bridge	420020
Namoi	440	650	110,000	Namoi R at Goangra	419026
Gwydir	400	540	7,000	Mehi R at Bronte	418058
NSW Border Rivers	250	330	50,000	Barwon R at Mungindi	416001
Barwon–Darling	330	440	440,000	Darling R at Wilcannia Main Channel	425008
NSW Upper Murray	54	59	150,000	Murray R at Heywoods	409016
NSW Riverine Plains	310	390	1,100,000	Murray R at Red Cliffs	414204
NSW Mallee Zone	380	470	1,300,000	Flow to SA	426200

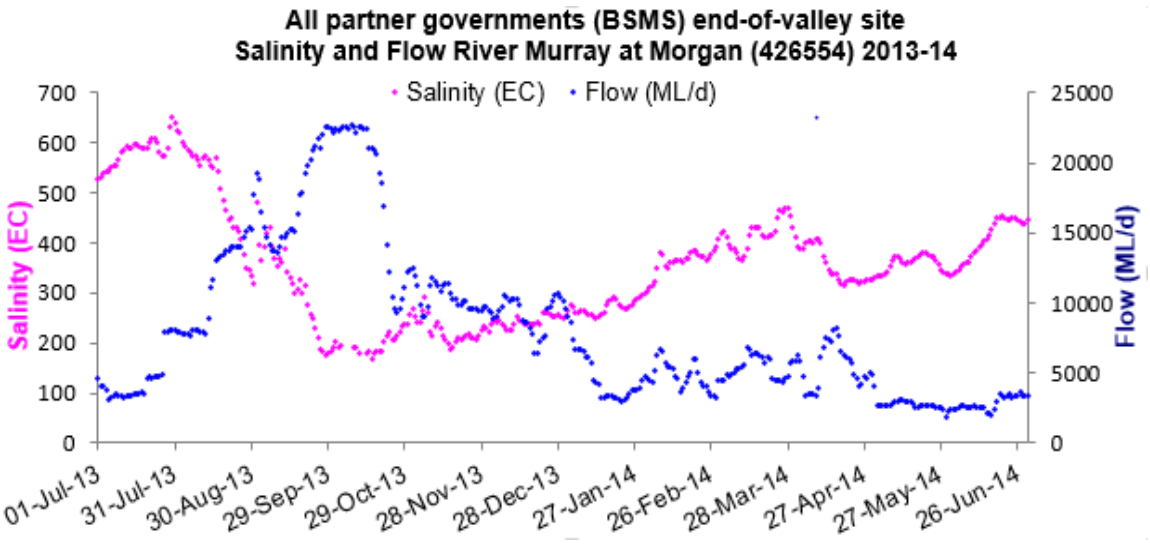
Valley	Salinity (EC) Mean (50%ile)	Salinity (EC) Peak (80%ile)	Salt load (t/y) mean	Valley reporting site	AWRC site number
Victoria					
Wimmera	1,380	1,720	31,000	Wimmera R at Horsham Weir	415200
Avoca	2,060	5,290	37,000	Avoca R at Quambatook	408203
Loddon	750	1,090	88,000	Loddon R at Laanecoorie	407203
Campaspe	530	670	54,000	Campaspe R at Campaspe Weir	406218
Goulburn	100	150	166,000	Goulburn R at Goulburn Weir	405259
Broken	100	130	15,000	Broken Ck at Casey's Weir	404217
Ovens	72	100	54,000	Ovens R at Peechelba East	403241
Kiewa	47	55	19,000	Kiewa R at Bandiana	402205
Vic. Upper Murray	54	59	150,000	Murray R at Heywoods	409016
Vic. Riverine Plains	270	380	630,000	Murray R at Swan Hill	409204
Vic. Mallee Zone	380	470	1,300,000	Flow to SA	426200
Queensland					
Qld Border Rivers	250	330	50,000	Barwon R at Mungindi	416001[a]
Moonie	140	150	8,700	Moonie R at Fenton	417204A
Condamine–Balonne	170	210	4,200	Ballandool R at Hebel—Bollon Rd	422207A
	170	210	5,000	Bokhara R at Hebel	422209A
	150	280	6,500	Braire Ck at Woolerbilla—Hebel Rd	422211A
	170	210	29,000	Culgoa R at Brenda	422015[a]
	160	210	10,000	Narran R at New Angledool	422030[a]
Paroo	90	100	24,000	Paroo R at Caiwarro	424201A
Warrego	101	110	4,800	Warrego R at Barringun No.2	423004[a]
	100	130	5,500	Cuttaburra Ck at Turra	423005[a]
Australian Capital Territory					
ACT	224	283	32,700	Murrumbidgee R at Hall's Crossing	410777

[a] These sites are operated by New South Wales for Queensland

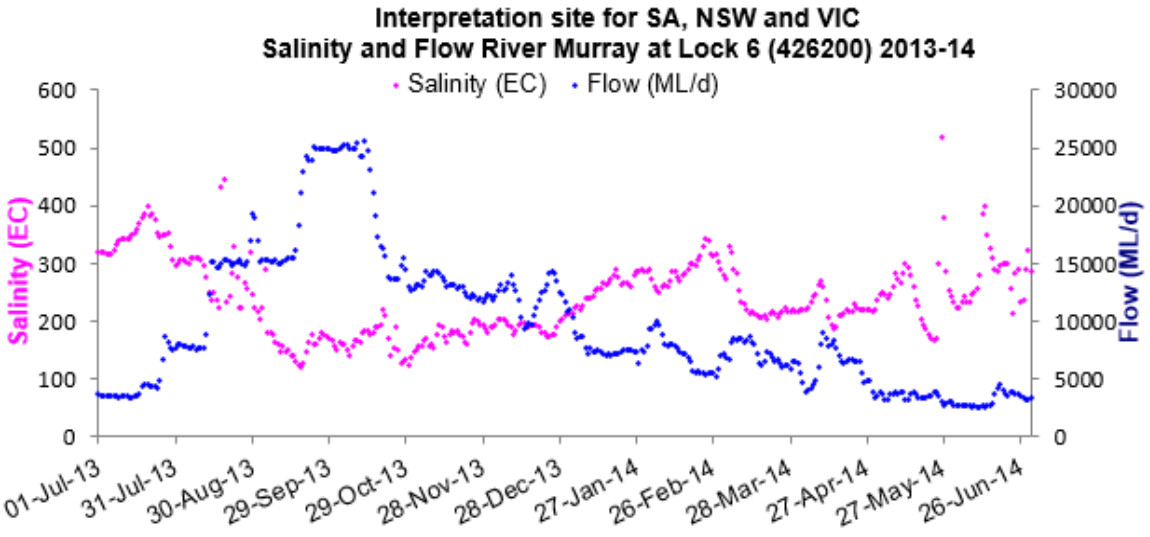
Appendix D: Flow and salinity for end–of–valley target sites 2013–14

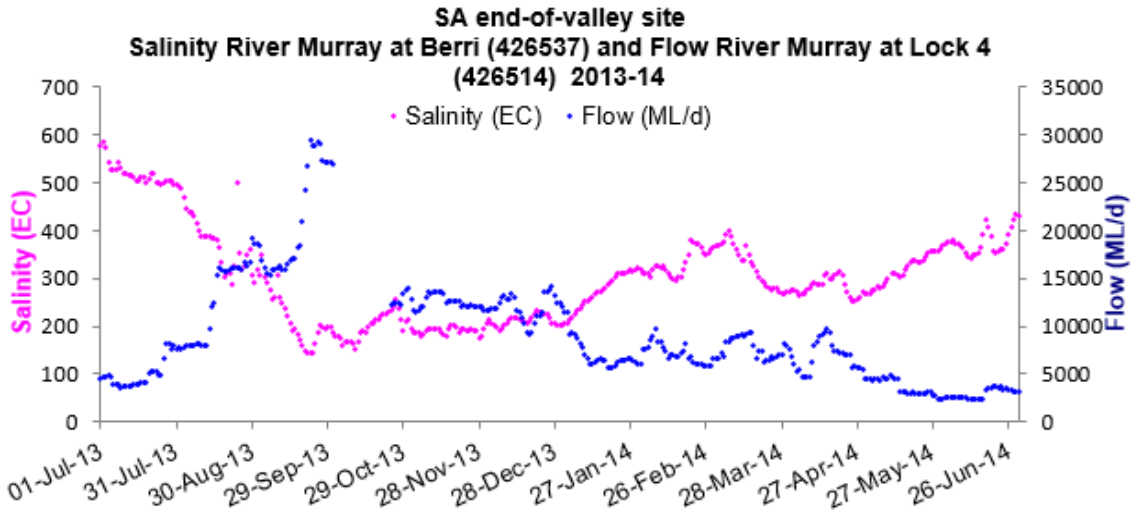
The dot plots presented in the following pages are related to the end–of–valley target sites and illustrate flow and salinity for the 2013–14 reporting period.

