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Background
The Murray-Darling Basin Commission is obliged to undertake a Mid-Term Review (MTR) of the Basin Salinity Management Strategy (BSMS), and of Schedule C to the Murray-Darling Basin Agreement, to provide strategic direction for BSMS implementation from 2008 to 2015. The review has been conducted in accordance with the requirements as set out in Schedule C (Clause 35).

The Review focuses on progress in implementing the Strategy for the first 7 years through:

1. an examination of the changes in the policy, operational arrangements, science and technical understanding over the first phase of implementation of the BSMS;
2. analysis of BSMS implementation since 2001 to identify key successes, challenges and risks;
3. analysis by the jurisdictionally based Mid-Term Review Task Force regarding how issues identified at 1 and 2 will influence implementation directions; and
4. independent review of findings.

Key successes
Significant progress has been made in implementing the Basin Salinity Management Strategy in its first phase (2001-2007). The Strategy has achieved significant outcomes in policy, operational arrangements and improvements in science and technical understanding.

Policy successes
- revision and implementation of Schedule C (2002) to the Murray-Darling Basin Agreement to establish Basin-wide jurisdictional accountability for end-of-valley salinity targets, Salinity Registers, monitoring and reporting to achieve Basin-wide improvement in water quality;
- agreement and implementation of Operational Protocols that underpin the implementation of the BSMS by all jurisdictions;
- an accountability and reporting framework that is sufficiently robust to address long term in-stream salinity impacts and with enhancement will also address short term salinity peaks; and
- funding initiatives that have enabled continued construction of salt interception infrastructure which upon completion by 2010, will achieve an average river salinity benefit of 61 EC at Morgan in South Australia.

Operational successes
- effective ongoing operation of salt interception infrastructure;
- annual Basin-wide reporting and Independent Audit to enable effective regular reporting to Commission and Ministerial Council, and analysis of progress against the BSMS and Schedule C; and
- substantial progress towards regionalisation of catchment management.
Science and technical understanding successes

- development and continuous improvement of tools and information to:
  - quantify and predict the impact of land use (including management) and land-use change on groundwater and river salinity processes;
  - simulate the economic costs of in-stream salinity to downstream users (excluding the environment); and
  - record and account for the salinity debits and credits for each state within the Basin;
- assessment of the feasibility for establishment of salt interception infrastructure for saline inflows to the River Murray at all known locations in South Australia and Victoria;
- identification of floodplain salt storages as a significant risk to in-river salinity and floodplain health; and
- recognition of the risk of salinity peaks in the Lower Murray.

Key challenges

The principles of salinity accounting under the BSMS are based on the economic impact of salinity and are managed through a system of debits and credits. These accounting procedures are underpinned by an agreed climatic period for hydraulic modelling (the 1975-2000 Benchmark Period), an agreed cost function for the impacts of salinity and an accounting arrangement that takes account of the shared responsibility for the legacy of past action and the individual responsibility for the impact of future actions.

The management, accounting and reporting of Salinity is complex and even more so in a system such as the Murray-Darling Basin where sub-catchments experience highly variable rainfall and flow conditions. It is a significant challenge to communicate progress against the in-stream basin target that is based on long term salinity modelling essentially when that target is not directly related to real time salinity outcomes measured in the river. This matter is compounded by the Benchmark Period, upon which the long term salinity impacts are assessed, which currently does not incorporate the current drought data and may not reflect the full range of past and future climatic variability (including climate change).

New policy initiatives have led to changing patterns of water use. These include the distribution of irrigation water and environmental flows which have the potential for salinity impacts and management that were not envisaged at the commencement of the strategy.

There has also been a major change in the value of water and prices paid and received for agricultural products which has implications for the cost functions upon which investment decisions are made. A broader range of options should be explored for investments to address salinity risk.

The present strategy is based on the premise that past actions termed ‘legacy of history’ are a responsibility of the broad community and that impacts of future actions are the responsibility of the proponents of the future actions. This is the basis of the three components of salinity accounting i.e. Registers A and B under Schedule C and outcomes against end-of-valley targets. This has led to the application of different methods for the analysis of impacts of post 1988 actions compared with the legacy of pre 1988 actions.
Policy challenges

- reviewing the appropriateness of the present Benchmark Period in light of drought and climate variability/change;
- regular review of the salinity cost functions taking into account shifts in commodity prices and the distribution of irrigated crops;
- reviewing and reassessment of the way in which past impacts and future impacts are managed and accounted (i.e. a common currency for Registers A and B);
- developing more effective linkages between salinity and other natural resource management initiatives to optimise synergies and tradeoffs;
- developing triple bottom line assessment of future investment proposals; at present the environment is not explicitly accounted for in cost/benefit analysis for salt interception infrastructure; and
- improving documentation and assignment of risk associated with investment decisions.

Operational challenges

- salt interception infrastructure treats the symptoms of salinity rather than the cause – we need more success in preventative actions by looking at more innovative approaches to salinity management in catchments;
- developing real time management of in-stream salinity to:
  - manage short term salinity processes arising from TLM management actions;
  - manage short term salinity peaks arising from post flood salt accessions and in severe drought when river flows are inadequate to dilute saline flows from groundwater and wetlands in the lower Murray; and
  - pursue opportunities to export salt using the river;
- improvement in the Operational Protocols relating to irrigation accountability to manage the potential salinity impacts of expansion of water trade;
- development of Operational Protocols to manage the potential salinity impacts of reconfiguration of irrigation areas; and
- agreement on a clear work program for the BSMS that reflects activities and programs of action at a basin, state and regional scale.

