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MURRAY–DARLING BASIN AUTHORITY

Basin Salinity Management 2030

2017–18 Status report

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Acknowledgement of the Traditional Owners of the Murray–Darling Basin
The Murray−Darling Basin Authority pays respect to the Traditional Owners and their Nations of the Murray−Darling Basin. We acknowledge their deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

The guidance and support received from the Murray Lower Darling Rivers Indigenous Nations, the Northern Basin Aboriginal Nations and our many Traditional Owner friends and colleagues is very much valued and appreciated.

Aboriginal people should be aware that this publication may contain images, names or quotations of deceased persons.

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Introduction

To continue ongoing collective efforts in salinity management, the basin states (which includes the Australian Capital Territory) and the Australian Government (including the Murray-Daring Basin Authority (MDBA)) prepared the Basin Salinity Management 2030 (BSM2030) strategy, which was agreed by the Ministerial Council in November 2015. The BSM2030 strategy focuses on continuing to ensure salinity within the Murray-Darling Basin is maintained at appropriate levels to protect economic, environmental, cultural and social values. Key elements of the BSM2030 strategy include:

- Maintaining the existing salinity accountability framework and incorporating new issues related to environmental water and flow management.
- Using risk-based approaches to improve the cost effectiveness of salinity management.
- Trialling different options to manage Salt Interception Schemes (SIS) so operations and costs can be reduced when river salinity is forecast to be low.
- Investing in knowledge priorities to reduce uncertainty around future salinity risks, which may assist in avoiding future capital investment in new works to manage salinity.

Under the BSM2030 strategy, every second year from 2016 the MDBA is required to prepare a BSM2030 status report for the Basin Officials Committee (BOC). This is the second BSM2030 status report prepared by the MDBA. The information contained within this report and each of the Contracting Governments' BSM2030 reports will be compiled into a summary report for Ministerial Council.

Overview of outcomes

Key achievements in 2017–18:

- In June 2018, Ministerial Council agreed, to the Water Amendment Regulations that amend Schedule B of the Murray-Darling Basin (MDB) Agreement to give effect to the BSM2030 strategy.
- The basin salinity target was met for the ninth consecutive year. The target aims to maintain the average daily salinity at a simulated level of less than 800 EC for at least 95% of the time at Morgan, South Australia.
- The SIS diverted approximately 484,586 tonnes of salt away from the River Murray system and adjacent landscapes.
- The first independent audit was completed under the BSM2030 strategy, confirming that New South Wales, Victoria and South Australia had a net credit balance on the 2017 salinity registers. (The Australian Capital Territory and Queensland have no items on the salinity registers).
- The inaugural BSM2030 salinity forum, held in Adelaide in November 2017, brought together approximately 50 participants including MDBA and jurisdictional river operators, environmental water managers and salinity managers to collaborate, share experiences and transfer knowledge of best practice for salinity management.
- New Basin Salinity Management Procedures are being developed in consultation with Contracting Governments. These procedures will provide the operational details and

arrangements to consistently guide implementation of joint salinity management and the accountabilities under Schedule B of the MDB Agreement.

- Knowledge priorities to reduce uncertainty around future salinity risks were progressed, including:
    - Developing a transfer function for use in groundwater models to calculate irrigation recharge to groundwater.
    - Conducting a floodplain workshop to determine knowledge gaps and priorities for future work relating to environmental watering and floodplain salinity dynamics.
    - Continuing investigations at trial sites to understand system responses to changed SIS operations.

Summary of joint works and measures

The BSM2030 strategy focuses on existing scheme operations and investing in learning and knowledge development for SIS operations.

Scheme operation and maintenance

In 2017–18, operating and maintaining the existing MDBA SIS assets continued to focus on knowledge development to minimise operating costs, in particular, power costs associated with pumping.

SIS operation has continued to be highly successful in terms of in-river outcomes. SIS diverted approximately 484,586 tonnes of salt away from the River Murray and adjacent landscapes in 2017–18 (Table 1). The salt load diverted in 2017–18 was similar to the figures achieved in recent years, following a slight reduction in 2016–17 due to the shutdown of SIS during and after the 2016 floods.