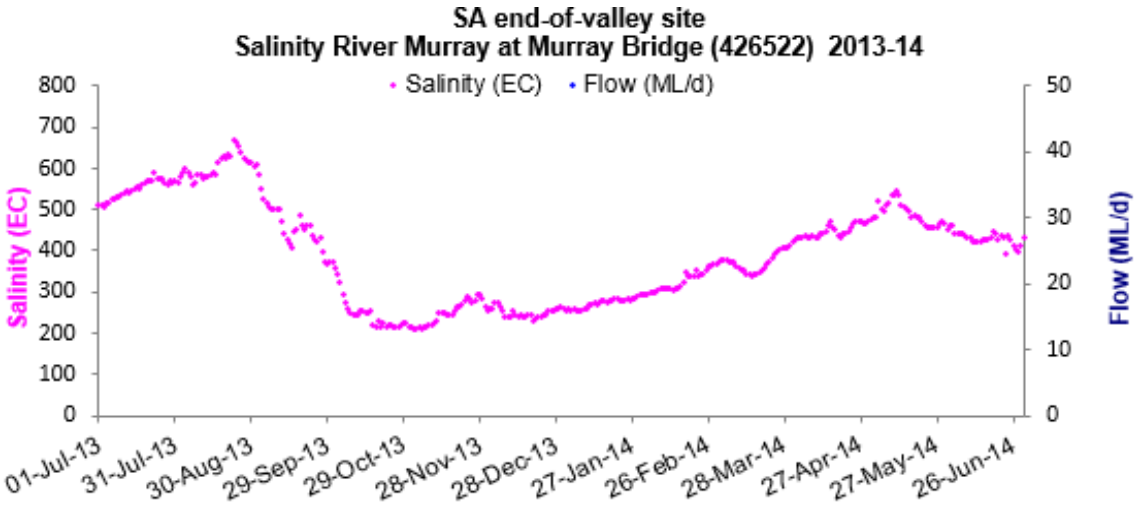
All Partner Governments



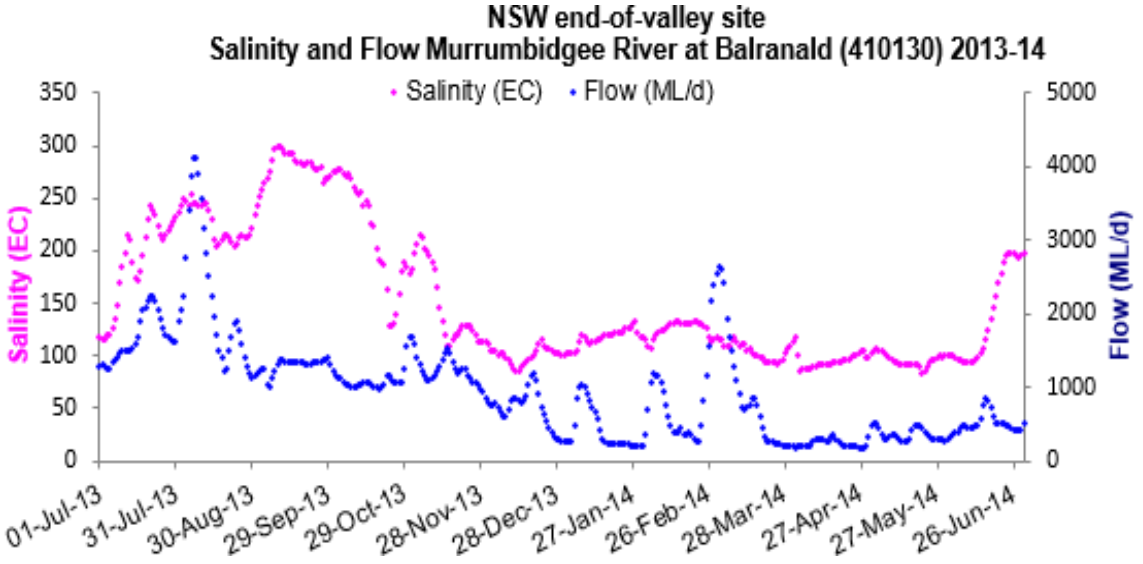
South Australia

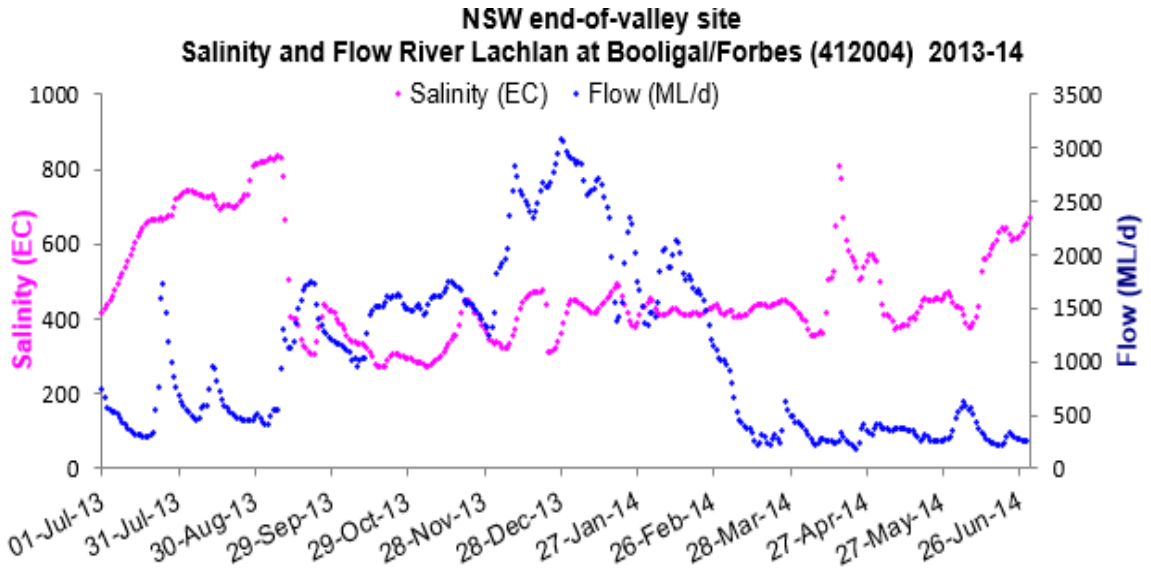


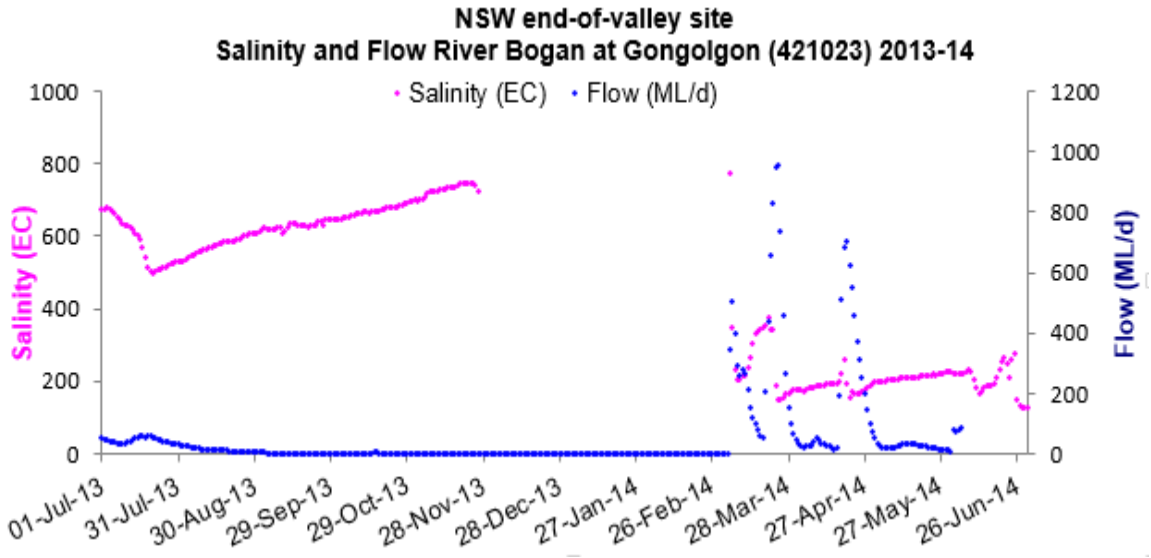


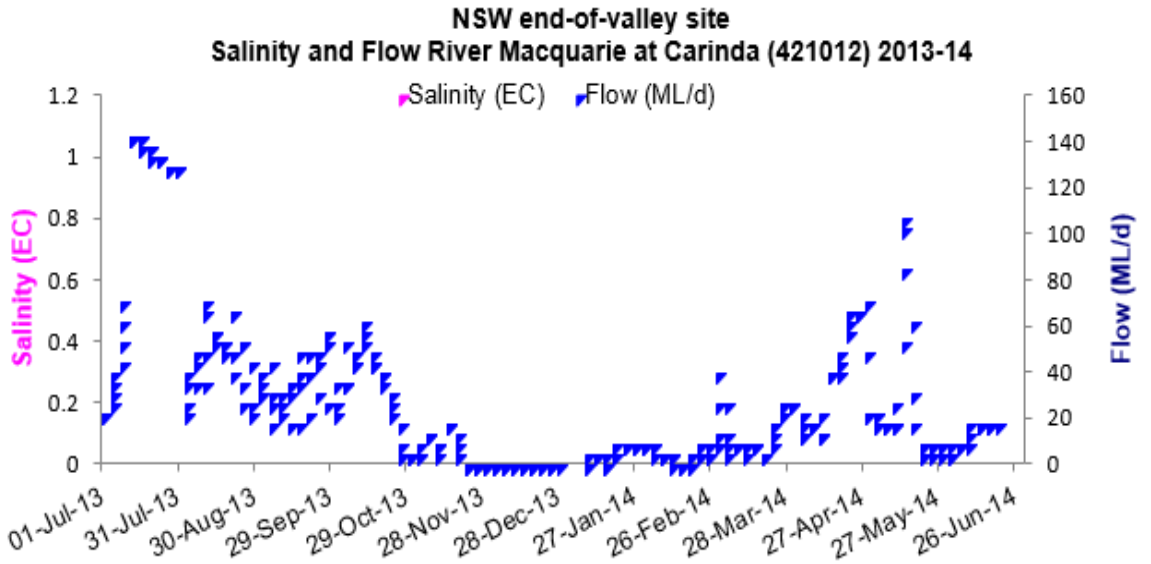


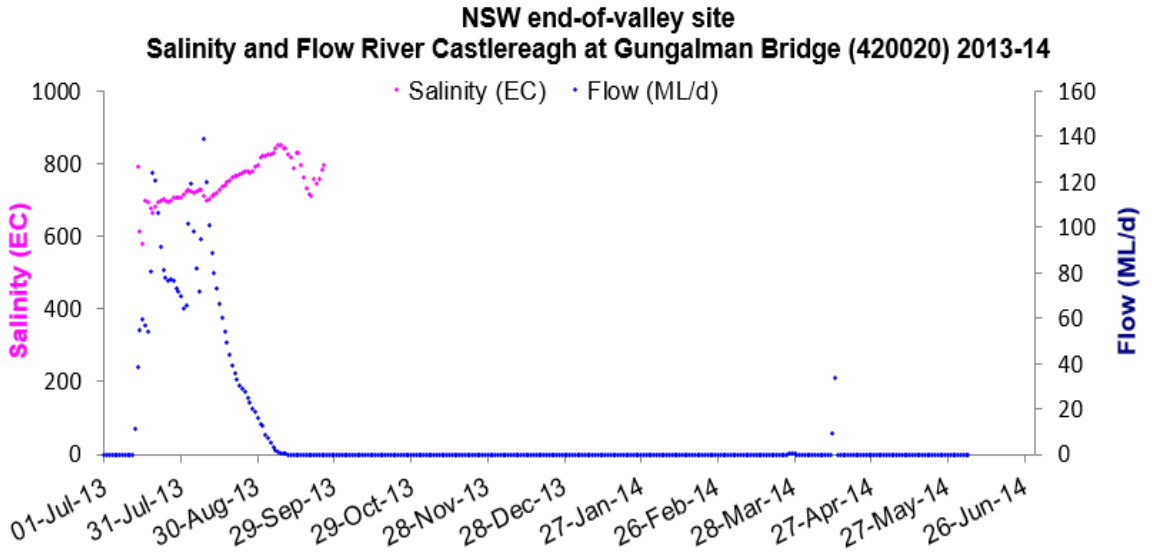
New South Wales

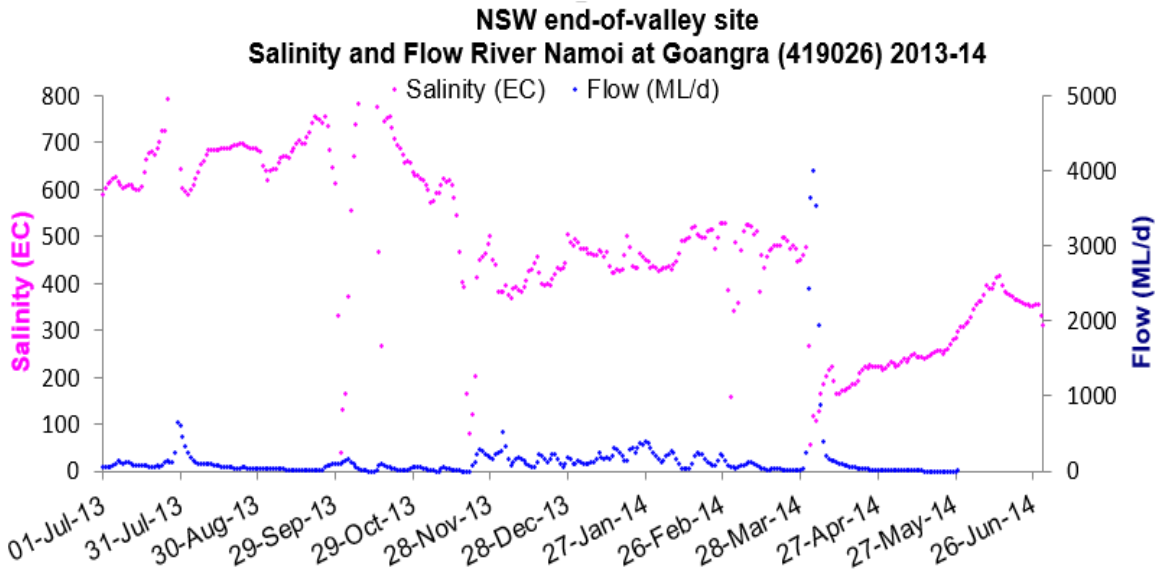


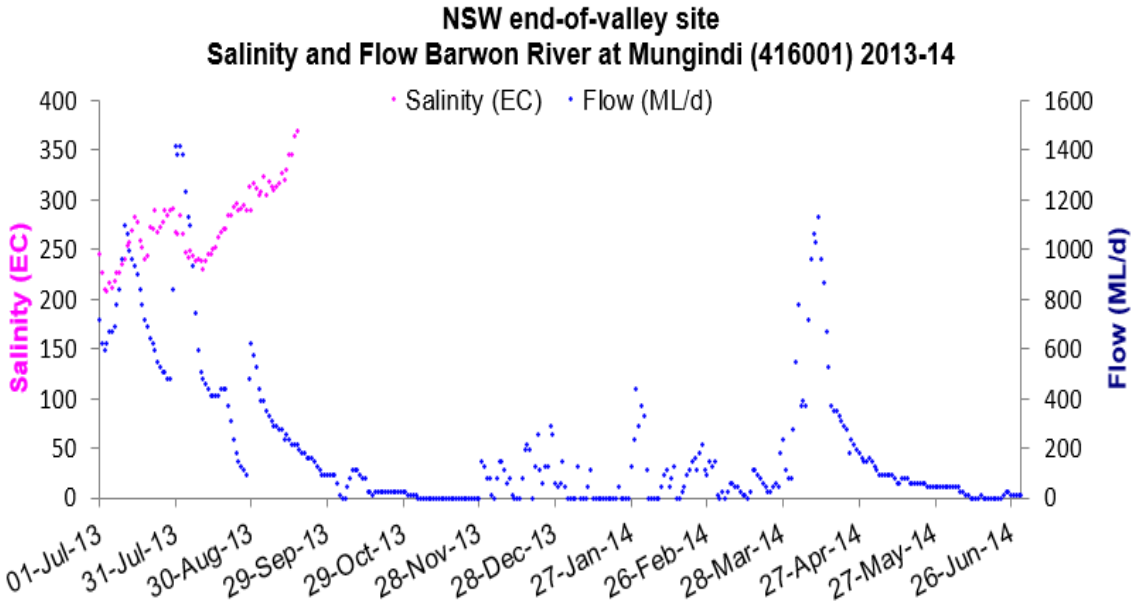

NSW end-of-valley site
Salinity and Flow River Lachlan at Booligal/Forbes (412004) 2013-14
Salinity (EC)
Flow (ML/d)
Salinity (EC)
Flow (ML/d)
1000
800
600
400
200
0
3500
3000
2500
2000
1500
1000
500
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

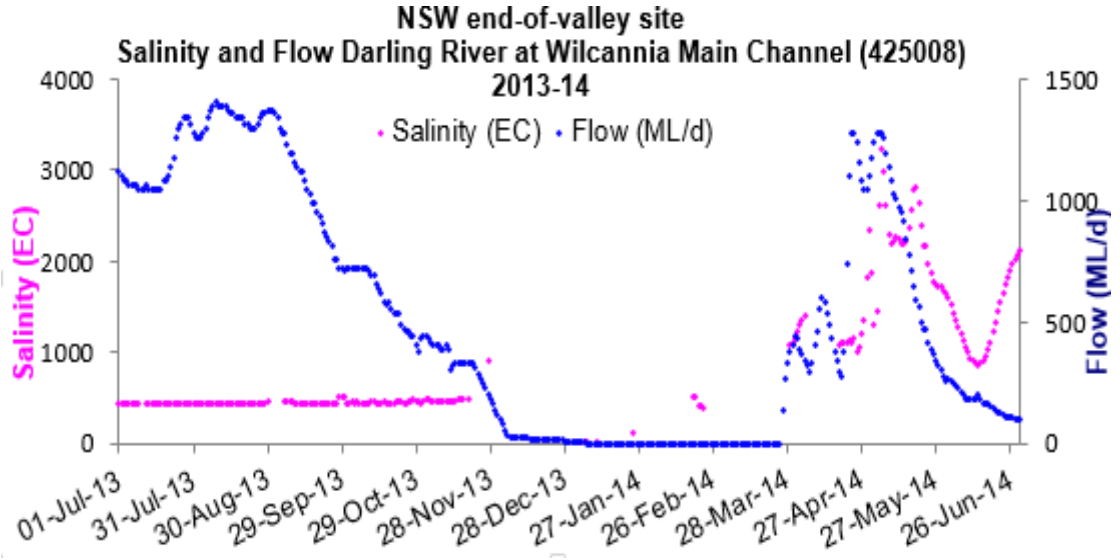

NSW end-of-valley site
Salinity and Flow River Bogan at Gongolgon (421023) 2013-14
Salinity (EC)
Flow (ML/d)
Salinity (EC)
Flow (ML/d)
1000
800
600
400
200
0
1200