Science and technical understanding challenges

- implementing further offsetting action to maintain the Basin Salinity Target at Morgan as current indicators suggest that the long term salinity impacts are likely to exceed existing offset measures (salt interception infrastructure) resulting in increased river salinity. This will require a significant increase in salinity mitigation works or measures to achieve and maintain the Basin Salinity Target at Morgan;
- development of knowledge of the effects of climate change on long term average and peak river salinities;
- development of understanding of the process of salt accumulation within the floodplain, and development of remediation actions. This may require more emphasis on floodplain management;
- bringing consideration of environmental and social impacts (including development of agreed metrics) into the evaluation of the benefits and dis-benefits of salinity management measures, particularly joint works and measures; and
- the need to develop a process to target salinity actions to areas where they are most effective such as the salinity benefits of improved dryland farming systems compared with the salinity benefits of irrigation and floodplain management, in-stream flow management and joint works and measures.
Recommendations and future directions

A key finding of the Mid-Term Review process is that the Basin Salinity Management Strategy (2001-2015) is sufficiently robust to deal with the above challenges. Indeed, it is essential that ongoing implementation of the BSMS is maintained to build on the solid progress to date. The key challenges identified in this report provide a firm basis for setting the priorities for on-going implementation. The key recommendations for Commission and Ministerial Council arising from the Mid-Term Review are as follows:

Policy recommendations

- the Basin Salinity Management Strategy (2001-2015) should be retained in its current form;
- Schedule C to the Murray-Darling Basin Agreement is robust and does not require modification;
- that the Commission direct the Salinity Program to revise and extend the BSMS Operational Protocols in accordance with the MTR findings and recommendations;
- begin the planning process in 2012 for the next phase of Basin salinity management;
- in implementing the nine BSMS elements, the MDBC and jurisdictions should incorporate the findings and directions provided by the Mid-Term Review.
- develop methods to account for and achieve environmental outcomes from salinity mitigation actions through integration across Commission programs;
- support integration and alignment of national funding initiatives and reporting with regional catchment strategies that reflect BSMS objectives and integrated catchment management outcomes;
- increase emphasis on Catchment Actions to address the causes of salt mobilisation and more innovative and sustainable measures to deal with the effects, such as real time operations; and
- promotion of the BSMS as suitable for incorporation into National Plan for Water Security.

Operational recommendations

- the MDBC should complete the existing 61 EC joint works program;
- that by June 2008, the MDBC develop a new Works and Measures Program (provisionally estimated to be in the order of 40 EC) to offset anticipated increases in River salinity. The extent of the revised program required by 2015 is dependent upon:
  - improved estimates of ‘legacy of history’ impacts;
  - the proposed review of the Benchmark Period and the implications for progress against the Basin target.
  - the proposed review of the salinity cost function;
  - state demand for additional ‘development’ credits;
  - the net impact of TLM actions; and
  - potential to offset impacts through targeted Catchment Actions.
- The BSMS annual reporting requirements should be aligned with the MDBC Integrated Basin Reporting program and NAP/NHT reporting obligations; and
- By December 2008, the MDBC should investigate options for:
  - real time river operations that manage large salt loads mobilised to the river; and
  - real time in-stream targets that are integrated with the accountability framework.
Science and technical understanding recommendations

- hydrological data sets that reflect the latest research on climate change and climate variability should be developed and applied to modelling scenarios so as to ensure the best possible tools for predicting long term salinity impacts;
- the Basin Salinity Target should be reviewed with consideration given to a recommendation on replacement or complementary salinity targets that link more closely to the Salinity Registers and allow for adaptive real time salinity outcomes;
- the MDBC should develop a robust and transparent investment framework that enables environmental and social impacts to be assessed in the evaluation of benefits and dis-benefits of salinity management measures, particularly joint works and measures proposals; and
- the MDBC should review the Salinity Registers with the objectives of:
  - making them easier to understand;
  - including consideration of environmental and social impacts (in addition to the economic impacts); and
  - making them relevant to real time salinity management.
1. Introduction

1.1 Background

The Murray-Darling Basin Commission (MDBC) has undertaken a Mid-Term Review of the Basin Salinity Management Strategy (BSMS) and Schedule C to the Murray-Darling Basin Agreement to assess their effectiveness and recommend changes to improve BSMS implementation from 2008 to 2015. This report documents the outcomes of the Mid-Term Review and provides the basis for recommendations to the Murray-Darling Basin Ministerial Council (MDBMC).

1.2 Mid-Term Review requirements

The Basin Salinity Management Strategy states:

…the Strategy will be subject to a Mid-Term Review in 2007 to determine the utility of the Strategy for ongoing implementation. As part of the Mid-Term Review, the current state-of-play regarding predicted ‘legacy of history’ impacts and the effect of intervention actions undertaken to that time (as assessed by the rolling five-year review and audit process) will be collated into a new Basin Salinity Audit.

Further to this:

The Mid-Term Review will confirm arrangements for the proposed extension to the new joint works program beyond 2007 to ensure that the Basin Salinity Target will be maintained. A Council statement may be made on the outcomes of the Mid-Term Review.

This report has been written with these directives in mind to ensure that they are addressed.

Schedule C to the Murray-Darling Basin Agreement expands on these requirements and Clause 35 states that:

(1) The Commission must, by 31 December 2007 and at intervals of no more than 7 years thereafter, prepare and give to the Ministerial Council and the Community Advisory Committee, a report upon:

(a) the operation of this Schedule; and
(b) its usefulness and effectiveness in implementing aspects of the Strategy.

This report is considered to be consistent with Clause 35 (1) with 1(a) and 1(b) specifically addressed in Section 2.3.

Clause 35 also states:

(2) Without limiting the contents of any report prepared under sub-clause 35(1), the Commission must include:

(a) a summary of:

(i) the Delayed salinity impacts; and
(ii) the salinity impacts of every Accountable Action undertaken before the date of the report,

within the Murray-Darling Basin, based on the reports prepared under clause 33 during the preceding 5 years; and

(b) a description of any additions to, or alterations of, the Joint Program proposed to ensure that the Basin Salinity Target is met, since the Commission's last report made under sub-clause 35(1).
(3) A report prepared under sub-clause 35(1) may conclude that a State Contracting Government has not complied with one or more of its obligations under this Schedule.