Responsive management of salt interception schemes

As part of the trial of responsive management of SIS introduced under the BSM2030 strategy, each month the MDBA prepared a six-month salinity forecast, with SIS workshops held quarterly to review current and forecast salinity conditions and to make decisions on the level of SIS operations. At the time of reporting (September 2018) the majority of schemes were operating close to full time, with the exception of a number of individual bores with changed operations due to the responsive management trials.

An overview of operational decisions made with consideration to responsive management of SIS and operations/maintenance activities over 2017–18 is provided below:

Quarter 1 – Given the high degree of uncertainty in the climate and flow forecasts at the time of year (late winter/early spring) it was recommended to maintain full operation of SIS to the extent possible.

Quarter 2 – SIS continued to maintain full operations to the extent possible based on consideration of modelled in-river salinities over the forecast period and planned adjustments to individual bores within responsive management trial sites.

Quarter 3 – SIS continued to maintain full operations to the extent possible with the exception of Murtho SIS which was agreed to be operated at a reduced capacity and bores adjusted for the purposes of the responsive management trials. This decision was made with consideration to modelled in river salinities over the forecast period reducing from the previous quarter.

Quarter 4 – Murtho SIS was increased back to full operations and all other SIS continued to maintain full operations to the extent possible, with the exception of bores adjusted for the purposes of the responsive management trials. This decision was made with consideration to increased modelled in river salinities over the forecast period and shutdowns of the Woolpunda and Waikerie schemes for planned maintenance works.

A responsive management of SIS project plan has been prepared to address the seven key knowledge gap initiatives (KGIs) identified at the commencement of the project, targeting six floodplain trial sites. Monitoring activities have been underway since 2016, with the majority of monitoring activities established in January 2018 to inform baseline conditions prior to altering the operations at the target bores. The approach for landscape scale geophysics monitoring is still being refined with work health and safety being the key issue.

While progress has been made with the installation of key monitoring equipment and regular routine monitoring runs across trial sites, delays have been experienced due to the 2016 floods and operational priorities across the SIS program. MDBA has previously advised Contracting Governments that in order to obtain a reasonable data sample to inform KGIs, it is likely the trial will need to be extended beyond 2019.

Table 1: Joint salt interception scheme performance report 2017–18

Salt interception scheme	Volume pumped (ML)	Salt load diverted (Tonnes)	Average salinity (EC units)	Target achieved (% of time)	Power consumption (kWh)
Pyramid Creek	870	21,369	40,714	100%	147,497
Barr Creek	4,116	29,641	11,160	100%	78,513
Mildura-Merbein	1,085	45,118	79,322	51%	179,582
Mallee Cliffs	1,758	57,714	51,308	97%	519,712
Buronga	1,966	49,901	39,667	100%	427,847
Upper Darling	1,386	35,550	40,076	78%	282,770
Pike River	234	8,668	49,967	NA	72,692
Murtho	1,802	42,621	38,723	41%	2,540,255
Bookpurnong	896	23,238	39,087	89%	342,638
Loxton	1,245	21,775	27,187	89%	492,605
Woolpunda	4,701	91,859	30,557	95%	2,848,914
Waikerie	3,235	57,130	29,886	85%	1,226,206
Rufus River	0	0	42,478	100%	3,739
Totals	**23,294**	**484,586**			**9,162,970**

Notes: Operation of pumps varies from year to year based on operational advice from the MDBA due to budgets; operational and maintenance requirements; and loss of access and/or scheme operating rules during periods of high flow.

BSM2030 review plan

The BSM2030 review plan (endorsed by BOC at meeting 43 – October 2016) sets out the frequency for the review of register entries, models and end-of-valley outcomes under the BSM2030 strategy.

Consistent with the amendments to Schedule B:

- The review plan will be reviewed annually and may be amended by the Authority on the advice of Contracting Governments, in order to alter the frequency or level of review of any item.
- The independent auditors must carry out a review of the Review Plan (including the appropriateness of the frequency of reviews).

A template was developed to track the progress of reviews as set out in the Review Plan and to document any changes to the timing of reviews. The template was discussed at Basin Salinity Management Advisory Panel (BSMAP) meetings, where Contracting Governments and MDBA provided review updates including changes to timelines. Tracking progress of reviews and documenting the changes to the review frequency provides evidence as required for complying with Schedule B requirements.