1000
800
600
400
200
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

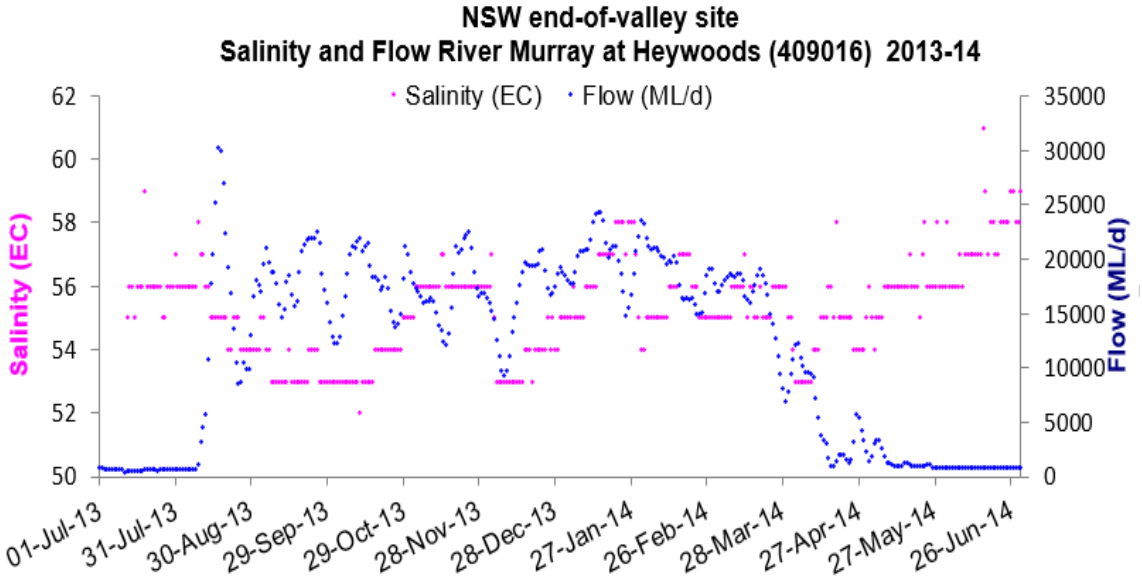

NSW end-of-valley site
Salinity and Flow River Macquarie at Carinda (421012) 2013-14
Salinity (EC)
Flow (ML/d)
Salinity (EC)
Flow (ML/d)
1.2
1
0.8
0.6
0.4
0.2
0
160
140
120
100
80
60
40
20
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

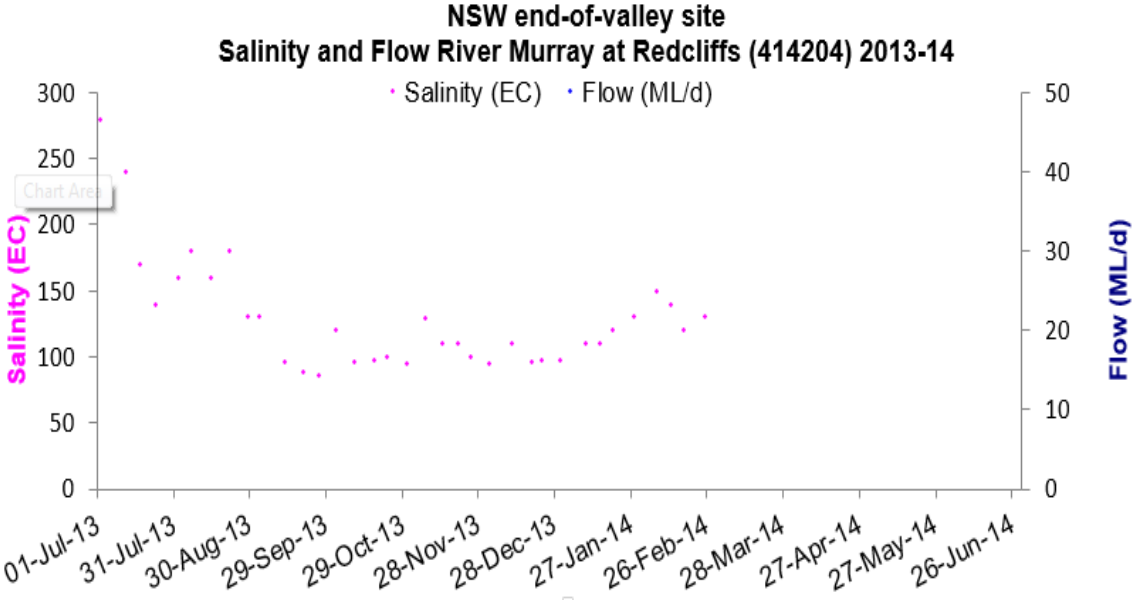

NSW end-of-valley site
Salinity and Flow River Castlereagh at Gungalman Bridge (420020) 2013-14
Salinity (EC)
Flow (ML/d)
1000
800
600
400
200
0
160
140
120
100
80
60
40
20
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14


NSW end-of-valley site
Salinity and Flow River Namoi at Goangra (419026) 2013-14
Salinity (EC)
Flow (ML/d)
800
700
600
500
400
300
200
100
0
5000
4000
3000
2000
1000
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