In regard to the requirements of Clause 35(2)(a), these are covered in the BSMS Annual Implementation Report 2006-2007, however a copy of the November 2007 Salinity Registers from the Annual Implementation Report 2006-07 is at Appendix C for completeness. In regard to Clause 35(2)(b), there is significant discussion in section 3.2.4 on the Joint Works and Measures Program. The basis for the recommendation on additions to or alterations of, the Joint Works and Measures Program is at Appendix B. In regard to Clause 35(3), this responsibility has been delegated to the Independent Audit Group for Salinity (IAG-Salinity), for their 2006-2007 audit.

1.3 Approach to the Mid-Term Review

A Mid-Term Review (MTR) Task Force was established and tasked with reporting to the Commission’s higher level inter-jurisdictional working groups via the BSMS Implementation Working Group. Terms of Reference for the MTR Task Force were developed consistent with the MTR requirements outlined in Section 1.2, and they are provided in Appendix D. The Commission endorsed a MTR work plan which identified that the BSMS MTR would be conducted in three phases.

Phase 1 – Stocktake of Progress comprised:

- An inventory of knowledge that will inform the MTR;
- Definition of key issues by the MTR Task Force to inform the Stocktake and Phase 2 of the Mid-Term Review; and
- A Stocktake report (URS 2007) on BSMS implementation actions to date, setting the scene and confirming the scope of Phase 2, including any additional key issues and making recommendations for future directions.

Phase 2 – Mid-Term Review Final Report comprised:

- A series of technical workshops;
- A risk management workshop;
- A strategic directions workshop;
- Drafting of the MTR Final Report based on findings of the Stocktake and results of technical workshops, providing detailed recommendations for future implementation of BSMS and Schedule C;
- Independent Review of the MTR Final Report (Appendix E);
- Completion of the MTR Final Report, incorporating feedback from the independent review; and
- Submission of the MTR documentation through Natural Resources Management Committee and MDBC to MDBMC for consideration.

Phase 3 – Implementation of Mid-Term Review Recommendations will involve:

- Implementation of MTR recommendations as approved by MDBMC.

As the Mid-Term Review was a high level policy review, specific and detailed investigations have not been undertaken as part of this process. The findings presented in this document are based on a consultation process including a series of workshops undertaken under direction from the MTR Task Force. The consultation process drew upon the experience and expertise of workshop participants. For some issues, the outcomes of the consultation process have generated further questions. Accordingly some of the findings and
consequently the recommendations propose further investigations and changes to the BSMS Operational Protocols.

1.4 Structure of this report

The ongoing implementation of the BSMS and the effectiveness of Schedule C (including its Operational Protocols) are assessed in Section 2 of the report. This leads to a series of recommendations regarding the BSMS, Schedule C and the BSMS Operational Protocols.

Early in the MTR, a number of key issues were identified as items needing to be addressed. Through the MTR consultation process, the list of specific issues has been refined. An assessment of each of these key issues is the focus of Section 3. This includes the background to each issue, future directions and recommendations.

In aggregate, the recommendations arising from these sections form the basis for submission of the MTR Final Report through the Murray-Darling Basin Commission to Murray-Darling Basin Ministerial Council.

In line with the Independent Review Panel Terms of Reference, as presented to Commission 91 - 5 December 2006, the MDBC Chief Executive, President and Deputy President appointed Roger Wickes, Andrew Campbell and Dr Neil Byron to the Independent Review Panel to provide independent, scientific and socio-economic advice on issues relating to the methodology and findings of the Mid-Term Review and recommend improvements if required. These findings are at Appendix E.
2. Assessment of the Basin Salinity Management Strategy components

2.1 Introduction
Salt is a permanent feature of the Australian landscape and poses an ongoing threat to land and water resources within the Murray-Darling Basin. The BSMS provides a robust framework that enables coordinated actions to address salinity risk across the Basin.

2.2 Basin Salinity Management Strategy

Background
The essential components of the BSMS are a series of four objectives supported by nine implementation elements. These have been reviewed in the MTR and the findings are discussed below.

The BSMS states that:

“The life of this Strategy extends to 2015, however it is recognised that salinity management is a long-term challenge that will extend well beyond that date. As this Strategy is implemented, consideration will be given to the most appropriate framework for salinity management beyond 2015. The Commission and Council will ensure that a seamless transition occurs from this Strategy to the subsequent framework.”

The BSMS should therefore be an ongoing Strategy with significant reviews scheduled on a seven year basis. If it is deemed that the Strategy needs significant changes or replacement in the future, significant planning is required around 2012 to look beyond the BSMS end date of 2015, to formulate how salinity in the Basin will be managed beyond 2015.

BSMS Objectives
The BSMS objectives were developed to focus salinity management on limiting the rate of spread of salinity and its impacts on water quality, aquatic and terrestrial ecosystems, productive land, cultural heritage and infrastructure and, if at all possible, reverse its increasing trend. The objectives are:

1. Maintain the water quality of the shared water resources of the Murray and Darling Rivers for all beneficial uses – agricultural, environmental, urban, industrial and recreational;
2. Control the rise in salt loads in all tributary rivers of the Murray-Darling Basin, and through that control, protect their water resources and aquatic ecosystems at agreed levels;
3. Control land degradation and protect important terrestrial ecosystems, productive farm land, cultural heritage, and built infrastructure at agreed levels Basin-wide;
4. Maximise net benefits from salinity control across the Basin.