The transition to the SOURCE model has delayed a number of MDBA register entries reviews, for which the salinity impacts will be re-estimated using the new river model. These delays were due to issues with resolving the outcomes from the review of other accountable actions, this subsequently delayed re-estimation of the baseline, which is a key step in moving to the new river model. The transition to the SOURCE model will progress throughout 2018-19.

Reviews

A number of reviews of joint works and measures were completed in 2017–18, including the Waikerie (all stages), Woolpunda and Murtho schemes in South Australia, and Mildura-Merbein in Victoria. The Mildura-Merbein SIS post construction review determined that the rehabilitated scheme meets the performance targets of the old scheme, whilst covering around 50% of the area. Register entries for the Mildura-Merbein scheme remain unchanged. Outcomes from reviews conducted by State Contracting Governments are provided in their respective status reports.

Summary of the 2018 salinity registers

Under BSM2030, actions that increase and decrease average river salinity are accounted as debits and credits and recorded in a register. Actions such as new irrigation developments may generate a debit on the register because they may increase salt loads to the River Murray. By comparison, actions such as operating SIS and improving irrigation practices may generate credits (a reduction in river salinity).

Each register entry covers salinity impacts on the river arising from recent accountable actions (Register A), as well as from major historical land and water use decisions (Register B). Each year, the Contracting Governments inform the MDBA about reviews of existing register entries and new activities that have significant salinity effects. Reviews are submitted to the MDBA for independent

peer review and then provided to BSMAP for endorsement. A summary of the 2018 salinity registers is provided in Table 2.

Table 2: Summary of the 2018 salinity registers

Actions	NSW ($m/year)	Vic ($m/year)	SA ($m/year)	Qld ($m/year)	ACT ($m/year)	Commonwealth contribution (EC) [b]
Joint works & measures	2.910	2.910	1.124	0	0	32
State shared works & measures	0.188	0.188	0	0	0	0
State actions	3.456	1.809	2.410	tbd	tbd	1.0
Total register A	6.555	4.908	3.535	tbd	tbd	33
Total register B [a]	0.500	-0.342	4.298	0	0	0
Balance registers A & B	7.055	4.566	7.833	0	0	33

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

tbd to be determined.

[a] *total includes transfers from Register A.*

[b] *Australian Government contributions are in modelled salinity reduction at Morgan, South Australia.*

Modelled salinity outcomes at Morgan, South Australia

For the ninth consecutive year the basin salinity target was met (Figure 1). The modelled salinity outcome at Morgan, South Australia in 2018 was 777 EC for 95% of the time. This is below the basin salinity target that aims to maintain Morgan salinity at a simulated level of less than 800 EC for 95% of the time. Figure 1 illustrates the progressive reduction in modelled river salinity in response to changes in development and the implementation of mitigation works and measures over time.

Reviews of accountable actions completed in 2017–18 resulted in an increase to the modelled 95 percentile salinity at Morgan in 2018. The increase was primarily due to new knowledge from improved information and monitoring. This improved understanding resulted in a reduction of the estimated salinity benefit provided by the Murtho, Waikerie Lock 2, and Waikerie Phase 2A schemes.