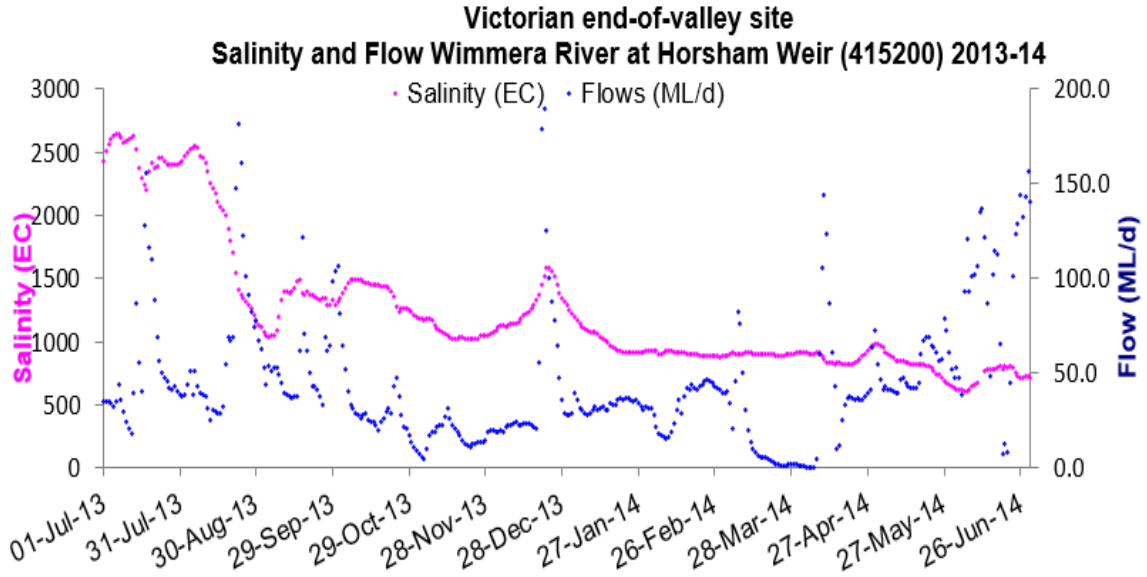

NSW end-of-valley site
Salinity and Flow Barwon River at Mungindi (416001) 2013-14
Salinity (EC)
Flow (ML/d)
400
350
300
250
200
150
100
50
0
1600
1400
1200
1000
800
600
400
200
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

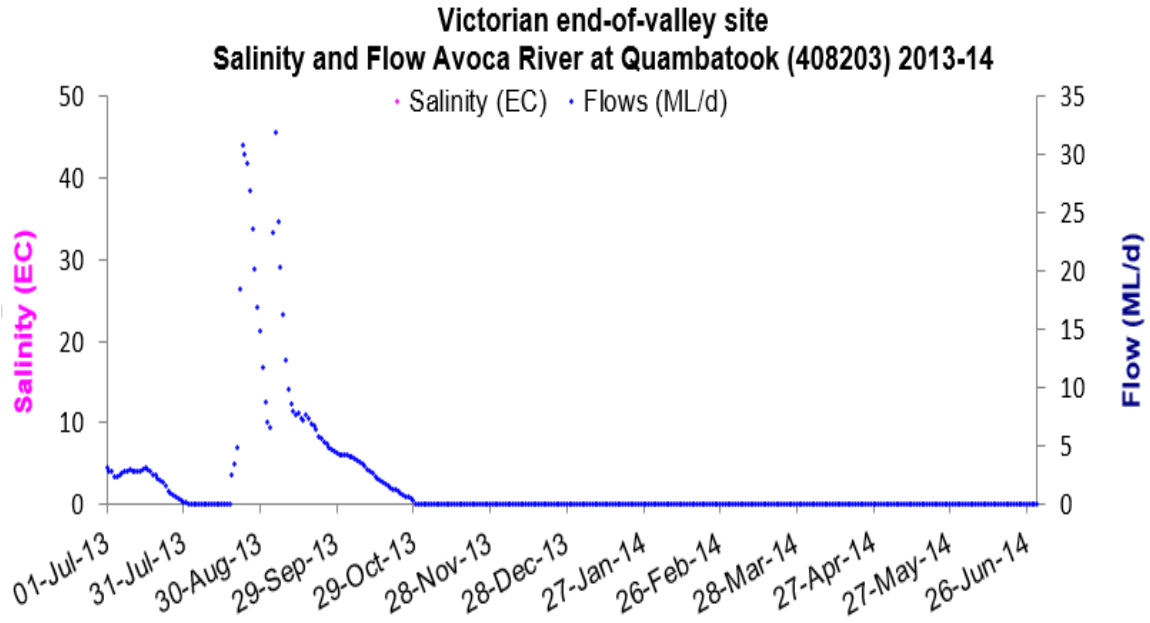

NSW end-of-valley site
Salinity and Flow Darling River at Wilcannia Main Channel (425008)
2013-14
Salinity (EC)
Flow (ML/d)
4000
3000
2000
1000
0
1500
1000
500
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

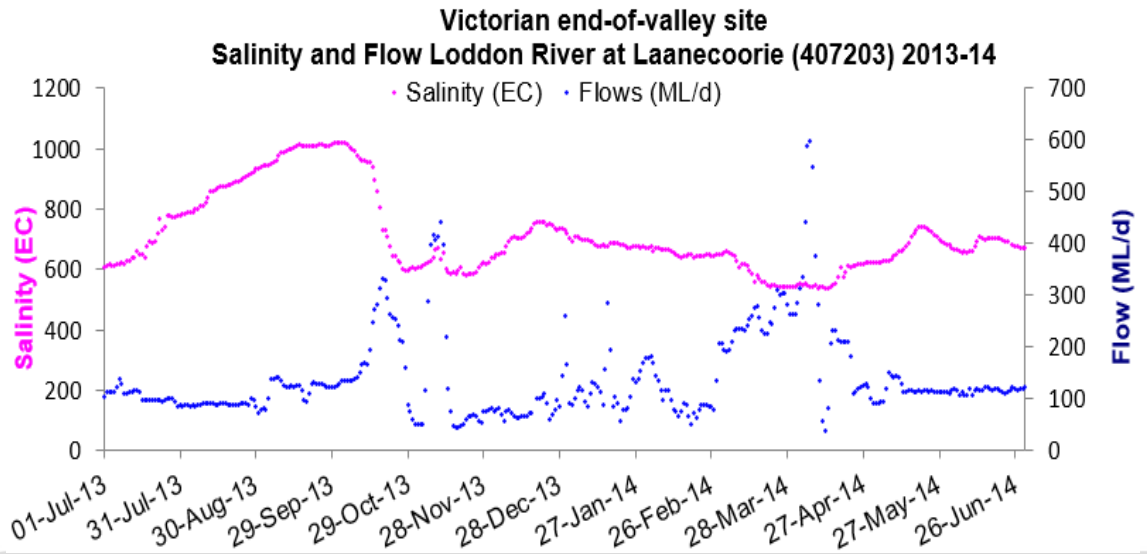

NSW end-of-valley site
Salinity and Flow River Murray at Heywoods (409016) 2013-14
Salinity (EC)
Flow (ML/d)
62
60
58
56
54
52
50
35000
30000
25000
20000
15000
10000
5000
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

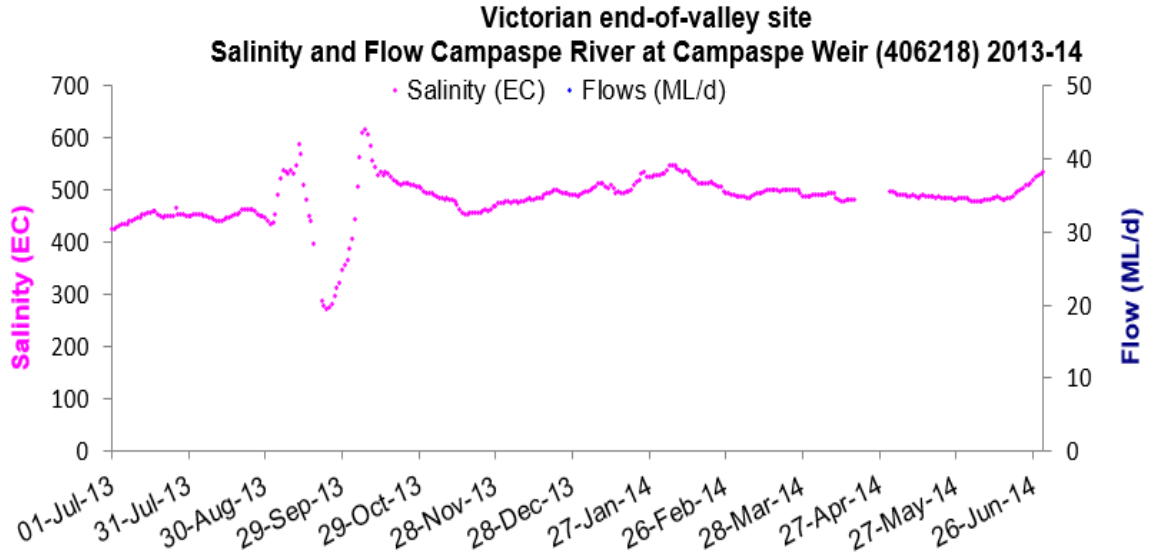

NSW end-of-valley site
Salinity and Flow River Murray at Redcliffs (414204) 2013-14
Salinity (EC)
Flow (ML/d)
300
250
200
150
100
50
0
50
40
30
20
10
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