Review of the BSMS Objectives shows that they remain relevant, notwithstanding changes in policy settings and institutional arrangements affecting management of the Basin, advances in science and technology, and external factors such as climate change. Therefore they should be retained unchanged. However, the review also showed that there have been different rates of progress against each objective.
In the case of Objective 1, water quality of the shared water resources of the Murray and Darling Rivers has been improved but target salinity levels are not yet met at all locations, including the Basin Salinity Target location at Morgan. Continued effort is required in all BSMS implementation activities to achieve it on an ongoing basis. These include ongoing investment in the Joint Works and Measures Program, as outlined in Section 3.2.4, in-valley actions to meet end-of-valley targets and new initiatives such as encouraging water trade out of high impact zones into low impact zones. Interactions with other MDBC programs, such as The Living Murray, now need to be taken into account as well.

Objective 2 is targeted at managing salinity in sub-catchments across the Basin and the main driver for achieving it is the end-of-valley targets. However, the assessment of future salinity scenarios at the end-of-valley target sites (the ‘agreed levels’) has not occurred consistently across the Basin and there is not always a strong program of actions in place to achieve them. A stronger drive towards achieving this objective is therefore needed. Clarification is needed as to what is meant by the term ‘agreed levels’. A complication is that, apart from the Basin Salinity Target, there is no clear expression of what is the desired condition of the Basin from a salinity perspective. There is further discussion of the salinity targets in Section 3.2.2.

Objective 3 is achievable but it has always been recognised this will entail some compromises, in terms of adjustments to living with salt and retirement of land. At present there is less clarity as to what is meant by the term ‘agreed levels’ for this Objective than there is for Objective 2 as there are no indicators of success. Therefore, ‘agreed levels’ need to be clarified and determined and overall salinity thresholds and levels need to be more explicit for each catchment. The definition ‘built infrastructure’ also should include ‘urban areas’.

In Objective 4, maximisation of net benefits is achievable, however, no agreed methodologies are available yet to clearly demonstrate this except in the selection of salt interception schemes, and even then the non-market values have not been adequately accounted for. The management of salinity needs to become much more sophisticated than previously. Salinity peaks and troughs need to be managed as well as averages; broader issues such as climate change need to be considered and the key roles of water use efficiency, floodplains and water trades need recognition. It is possible that investment priorities may have been changed if triple bottom line outcomes were considered during the first phase of BSMS implementation.

**Implementation Elements**

In summary, the nine implementation elements of the BSMS are:

1. Developing capacity to implement the Strategy;
2. Identifying values and assets at risk;
3. Setting salinity targets;
4. Managing trade-offs with the available within-valley options;
5. Implementing salinity and catchment management plans;
6. Redesigning farming systems;
7. Targeting reforestation and vegetation management;
8. Constructing salt interception works;

The review of the nine elements shows they remain relevant and are appropriate to move the BSMS into its second phase from 2008 - 2015.

The approach to implementation of each element has also been reviewed. From this it has been found that the implementation of Elements 3, 5 and 7 need no change but the implementation of the others would benefit from some modifications.
For Element 1 (Developing capacity to implement the Strategy), the delivery of the communication and education components need to be strengthened to ensure improved communication across the parties. Communication should pay special attention to the roles, functions and responsibilities of parties to the BSMS and how these interact from the national level to the regional level.

Under Element 2, there is a need to explicitly consider how risk is managed (Identifying values and assets at risk), and this needs to flow through to BSMS implementation generally. This Element should promote the principle of prevention rather than remediation - the importance of preventing the degradation of those natural systems currently in good condition.

There is a need to revise how Element 4 (Managing trade-offs) is implemented to provide greater clarity in its application. How trade-offs are being made and whether there is potential for conflict with decisions appropriate at other scales, should be investigated. Improved integration and cooperation between NHT3 and NWI planning and BSMS requirements is needed and should be the subject of discussion at the State and national levels. Feeding information from the Commonwealth and States into the IAG-Salinity process may be one suitable mechanism for improving the targeted implementation of the BSMS.

The implementation of Element 6 (Redesigning farming systems) should be adjusted to reflect the need for practical changes to farming systems which reduce salinity risk without jeopardising the viability of farming enterprises at the same time. Options for packages of works, measures and payments need to be investigated to address the viability problem and also deliver required salinity outcomes. 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.

Element 8 is currently focused on salt interception schemes. The application of this Element should be widened to include other salinity mitigation initiatives such as dilution flows, and to recognise synergies with other programs such as The Living Murray.

Element 9 should be retained and a review of accountability processes should be undertaken to distinguish accountability entries on the Salinity Registers based on modelling from shorter-term management of salinity in the River. The potential need for additional targets and new or changed accountability arrangements, to allow for real time river salinity management, should also be explored.

Recommendations

- The BSMS (2001-2015) should be retained in its current form;
- Begin the planning process in 2012 for the next phase of Basin Salinity Management;
- In Implementing the nine BSMS elements, the MDBC and jurisdictions should incorporate the findings and directions provided by the Mid-Term Review.
2.3 Schedule C

Background
The BSMS is complemented by Schedule C of the Murray-Darling Basin Agreement. The current Schedule C was formally agreed to by the MDBMC in November 2002. The purpose of Schedule C is to provide the accountability framework for implementation of the BSMS by the participating jurisdictions. Schedule C provides for:

- joint works, measures and other actions to reduce or limit the rate at which river salinity increases within the Murray-Darling Basin;
- the adoption of salinity targets;
- establishment and maintenance of Salinity Registers to record salinity impacts and to allocate salinity credits and salinity debits to Contracting Governments; and
- monitoring, assessing, auditing and reporting on matters set out in the Schedule and on progress in implementing the BSMS.

Schedule C focuses on jurisdictional accountabilities and governance requirements but does not provide a legislative basis for some other implementation elements of the strategy that are considered to be the province of partner governments. This approach has strengths in that it provides jurisdictions the flexibility to manage salinity risk in conjunction with other jurisdictional natural resource management programs.