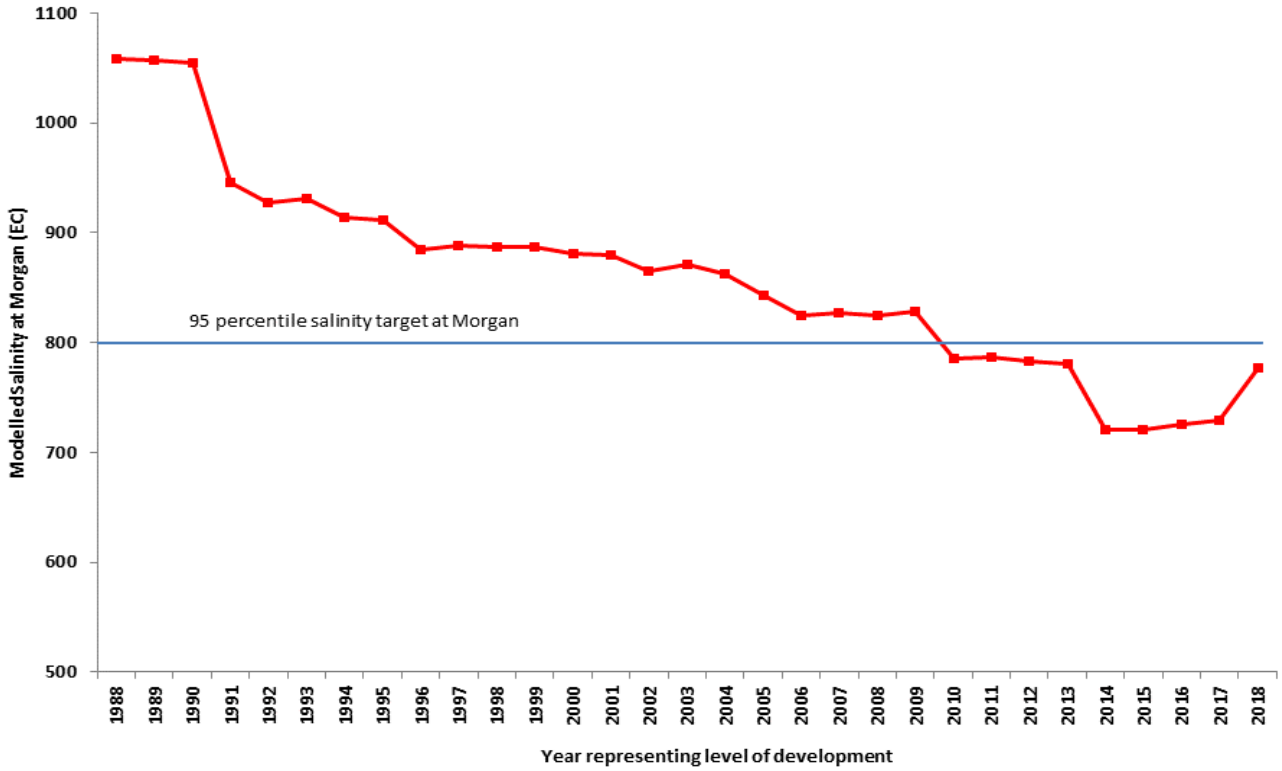

Figure 1: Modelled 95 percentile salinity over the 1975 to 2000 benchmark period at Morgan, South Australia, due to the implementation of salinity management programs from 1988 to 2018.

Note: The river model is capable of simulating median and average daily salinity levels with a higher level of confidence, when compared to the 95 percentile daily salinity level.

Improvements in salinity management to date can be assessed by modelling outcomes for baseline condition levels of development and salinity mitigation and comparing them with outcomes based on 2018 levels of development and salinity mitigation (over the 1975 to 2000 benchmark period). Table 3 demonstrates that under the defined variable climatic regime, the incidence of salinity exceedance of 800 EC at Morgan has substantially declined.

Table 3: Simulated salinity (EC) summary statistics at Morgan, South Australia, for baseline and 2018 conditions over the 1975 to 2000 climatic period

Period	Time interval	Average (EC)	Median (EC)	95 percentile (EC)	% time greater than 800 EC	% time less than 800 EC
25 years	Modelled 1988 conditions 1975–2000	665	666	1058	28	72
25 years	Modelled 2018 conditions 1975–2000	490	465	777	4	96

Note: Baseline conditions are set at 2000. However, salinity impacts arising from development activities between 1988 and 2000 in New South Wales, Victoria and South Australia are accountable under the Basin Salinity Management Strategy and have been excluded from the baseline, so for New South Wales, Victoria and South Australia, the baseline represents 1988 conditions.

Observed salinity outcomes at Morgan, South Australia

A comparative assessment of average, median, 95 percentile and peak salinity levels measured at Morgan, South Australia over four time intervals (1, 5, 10 and 25 years) to June 2018 is provided in Table 4.

The 2017–18 measured average and median salinity levels at Morgan were slightly higher than the 5 year statistics, although, the 95 percentile and peak salinity were lower than the other periods in Table 4. The improvement in recent salinity statistics compared to longer term 25 year salinity statistics indicates the effectiveness of the progressive implementation of the salinity mitigation program.