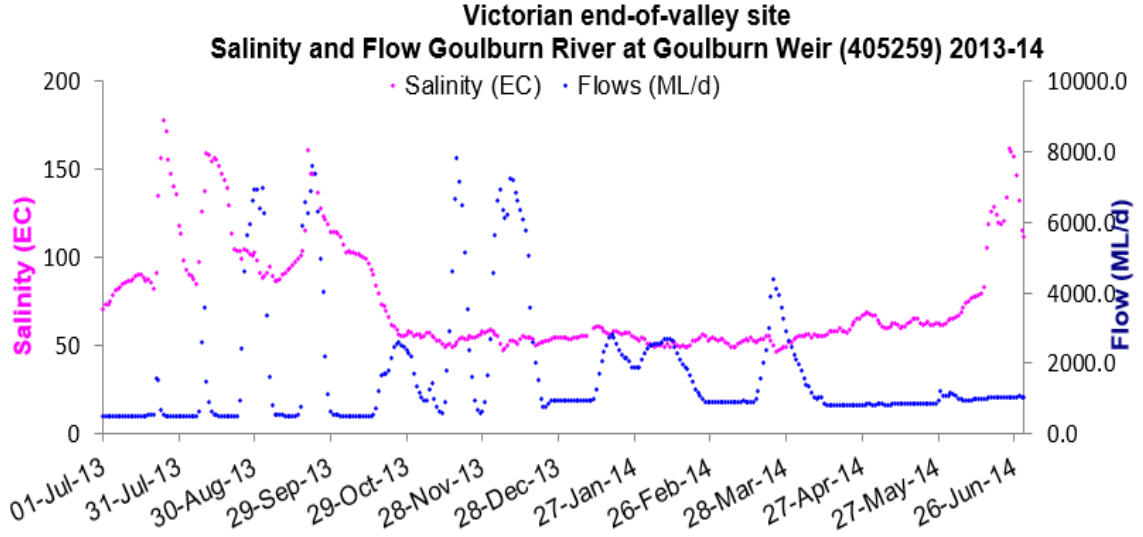
Victoria

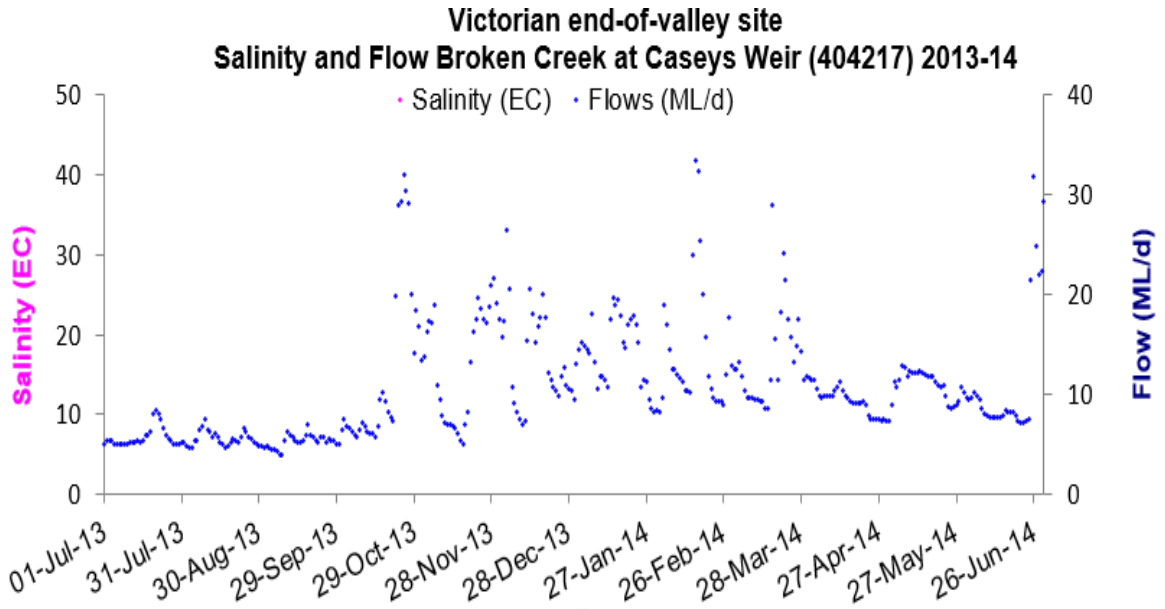

Victorian end-of-valley site
Salinity and Flow Wimmera River at Horsham Weir (415200) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
3000
2500
2000
1500
1000
500
0
200.0
150.0
100.0
50.0
0.0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

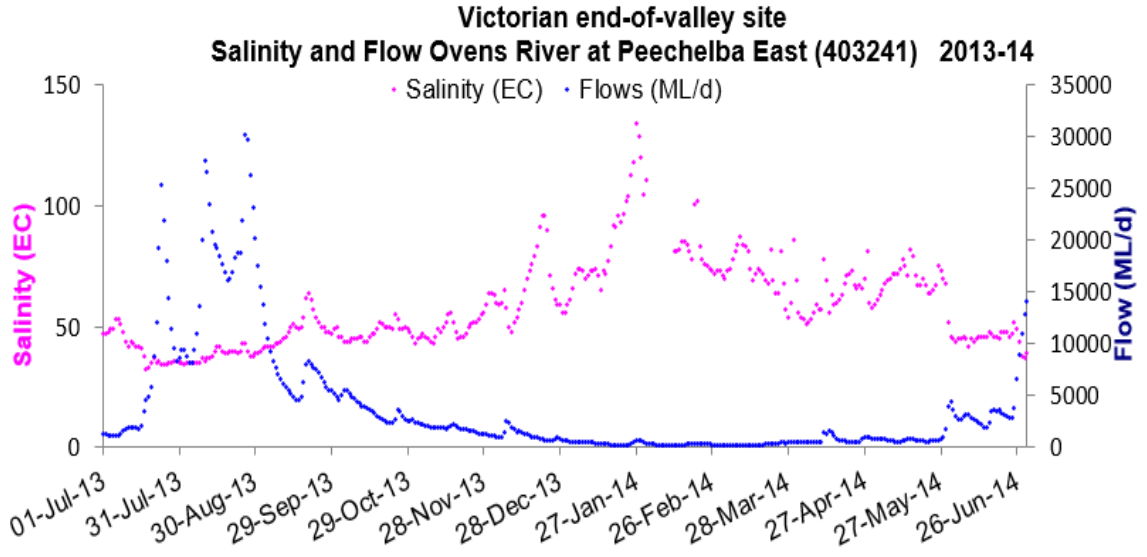

Victorian end-of-valley site
Salinity and Flow Avoca River at Quambatook (408203) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
50
40
30
20
10
0
35
30
25
20
15
10
5
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

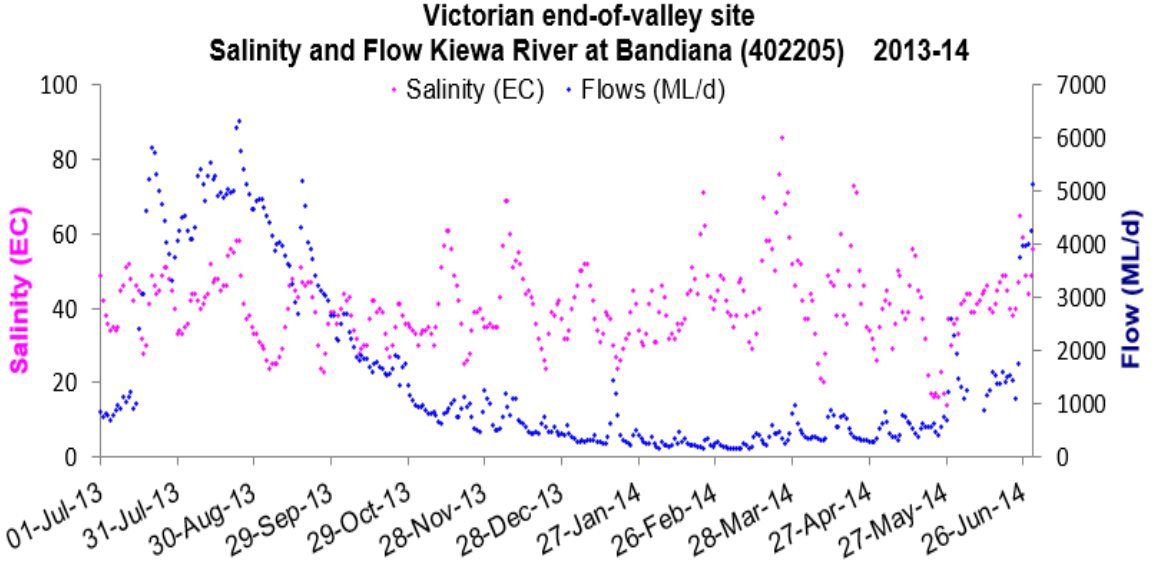

Victorian end-of-valley site
Salinity and Flow Loddon River at Laanecoorie (407203) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
1200
1000
800
600
400
200
0
700
600
500
400
300
200
100
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

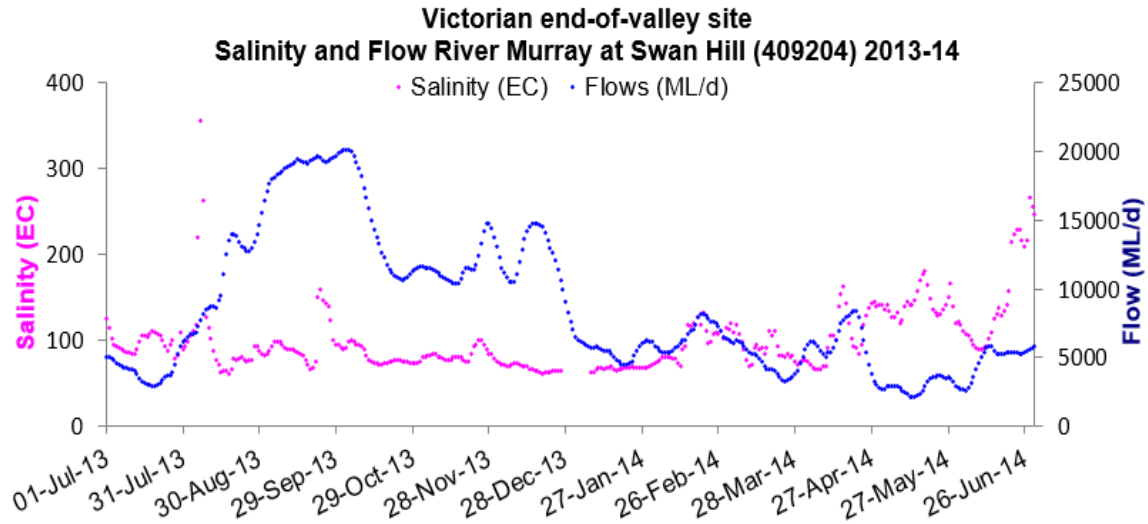

Victorian end-of-valley site
Salinity and Flow Campaspe River at Campaspe Weir (406218) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
700
600
500
400
300
200
100
0
50
40
30
20
10
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14


Victorian end-of-valley site
Salinity and Flow Goulburn River at Goulburn Weir (405259) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
200
150
100
50
0
10000.0
8000.0
6000.0
4000.0
2000.0
0.0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

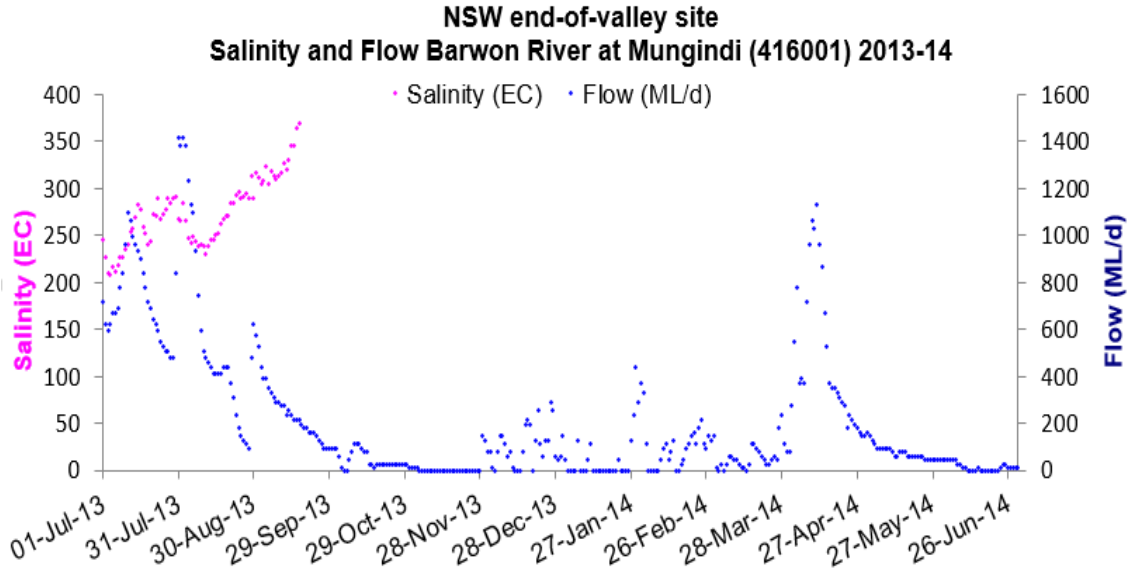

Victorian end-of-valley site
Salinity and Flow Broken Creek at Caseys Weir (404217) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
50
40
30
20
10
0
40
30
20
10
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