Schedule C has been very effective in establishing the accountabilities required to achieve the downstream water salinity outcomes and should be retained. It is generally considered to be a very useful and effective legal framework to assist implementation of the key water quality, salinity accounting, review and reporting elements of the BSMS. It also provides the authority for the annual independent audit which reviews progress on implementing the BSMS.

Recommendation

- Schedule C to the Murray-Darling Basin Agreement is robust and does not require modification.

2.4 BSMS Operational Protocols

Background
The BSMS Operational Protocols provide detailed operating rules to ensure consistency with the principles and accountabilities set out in Schedule C. The BSMS Operational Protocols are intended to provide clarity in the implementation of the Schedule; they do not and cannot attempt to modify the provisions of the Schedule; nor are they prescriptive.

The BSMS Operational Protocols have supported the BSMS implementation relatively well. This MTR has identified a number of matters that require amendment of existing Operational Protocols or new protocols. These range from clarification of terms in the BSMS objectives such ‘agreed level’ to more complex matters such as accounting for environmental impacts of water trading and amendment to the Salinity Registers. Matters arising from this MTR which may require amendment of or preparation of additional Operational Protocols are:

- Chapter 2 Within-valley working arrangements – amendments may be required to reflect work on salinity targets and the Benchmark Period as detailed in sections 3.2.1 and 3.2.2;
- Chapter 3 Basin wide reporting arrangements – amendments may be required to reflect review of the methodology for calculating entries for the salinity accounting framework as
detailed in section 3.2.3 and to cover for environmental accounting arrangements as
detailed in section 3.4.1;
• Chapter 4 Works and Measures – amendments maybe required to reflect updates to the
  Joint Works and Measures Program as detailed in section 3.2.4; and
• Chapter 5 Monitoring, reporting, auditing and review – amendments may be required to
  support revised annual reporting arrangements as detailed in section 3.2.6.

Recommendation
• That the Commission direct the Salinity Program to revise and extend the BSMS
  Operational Protocols in accordance with the MTR findings and recommendations.
3. Assessment of key issues

3.1 Introduction

The Mid-Term Review process drew upon the expertise of salinity and natural resource management practitioners across the Murray-Darling Basin. The strengths underlying the effectiveness of the BSMS and Schedule C were identified, along with the key issues that need to be considered in order for the BSMS to deliver on its Objectives through the next eight years of implementation.

A discussion on each of these key issues is provided in the sections that follow. The discussion includes the background to each issue, future directions and recommendations. Section 3.2 covers the issues that are considered to be dealt with relatively well under current BSMS implementation but where enhancement will assist in achieving the BSMS Objectives. Section 3.4 provides directions on emerging issues requiring major implementation initiatives so as to address environmental impacts of salinity, particularly within the lower Murray floodplain and the short term issues that periodically arise from river salinity peaks.

3.2 Existing implementation issues

3.2.1 The Benchmark Period

Background

The extent to which salt is mobilised within the landscape is dependent on the rate of surface and subsurface movement of water. In years of relatively low rainfall, salt is contained within the landscape whereas in wet periods it is mobilised and degrades land and water resources.

In recognising changes in salt mobilisation and dilution effects over time, the BSMS specifies a climatic sequence (currently defined as 1975-2000) to underpin modelling the impact of salinity on water quality over a period of typical climatic variability. This is referred to as the Benchmark Period. 1975-2000 was selected as the Benchmark Period because it was the period for which adequate salinity data was available for modelling across most of the Basin. It was anticipated this period would adequately represent the typical range of climate variability that could be expected over the short to medium term; as a minimum it was considered to be an improvement on the 1975-1985 period used in the preceding Salinity and Drainage Strategy.

At the time the BSMS was developed, it was acknowledged that more extreme climate events than those recorded during the Benchmark Period had been observed in the past and would be observed in the future. It was also recognised that while it would be preferable to use 100 or more years to define the Benchmark Period, the available salinity data within the Murray-Darling Basin was limited. Thus the 25 years with relatively good records was selected as a compromise with Schedule C providing sufficient flexibility for the Commission to determine a new period if required.

In light of the current drought, the adequacy of the 1975-2000 period in representing expected climatic variability over the 15 year strategy is questionable; however, the simple addition of another five years of records relating to the drought period has the potential to distort the Benchmark Period to overtly represent an unusually dry period, rather than improving its functionality for assessing accountability and progress against targets.
In addition, it is now recognised that other factors such as climate change may affect climate variability in future. As climate change and other factors are not currently represented within the existing Benchmark Period, these issues may require further consideration in the selection and application of hydrological datasets that form the basis for quantifying uncertainties in predicting future salinity impacts.

While these questions are clearly critical to having confidence in the long term risks to achieving the BSMS objectives, the existing Benchmark Period does provide a stable basis on which actions can be assessed against targets.

Future Directions

- The existing 1975-2000 Benchmark Period should be retained over the short term;
- Review the climatic sequence of 1975-2000 upon which the current Benchmark Period is based, by June 2008;
- Research the extent to which the existing Benchmark Period provides an adequate hydrologic basis for assessment of the relative trade-offs between actions that cause salinity costs and benefits to the river;
- Develop greater understanding on the sensitivity of BSMS outcomes to alternative climate scenarios;
- Identify options for changing the Benchmark Period or changing the way in which the existing Benchmark Period is used, or confirm the existing Benchmark Period and approach to using it, by June 2009; and
- Communicate with regional bodies and communities on the value and key differences between the BSMS assessment of long term salinity predictions as derived over the Benchmark Period, and day to day salinity outcomes.

Recommendation

- Hydrological data sets that reflect the latest research on climate change and climate variability should be developed and applied to modelling scenarios so as to ensure the best possible tools for predicting long term salinity impacts.