Table 4: Summary of measured salinity levels (EC) at Morgan, South Australia

Period	Time interval	Average (EC)	Median (EC)	95 percentile (EC)	Peak (EC)	% time more than 800 EC
1 year	July 2017–June 2018	359	370	438	466	0%
5 years	July 2013–June 2018	327	315	509	732	0%
10 years	July 2008–June 2018	350	336	552	732	0%
25 years	July 1993–June 2018	444	421	724	1087	2%

The benefits that can be directly attributable to mitigation measures are demonstrated by Figure 2 using a combination of measured and modelled data. Figure 2 compares in-stream salinity outcomes at Morgan in South Australia with model predictions of the salinity outcome if no mitigation actions had been carried out since 1975. The results for the 2017-18 period demonstrate the effectiveness of all salinity mitigation works and measures since 1975 towards reducing salinity in the river.

Figure 2 also demonstrates the significant influence the flow regime has upon salinity and that the benefits of the actions are most obvious during low flow periods.

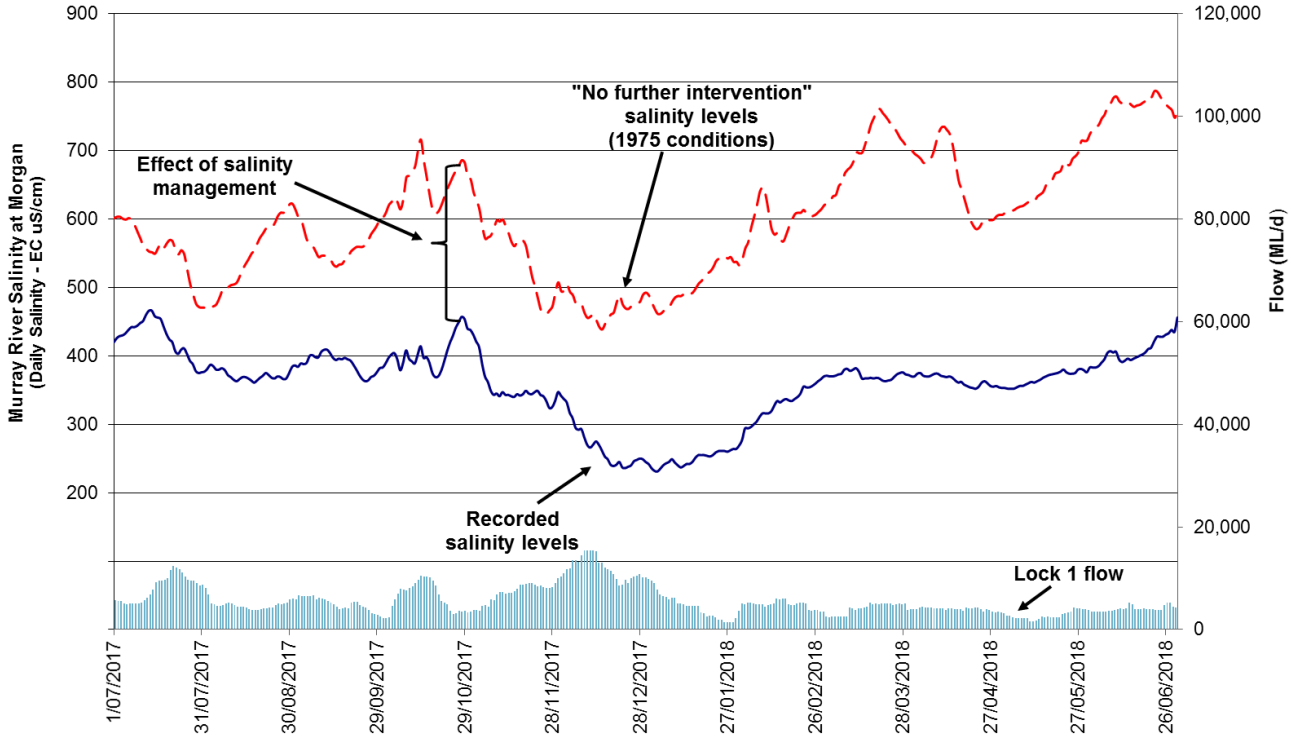

Figure 2: Comparison of modelled 'no further intervention' salinity levels' (1975 conditions) to mean daily recorded salinity levels at Morgan, South Australia, from July 2017 to June 2018 .