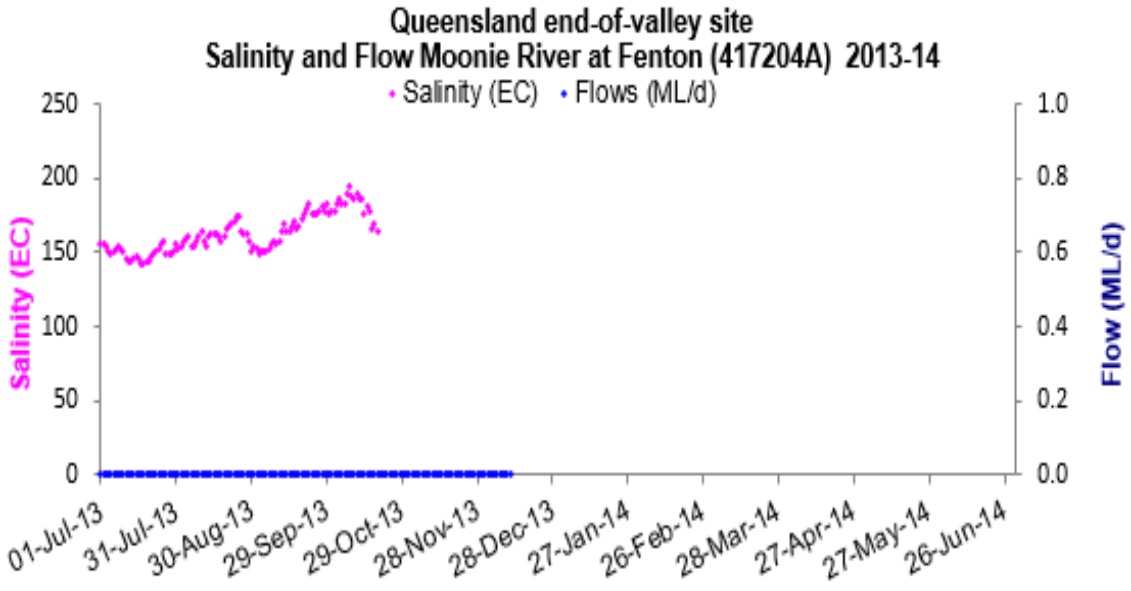

Victorian end-of-valley site
Salinity and Flow Ovens River at Peechelba East (403241) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
150
100
50
0
35000
30000
25000
20000
15000
10000
5000
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

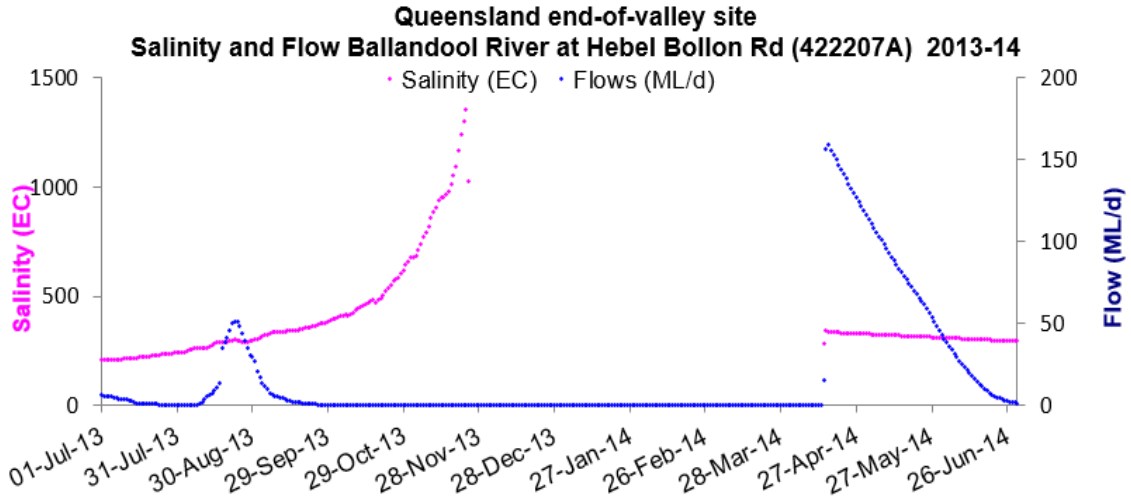

Victorian end-of-valley site
Salinity and Flow Kiewa River at Bandiana (402205) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
100
80
60
40
20
0
7000
6000
5000
4000
3000
2000
1000
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

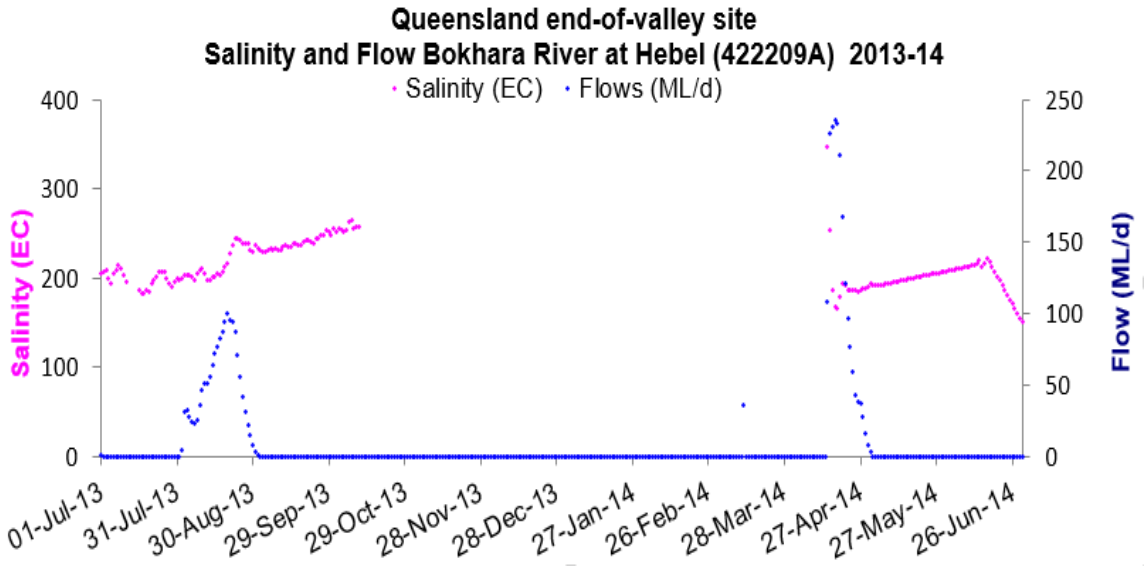

Victorian end-of-valley site
Salinity and Flow River Murray at Swan Hill (409204) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
400
300
200
100
0
25000
20000
15000
10000
5000
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

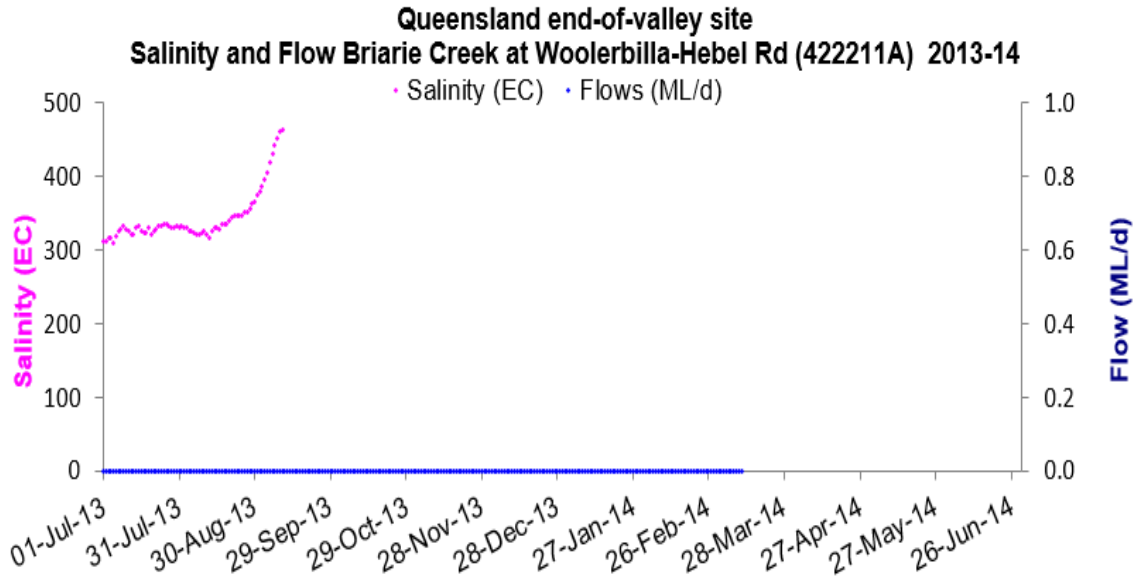
Queensland

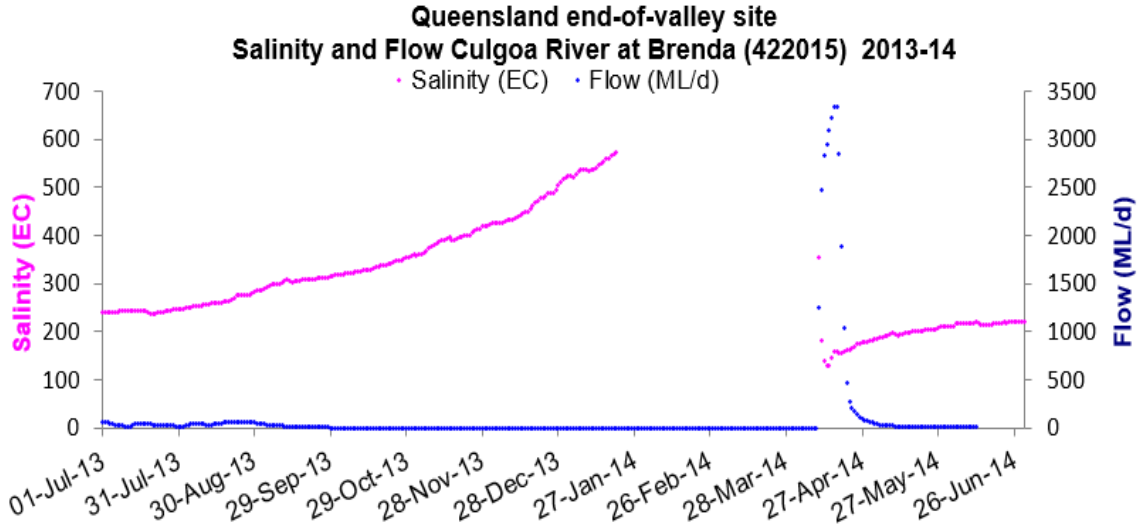

NSW end-of-valley site
Salinity and Flow Barwon River at Mungindi (416001) 2013-14
Salinity (EC)
Flow (ML/d)
Salinity (EC)
Flow (ML/d)
400
350
300
250
200
150
100
50
0
1600
1400
1200
1000
800
600
400
200
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