3.2.2 Salinity Targets

Background

The Basin Salinity Target

Within the BSMS objectives, significant weight is given to the protection of water quality of the shared water resources of the Murray-Darling Basin. The setting of a Basin Salinity Target was included as a key indicator of the success in achieving these objectives.

The Basin Salinity Target as specified within Schedule C is to maintain the average daily salinity at Morgan at a simulated level of less than 800 EC for at least 95 per cent of the time, modelled over the Benchmark Period using current-year levels of development. When the Basin Salinity Target was adopted it was presumed that it was ‘within reach’ but subsequent analysis has revealed that to achieve this target will be significantly more challenging.

While actual in-river salinities have remained low in the last year or two, progress against the Basin Salinity Target is monitored through a modelling approach rather than through actual river measurement. The modelled value indicated that given the current and expected salinity impacts of Accountable Actions recorded on the Salinity Registers, and utilising the existing Benchmark Period, the Basin Salinity Target has not been met under current levels of development and will
not be met without a significant increase in investment in salinity mitigation works or measures.

This is based on trend predictions from the 1999 Salinity Audit, as discussed in the following subsection on end-of-valley targets. While allowing for uncertainties in the modelling, the most recent work shows that current progress against the Basin Salinity Target is a modelled salinity of less than 800 EC for approximately 90 per cent of the time rather than 95 per cent of the time as prescribed in Schedule C. However, as the Benchmark Period is the fundamental hydrological dataset underlying the modelling framework, progress against the Basin Salinity Target is highly sensitive to the selected period. Any investment plan aimed at delivering on the existing Basin Salinity Target needs to recognise that achievements against the target are only relevant for the corresponding Benchmark Period.

**End-of-valley targets**

End-of-valley targets were incorporated into the BSMS as indicators of in-stream salinity outcomes arising from Accountable Actions across the Basin. They provide a basis for measuring the extent to which Accountable Actions contribute to achieving the Basin Salinity Target. Targets have now been set for all of the major tributary catchments, with the exception of the ACT which is expected to nominate a target by early 2008.

As early estimates of salt mobilisation from dryland catchments were relatively high, significant efforts have been invested in progressing the understanding of the drivers, processes and magnitude of salt mobilisation from the Mallee and upland catchments through the development of modelling tools. While these tools now indicate that the preliminary estimates of dryland salt mobilisation were excessive, the complexity in landscape processes means that sophisticated methodologies are not yet available to allow robust predictions of programs of actions and trade-offs between available within-valley options, to achieve end-of-valley targets over time. As a consequence, it remains unclear as to the extent to which Accountable Actions will contribute to the 10 EC salinity benefit anticipated within the Strategy from in-valley (including the Mallee) actions. However, given the predictions of future dryland salinity have changed, it is also unclear whether we need to achieve 10 EC from in-valley actions at all. What is clear is that the end-of-valley targets need revision and effort in dryland salinity management needs to be concentrated in areas where the risk of salinity induced damage is greatest. At present, the availability of finer scale data to identify within-valley values and assets is limited. However, new tools (i.e. 2Csalt) are being delivered that will improve evaluation of impacts of land management changes on in-stream salinity and river system models (for example, IQQM) for translating these impacts to end-of-valley target sites.

**Landscape targets**

While end-of-valley targets and the Basin Salinity Target are an effective basis for assessing performance against BSMS water quality objectives, they are largely remote from diffuse incidents of ecological decline (such as floodplain health) and land degradation. As such, in-stream end-of-valley targets do not directly relate to local assets and are therefore ineffective for business or community engagement, or as a basis for encouraging local land use or land management changes.

Given that the BSMS includes specific objectives associated with ecological and land based outcomes, understanding long term trends in salinisation with respect to assets external to rivers and streams would benefit from basin scale indicators of measures and performance designed to address these objectives.
While responsibility for local scale salinity targets and measures clearly remains within the province of the jurisdictions, the BSMS should provide the appropriate framework to progressively report at a basin scale on status and long term trends. At a jurisdictional scale, targets would require effective community engagement with mitigation activities and outcomes coordinated and linked with programs of actions as discussed in section 3.2.5.

The National Resource Monitoring and Evaluation Framework has been developed by the Australian, State and Territory Governments to assess both the health of the nation’s land, water and biological resources and the performance of Government programs, strategies and policies (particularly the National Action Plan for Salinity and Water Quality and Natural Heritage Trust programs). This framework defines ‘Matters for Target’ which can be reported using a range of indicators. The National Framework includes indicators for biophysical resource condition (including salinity) as well as community and social indicators relevant to natural resource management programs and the adoption of sustainable management practices and therefore have application for the BSMS.

Future Directions

- Retain the salinity targets in their existing form in the short-term;
- Design complementary targets as key performance indicators. They should provide for:
  - clear and transparent linkages between the Salinity Registers, the Joint Works and Measures Program and Basin salinity target(s);
  - innovative and adaptive salinity management allowing for opportunistic salt discharge from the Basin;
  - real time targets that allow Basin partners to manage in real time for river salinity outcomes against acceptable magnitudes, durations and times of year of peak river salinities and report annually on actual achievements;
- Further develop catchment based models and understanding of the value of the end-of-valley targets as surrogates for catchment resource condition;
- Review the selected values for each end-of-valley target and the prescribed Basin Salinity Target by June 2008 including the potential for complementary or alternatives to existing targets;
- Complete the related work recommended by the IAG-Salinity if it is still relevant, including:
  - assess the implications for the Basin Salinity Target if tributary salinity outcomes eventuate in line with end-of-valley targets; and
  - estimate the change in end-of-valley targets necessary for tributary valleys (including the tri-State Mallee region) to achieve the 10 EC credits at the Basin Salinity Target site; and
- Develop and link landscape targets to the National Resource Monitoring and Evaluation Framework through NRM regional planning processes and investment strategies under NHT3.