Basin Plan reporting

The Basin Plan requires the MDBA to monitor salinity at five reporting sites on a daily basis and at the end of each water accounting period, to assess whether the targets at the reporting sites have been met. The targets are deemed to have been met if the salinity levels have been below the target value for 95% of the time over the last five years. Results for July 2013 to June 2018 show that the salinity targets were met at four of the five sites—Murray Bridge, Morgan, Lock 6 and Milang. From July 2013 to end of June 2018, the salinity at the Burtundy site was above the target for 36% of days, with a peak salinity of 3,406 EC in August 2016. This resulted from record dry conditions in the Darling system in the 2015–16 water year, during which, the lower Darling River downstream of Menindee Lakes experienced eight consecutive months of no flow. This was the longest no flow period since construction of the Menindee Lakes Scheme and the lack of water available from Menindee Lakes made it difficult to manage salinity in the Lower Darling River. Nevertheless, over the 2017–18 period, salinity levels were below the target value, peaking at 825 EC in October 2017. Very dry conditions in the northern basin will continue to create challenges for salinity management in the lower Darling River.

The Basin Plan includes a salt export objective to ensure salt is flushed at a sufficient rate from the River Murray system into the Southern Ocean. The objective is expected to be achieved by discharging an average of two million tonnes of salt per year over a three year period.

Over the three-year period, July 2015 to June 2018, the annualised rate of salt export over the barrages was 0.86 million tonnes per year which is below the salt export objective. However, it

should be noted that the amount of salt exported would have been less without the increased flows resulting from the Basin Plan.

A range of factors can influence how much salt is exported each year. Extended droughts and periods of below average inflows into the River Murray System may not be sufficient to flush two million tonnes of salt whilst also maintaining salt concentration in the river at acceptable levels.

During low flow periods, the prevention of salt entering the river is more important than exporting salt out to the ocean. In 2017–18, the operation of SIS helped protect the river from salinity by diverting approximately 484,586 tonnes of salt away from the river and riverine landscapes.

Elevated salinity events

During 2017–18 BSMAP determined there were no elevated salinity events that warranted review.

However, discussions were held regarding two elevated salinity events that occurred during 2016–17 as part of the salinity forum held in Adelaide, in November 2017. The forum provided an opportunity for MDBA and jurisdictional river operators, environmental water managers and salinity managers to collaborate, share experiences and transfer knowledge of best practice for salinity management relating to these events.

At the salinity forum South Australia presented on the elevated salinity event in the River Murray in January 2017 and New South Wales presented on the lower Darling River elevated salinity event that occurred in August - October 2016.

The review of the elevated salinity event in the lower Darling River provided a number of important insights about the recommencement of flows that could be considered when designing future operating rules proposed in the Sustainable Diversion Limit (SDL) adjustment mechanism for the Menindee Lakes. Management strategies and procedures that could be addressed by the SDL adjustment mechanism include:

- Recognising that Menindee system inflows are unregulated and extremely unreliable, meaning an on-going likelihood of cease-to-flow events, but building awareness of the risks, and the options to deal with them, particularly when re-starting regulated rivers.
- The design of appropriate flow release patterns from Menindee Lakes to reduce the risk of the mobilisation of poor quality water.
- Setting aside a volume of water from the first inflows available after flow cessation to safely re-start the regulated river. This could be particularly relevant if sufficient dilution flows in the River Murray are not available.

Salinity management procedures and strategies that could be considered as a result of the review of the January 2017 elevated salinity event in the River Murray include:

- Investigating whether there are opportunities to flush and drain connected water bodies such as Lake Bonney, to reduce salinity during low risk periods.
- Flushing connected water bodies on the rising limb of a high flow.
- Maintaining river flows following an elevated salinity event to support the export of salt from the system.

Consistent with the BSM2030 implementation plan, MDBA also evaluated the effectiveness of the process for conducting a review of elevated salinity events, seeking opportunities for continuous improvement in the review process. The evaluation identified opportunities to refine the review process and that these improvements should be captured through updating the procedure that guides reviews, in addition to further clarifying the roles and responsibilities of salinity managers.

Core salinity monitoring network

The MDBA worked with South Australia and Victoria to prepare a list of surface water monitoring sites for inclusion in the network. MDBA will continue to work with New South Wales to finalise their core salinity monitoring sites in 2019.