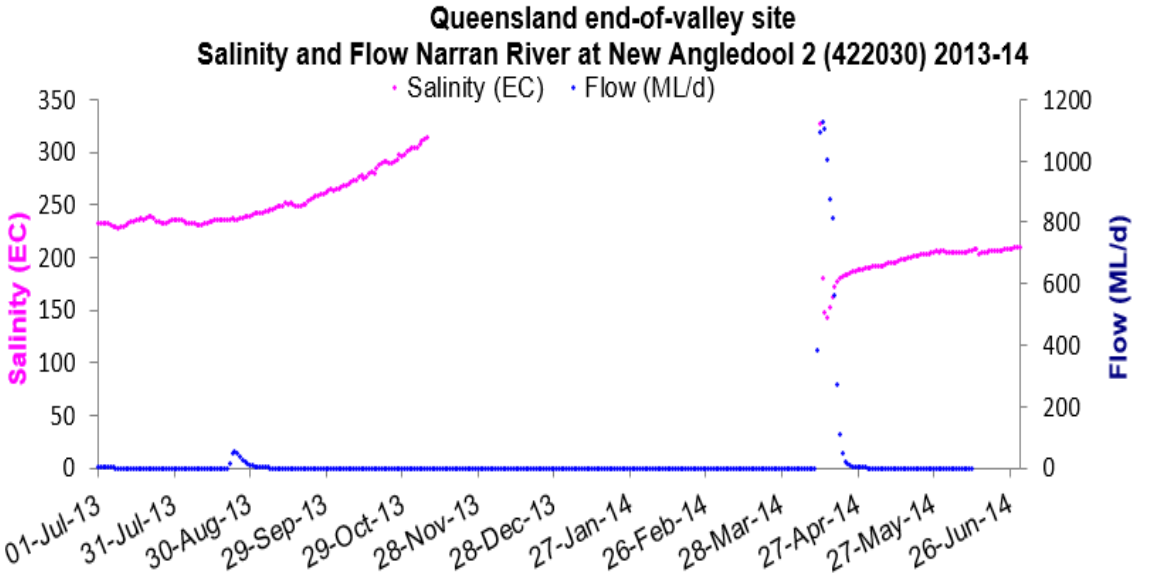

Queensland end-of-valley site
Salinity and Flow Moonie River at Fenton (417204A) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
250
200
150
100
50
0
1.0
0.8
0.6
0.4
0.2
0.0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

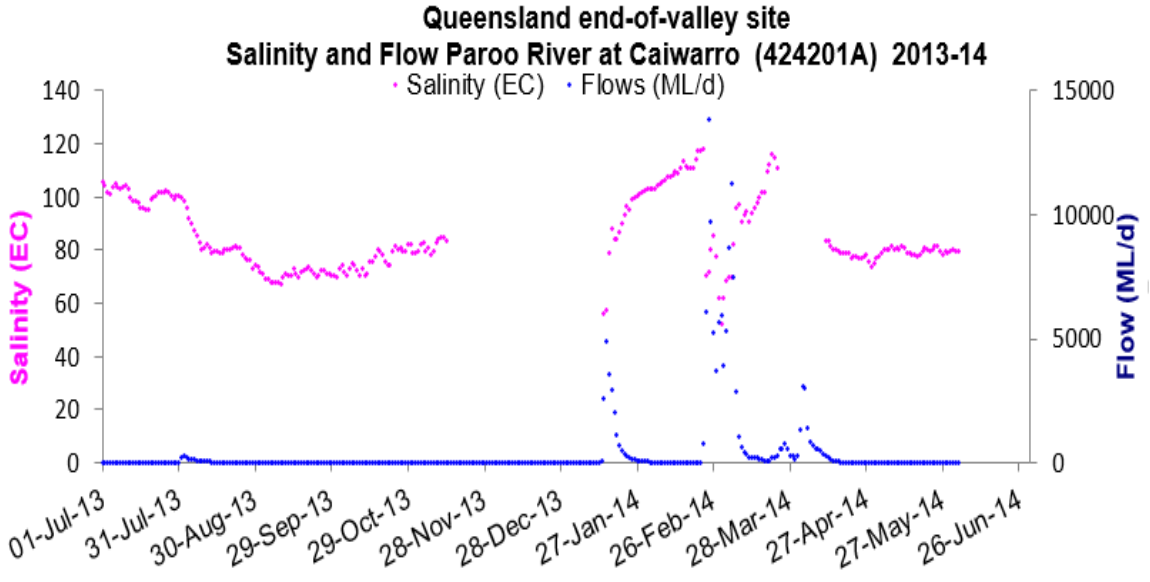

Queensland end-of-valley site
Salinity and Flow Ballandool River at Hebel Bollon Rd (422207A) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
1500
1000
500
0
200
150
100
50
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

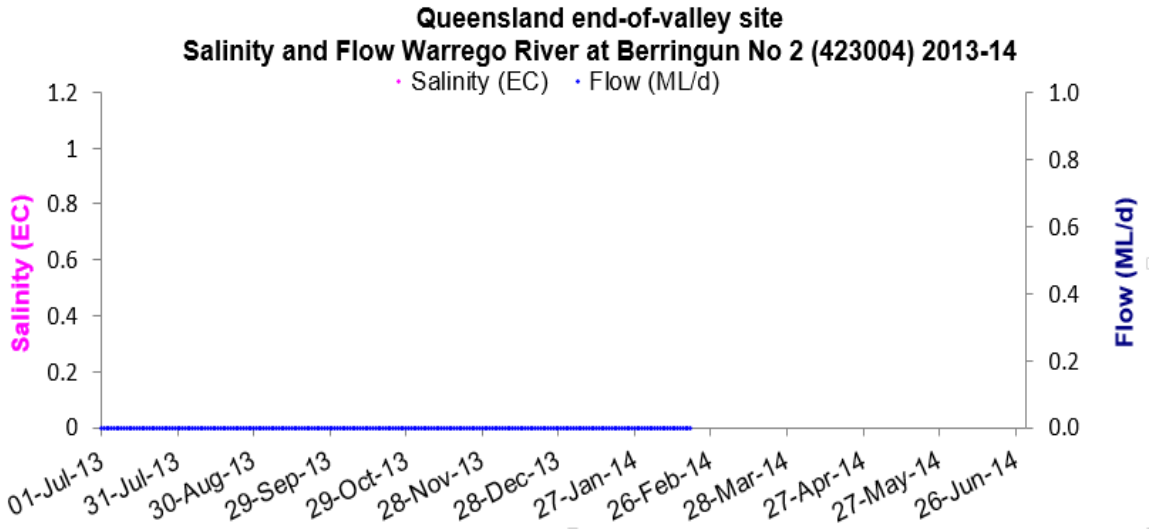

Queensland end-of-valley site
Salinity and Flow Bokhara River at Hebel (422209A) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
400
300
200
100
0
250
200
150
100
50
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

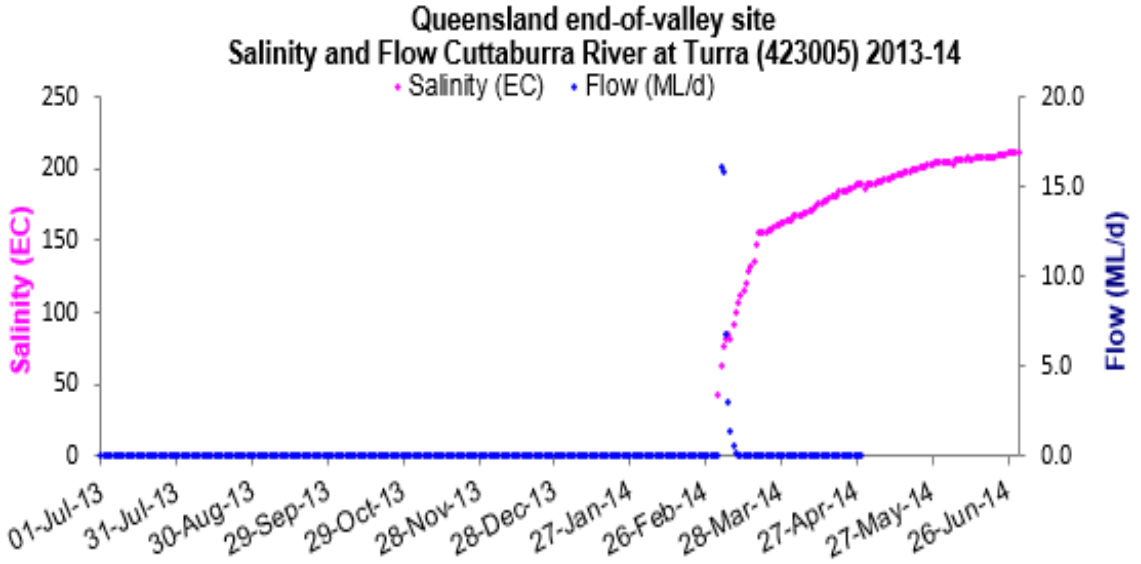

Queensland end-of-valley site
Salinity and Flow Briarie Creek at Woolerbilla-Hebel Rd (422211A) 2013-14
Salinity (EC)
Flows (ML/d)
Salinity (EC)
Flow (ML/d)
500
400
300
200
100
0
1.0
0.8
0.6
0.4
0.2
0.0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14


Queensland end-of-valley site
Salinity and Flow Culgoa River at Brenda (422015) 2013-14
Salinity (EC)
Flow (ML/d)
Salinity (EC)
Flow (ML/d)
700
600
500
400
300
200
100
0
3500
3000
2500
2000
1500
1000
500
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14

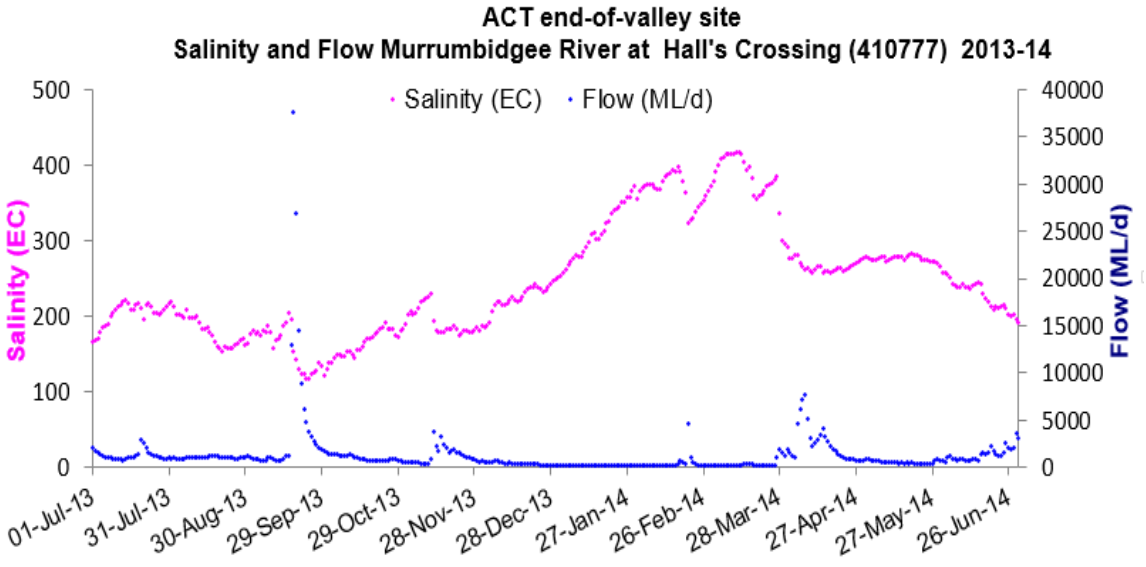

Queensland end-of-valley site
Salinity and Flow Narran River at New Angledool 2 (422030) 2013-14
Salinity (EC)
Flow (ML/d)
350
300
250
200
150
100
50
0
1200
1000
800
600
400
200
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14