Recommendation

- The Basin Salinity Target should be reviewed with consideration given to a recommendation on replacement or complementary salinity targets that link more closely to the Salinity Registers and allow for adaptive real time salinity outcomes.
3.2.3 Salinity Registers

Background
The Salinity Registers are the primary record of jurisdictional accountability for actions that affect salt mobilisation and are a working example of an effective environmental accountability framework. The Salinity Registers track the modelled effect of Accountable Actions on the river salinity at the Basin Salinity Target site and the salinity benefits and costs along the river. The Salinity Registers provide a framework to annually report on the salinity debits and credits of each government and progress towards achieving the targets for river salinity. They enable a consistent basis through which Basin-wide trade-offs and Accountable Actions are managed transparently. The Salinity Registers have been significantly strengthened in recent years with improved coordination of reporting arrangements and more robust entries for most Accountable Actions.

The methodology for calculating Salinity Register entries, as documented within the BSMS Operational Protocols, is complex with outcomes being sensitive to improved data and modelling techniques. Representation of both the current and delayed impacts within the Salinity Register contributes to the complexity of the calculations. This complexity is problematic because it requires the Commission and jurisdictional partners to maintain significant technical capacity and corporate knowledge which is a challenge in an era of skills shortage and high staff turnover.

The value of each Salinity Registers entry is derived from hydrological and salinity modelling converted to dollar units based on a cost function. The cost function reflects the point at which salt enters the river and the downstream impacts on agriculture and infrastructure. As such, the Salinity Registers are focused on balancing the economic impacts of changes in land and water use on River Murray salinity. Implementation of the BSMS currently does not incorporate a basis for accounting for environmental impacts of Catchment Actions despite the protection of ecological outcomes being an explicit objective of the BSMS. Action is needed to address this.

Not withstanding the complexities and some limitations, the Salinity Registers have been very effective as a quantifiable accounting arrangement for natural resource management outcomes. A copy of the November 2007 Salinity Registers is contained within Appendix C. Further information on the Salinity Registers, is contained within the BSMS Annual Implementation Report 2006-07.

Future Directions
- Retain the Salinity Registers in their current form in the short term;
- Consider improving the consistency between the Salinity Register A and B components, in particular the use of 30 year rolling averages versus a ticking clock methodology;
- Simplify the Salinity Registers structure to facilitate wider understanding within partner jurisdictions and the broader community;
- Review the salinity cost functions by June 2008. In doing so, consider:
  - the costs and benefits associated with the impact of Catchment Actions (and joint works and measures) on environmental values;
  - an agreed multi-attribute metric that will provide the basis for evaluating environmental, social, and economic costs and benefits;
  - the improved knowledge and capacity of landholders to manage leaching fractions so as to offset incidents of high salinity irrigation water; and
  - operational accountability consistent with real time operational targets.

Recommendation
- The MDB should review the Salinity Registers with the objectives of:
- making them easier to understand;
- including consideration of environmental and social impacts (in addition to the economic impacts); and
- making them relevant to real time salinity management.

### 3.2.4 The Joint Works and Measures Program

#### Background

The Joint Works and Measures Program provided for under Schedule C has focused on the commitment to construct salt interception infrastructure to deliver in-stream salinity outcomes. In particular, it focuses on achieving a 61 EC reduction in average salinity at Morgan by 2007 - 31 EC to offset the impact of past actions (pre 1988) and 30 EC shared equally between NSW, Vic and SA to offset State Accountable Actions (post 1988). The inevitable time-lag associated with planning, investigations and construction has led to some delays in the program. However the funding initiative from the Australian Government in 2005-06 has meant that the objective is expected to be achieved by 2010. To date, the investment in salt interception infrastructure has proven to be an effective method of removing salt as evidenced by progress against the 61 EC joint works program.

The Program has been successful in having delivered 40 EC benefit (average) and has contributed to the delivery of BSMS Objective 1 (Maintaining water quality of the shared resources). These in-stream outcomes offset the 'legacy of history' (past actions), and provide States with credits that offset land and water management activities that cause an in-stream salinity increase.

Notwithstanding these successes, the Basin Salinity Target will not be achieved through the current Joint Works and Measures Program, as discussed in Section 3.2.2, and implementation and operation of salt interception infrastructure is now revealing some long term issues for new and existing works. Part of the problem is that salt interception infrastructure is primarily suited to reducing the average salinity, rather than peaks.

Disposal infrastructure and facilities are known to have a finite life which has the potential to constrain both existing and future infrastructure unless new and innovative disposal options are developed. Hydrogeological investigations and economic analysis also suggest that the most economically viable schemes have been constructed or are under detailed investigation. It should also be noted that while new infrastructure may not be economically viable to achieve water quality objectives, it may be worthwhile to achieve other outcomes (for example, environmental objectives), highlighting the need to broaden the criteria by which viability is judged.

#### Future Directions

- Extend the Joint Works and Measures Program provisionally estimated to achieve 100 EC (an additional 40 EC) by 2015 (see Appendix B for additional details).
- Pursue delivery of future salinity reductions with a broader range of salinity management options including consideration of:
  - targeting salinity credits from the Joint Works and Measures Program to achieve offsets against 'legacy of history' and provide credits to the states to offset State Accountable Actions that cannot be delivered economically by mitigating salinity at the source;
  - understanding the uncertainty around predictions on the magnitude and timeframe for 'legacy of history' impacts becoming apparent at the river;
- adjusting the Joint Works and Measures Program to ensure it will still be applicable if Salinity Targets are changed; and
- complementing the objectives of other catchment management initiatives;

- Ensure the Joint Works and Measures Program is aligned with the broader principles of Integrated Catchment Management;
- Quantify demand for salinity credits for offsets to address:
  - actions such as the Environmental Works and Measures Program;
  - impact of The Living Murray initiatives (for example, salt mobilisation from environmental watering)
- Investigate the potential for managing dilution flows, environmental flows and reconfiguration programs to allow for salt export;
- Develop explicit jurisdictional and cross program cost and credit sharing arrangements, given that the cause and ecological effect of salinity may be local rather than being distributed across jurisdictional boundaries; and
- Develop an evaluation framework for a multi-objective Joint Works and Measures Program that features an investment environment that provides opportunities for innovative multi-objective proposals to be evaluated, and linkages to other programs, so as to optimise salinity, ecological and social outcomes across the Murray-Darling Basin.