Queensland end-of-valley site
Salinity and Flow Paroo River at Caiwarro (424201A) 2013-14
Salinity (EC)
Flows (ML/d)
140
120
100
80
60
40
20
0
15000
10000
5000
0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14


Queensland end-of-valley site
Salinity and Flow Warrego River at Berringun No 2 (423004) 2013-14
Salinity (EC)
Flow (ML/d)
1.2
1
0.8
0.6
0.4
0.2
0
1.0
0.8
0.6
0.4
0.2
0.0
01-Jul-13
31-Jul-13
30-Aug-13
29-Sep-13
29-Oct-13
28-Nov-13
28-Dec-13
27-Jan-14
26-Feb-14
28-Mar-14
27-Apr-14
27-May-14
26-Jun-14



Australian Capital Territory



Appendix E: Comparison of 2013–14 in–stream salinity outcomes with long–term trends for end–of–valley sites

Under the BSMS, the jurisdictions monitor flow and salinity for the nominated end–of–valley target sites and also, where applicable, for the interpretation sites (sites for shared rivers or valleys that cross state boundaries).

Table 14 summarises the in-stream EC at each monitored site in the Basin. Records indicate the 50th and 80th percentile for 2013–14, as well as the long–term 50th and 80th percentile EC values. The length of the long–term record is also indicated.

At the Basin scale, the 50th and 80th percentile salinities for 2013–14 were comparable with longer term statistics in some catchments and significantly different in others. No clear pattern is apparent, although a general observation is that the most significant differences between 2013–14 and the longer term statistics occurred in Queensland locations where higher salinities in 2013–14 may have been associated with prolonged dry conditions. In contrast, valleys in Victoria and South Australia displayed relatively lower salinities compared to longer term statistics, with New South Wales being mixed. A full understanding of why short–term salinity outcomes vary from longer term trends requires a detailed analysis for the specific catchment—a process undertaken as part of the five–year rolling reviews of each valley.

Estimates of salt load were calculated for records having both EC and flow data. Table 15 shows mean annual salt loads for 2013–14 along with long–term mean annual loads. Salt load exports for 2013–14 across the Basin were generally substantially lower than the long–term averages because of limited salt export during periods of low flows.

Table 14: Comparison of salinity data with long–term records for 2013–14 (units: EC)

Site	AWRC Site Number	Length of record (years)	50%ile 2013–14	50%ile All data	80%ile 2013–14	80%ile All data
Basin target site						
Murray at Morgan [a]	426554	76	353	493	438	1043
South Australia						
Berri Pumping Station	426537	72	298	399	371	581
River Murray at Murray Bridge	426522	80	401	511	509	760
NSW/Victoria shared						
Murray at Lock 6 [b]	426510	52	226	330	295	446
NSW						
Murrumbidgee at Balranald	410130	48	121	162	214	228
Lachlan at Forbes	412004	15	433	444	617	609
Bogan at Gongolgon	421023	14	540	366	663	576
Macquarie at Carinda	421012	22	614	576	655	677
Castlereagh at Gungalman	420020	13	744	666	805	941
Namoi at Goangra	419026	22	468	400	662	549
Mehi at Bronte	418058	13	266	428	759	639
Darling at Wilcannia	425008	49	461	381	1440	529

Site	AWRC Site Number	Length of record (years)	50%ile 2013–14	50%ile All data	80%ile 2013–14	80%ile All data
Murray at Heywoods	409016	41	55	52	56	57
Murray at Red Cliffs	414204	47	130	282	168	373
Victoria						
Wimmera at Horsham Weir	415200	22	1042	1224	1449	1646
Avoca at Quambatook [c]	408203	28	8796	6832	13083	10100
Loddon at Laanecoorie	407203	6	675	686	799	1049
Campaspe at Campaspe Weir	406218	24	490	589	511	818
Goulburn at Goulburn Weir	405259	25	61	72	100	119
Broken at Casey's Weir [d]	404217	1	126	NA	141	NA
Ovens at Peechelba East	403241	35	54	63	73	91
Kiewa at Bandiana	402205	41	40	42	48	51
Murray at Heywoods	409016	41	55	52	56	57
Murray at Swan Hill	409204	47	90	224	120	344
Queensland						
Barwon at Mungindi [e]	416001	19	271	254	407	320
Moonie at Fenton	417204A	11	152	136	155	175
Ballandool at Hebel—Bollon Rd	422207A	12	226	205	304	299
Bokhara at Hebel	422209A	12	203	189	230	223
Braire at Woolerbilla—Hebel Rd	422211A	11	NA	249	NA	314
Culgoa at Brenda [e]	422015	12	241	180	277	221
Narran at New Angledool [e]	422030	12	233	189	261	239
Paroo at Caiwarro	424201A	10	83	81	102	111
Warrego at Barringun [e,f]	423004	13	NA	140	NA	216
Cuttaburra at Turra [e]	423005	13	100	130	115	200
ACT						
Murrumbidgee at Hall's Crossing	410777	24	227	234	303	234

[a] 95 percentile for BSMS target at Morgan

[b] Salinity measured at site 426537 (Berri Pumping Station)

[c] Spot salinity data ends in Sep 2008 and continuous starts in Sep 2013

[d] Used salinity data for 404224B (Broken River at Gowangardie)

[e] These sites are operated by New South Wales on behalf of Queensland

[f] Salinity data stops in Sep 2012

NA = data not available

Table 15: Comparison of salt load data with long–term records for 2013–14

Site	AWRC Site Number	Length of record (years)	Mean annual salt load (tonnes) 2013–14	Mean annual salt load (tonnes) All data
Basin Target Site				
Murray at Morgan	426554	47	559,700	1,473,000
South Australia				
Berri Pumping Station	426537	20	551,300	552,200
River Murray at Murray Bridge	426522	NA	NA	NA
NSW/Victoria shared				
Murray at Lock 6	426200	52	457,900	1,215,200
NSW				
Murrumbidgee at Balranald	410130	48	37,700	103,100
Lachlan at Forbes	412004	15	102,200	117,600
Bogan at Gongolgon	421023	14	4,300	14,900
Macquarie at Carinda	421012	22	2,100	21,100
Castlereagh at Gungalman	420020	13	7,000	37,000
Namoi at Goangra	419026	22	11,400	77,200
Mehi at Bronte	418058	13	3,900	8,100
Darling at Wilcannia	425008	49	134,400	382,700
Murray at Heywoods	409016	41	147,600	132,400
Murray at Red Cliffs [a]	414204	31	NA	1,236,400
Victoria				
Wimmera at Horsham Weir	415200	22	13,100	14,100
Avoca at Quambatook [b]	408203	28	Limited data	Limited data
Loddon at Laanecoorie	407203	6	22,700	35,000
Campaspe at Campaspe Weir [c]	406218	1	19,100	NA
Goulburn at Goulburn Weir [d]	405259	25	30,400	47,900
Broken at Casey's Weir [e]	404217	1	10,400	NA
Ovens at Peechelba East	403241	35	39,200	43,200
Kiewa at Bandiana	402205	41	15,300	15,300
Murray at Heywoods	409016	41	147,600	132,400
Murray at Swan Hill	409204	47	179,100	574,400
Queensland				
Barwon at Mungindi [f]	416001	19	14,600	55,900
Moonie at Fenton	417204A	11	1,300	14,900
Ballandool at Hebel—Bollon Rd	422207A	12	400	8,600
Bokhara at Hebel	422209A	12	500	10,100
Braire at Woolerbilla—Hebel Rd	422211A	11	NA	53,700
Culgoa at Brenda [f]	422015	12	3,700	65,200
Narran at new Angledool [f]	422030	12	900	24,100
Paroo at Caiwarro	424201A	10	6,500	31,500
Warrego at Barringun [f, g]	423004	13	NA	30,100
Cuttaburra at Turra [f]	423005	13	3	28,300
ACT				
Murrumbidgee at Hall's Crossing	410777	24	57,400	75,500

[a] Flow data stops in October 1994

[b] Spot salinity data ends in Sep 2008 and continuous starts in Sep 2013

[c] Used flow data for 405200A (Campaspe at Rochester)

[d] Used flow data for 405200A (Goulburn River at Murchison)

[e] Used salinity data for 404224B (Broken River at Gowangardie)

[f] These sites are operated by New South Wales on behalf of Queensland

[g] Salinity data stops in Sep 2012

NA = data not available

Appendix F: BSMS operational process during 2013–14

The BSMAP terms of reference and membership (with representatives from MDBA, South Australia, Victoria, NSW, ACT, Queensland and the Australian Government) were approved by MDBA in June 2010. This advisory panel provides advice to MDBA through the Natural Resources Management Committee.

The advice of the BSMAP is valuable in the implementation of monitoring, evaluation and reporting components, which are essential to ensure accountability under the BSMS.

The BSMAP provides the necessary coordination, quality assurance, functions and policy advice, and liaises closely with the Technical Working Group on Salt Interception. Table 16 provides details of the BSMAP meetings held during 2013–14.

Table 16: Meeting schedule for the BSMS implementation during 2013–14

Meeting No.	Meeting date	Location	Representation
BSMAP 18 (Registers)	26 September 2013	Canberra	MDBA, NSW, Vic, SA, QLD, AG
BSMAP 19	29 October 2013	Brisbane	MDBA, NSW, Vic, SA, QLD, AG
BSMAP 20	20 February 2014	Teleconference	MDBA, NSW, Vic, SA, QLD, ACT, AG

A General Review of Salinity Management in the Basin was carried out in 2013-14 with guidance from an inter-jurisdictional steering committee (represented by all jurisdictions in the Basin) appointed by the Basin Officials Committee. The steering committee met several times in the year as set out in Table 17.

Table 17: Meetings and workshops held for the General Review of Salinity Management in the Basin

Meeting	Meeting date	Location
Steering Committee	8 November 2013	Canberra
Steering Committee	27 November 2013	Teleconference
Workshop	12 December 2013	Melbourne
Workshop	26 February 2014	Canberra
Workshop	26 March 2014	Melbourne
Steering Committee	4 June 2014	Canberra

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