Recommendations

- The MDBC should complete the existing 61 EC joint works program
- That by June 2008, the MDBC develop a new Works and Measures Program (provisionally estimated to be in the order of 40 EC) to offset anticipated increases in River salinity. The extent of the revised program required by 2015 is dependent upon:
  - improved estimates of 'legacy of history' impacts;
  - the proposed review of the Benchmark Period and the implications for progress against the Basin target;
  - the proposed review of the salinity cost function;
  - state demand for additional 'development' credits;
  - the net impact of TLM actions;
  - state demand for additional 'development' credits
  - potential to offset impacts through targeted Catchment Actions.
- The MDBC should develop a robust and transparent investment framework that enables environmental and social impacts to be assessed in the evaluation of benefits and dis-benefits of salinity management measures, particularly joint works and measures proposals.

3.2.5 Programs of actions

Background

A significant development in the evolution from the Salinity and Drainage Strategy to the BSMS was the concept of the BSMS as a basin-wide strategy that looked beyond the river to the diffuse and regional causes of salinity across the Murray-Darling Basin. This was a broadening of the Salinity and Drainage Strategy to tackle salinity throughout the Murray-Darling Basin.

BSMS elements were developed to address these causes of salinity including redesigning farming systems and targeted revegetation actions. Funding of these programs was foreseen to be through Natural Heritage Trust and National Action Plan for Salinity and Water Quality contributions to jurisdictional and regional programs. It was envisaged that these programs would in turn link to valley and basin-wide outcomes via the development of programs of actions to deliver end-of-valley targets discussed in Section 3.2.2.
Regional communities have included salinity management within regional catchment strategies. The Independent Audit Group-Salinity (IAG-Salinity) commented on impressive achievements by regional groups in implementing their investment plans in 2005-06. However, the IAG-Salinity has also promoted the need to effectively integrate and align national funding initiatives and reporting (such as NHT3) with regional catchment strategies that reflect BSMS targets.

Technical understanding and accountability processes have been successfully developed for irrigation related actions within the Mallee region and are under development for the Riverine Plains. For Catchment Actions within the dryland, there have been significant gaps in effective modelling tools that are linked to major tributaries (and thus River Murray Basin Salinity Target outcomes). The lack of availability of robust modelling tools for the dryland catchments has been an impediment to meeting the Schedule C requirements that jurisdictions provide programs of actions to meet end-of-valley targets. However, these are now being overcome with significant work being put into developing models to address BSMS needs. Significant progress has been made in delivering the 2Csalt model, which is designed to model catchment rainfall-runoff and salt exports, and it is now available for implementation in dryland upland catchments of the Murray-Darling Basin.

However, lack of understanding and quantification of the relationship between actions in the upper catchments and in-stream salinity outcomes remains to be fully addressed. Particular problems include:

- Difficulties in engaging communities on the relevance of upper Catchment Actions to end-of-valley targets and the Basin Salinity Target. This is because the benefits of achieving in-stream targets from these communities are generally subject to exceptionally long lag times, are difficult to quantify, are remotely located from the communities and do not relate to locally identified assets that may be under threat from salinity;
- Programs of actions aimed at redesigning farming systems or change management actions are likely to have lesser impact upon land management practices relative to the influence of externalities such as rainfall and commodity price variability;
- Actions to deliver long term land use change that provides environmental benefits will only be successful if they also deliver a more profitable outcome for the farming business.

In pursuit of whole of catchment outcomes, regional bodies are well aware of the potential for intervention to result in conflicting outcomes, and therefore include the making of trade-offs into their processes for developing and implementing catchment plans. Regional bodies also take socio-economic aspects into account as well as environmental aspects, in accordance with the principles of the triple bottom line approach.

For the same reason, BSMS implementation needs to be embedded within a framework targeted towards achieving whole of basin integrated catchment management outcomes with due recognition given to the fact that salinity is not the single most significant issue within every tributary valley.

There is increasing interest in Market Based Instruments (MBI) as a means of achieving effective adoption of Catchment Actions for controlling salt exports and land salinisation. Some elements of the BSMS (such as the capacity to utilise salinity credits to offset debits within the Salinity Register, and the Victorian Sunraysia salinity levy on new developments arising from trade) provide some of the characteristics of MBIs. Catchment Management Authorities also use
forms of MBIs through incentive and tendering schemes to progress environmental services, some of which contribute to salinity outcomes.

There remain however significant complexities with progressing towards full MBI initiatives in the context of providing river salinity offsets. Impediments include the current differences in methodology in calculating Register A and B salinity impacts (as discussed in section 3.2.3), low market participation and high transaction costs. Notwithstanding these constraints, there is potential to continue to explore further progression towards MBI initiatives through the continued development of salinity impact zones, involvement in irrigation district reconfiguration ventures and potential to seek other opportunities to invest in water recovery to achieve salinity outcomes. Progression of opportunities and developments in these areas should be investigated.

**Future Directions**

- Promote the integration of BSMS implementation with processes that prioritise natural resource management outcomes for each major tributary valley so as to assess the relative prioritisation for salinity investment and other matters such as regional catchment yield and shared water resources of the Murray-Darling Basin;
- Support flexible public and private multi benefit extension programs and proportional funding towards multi benefit public land works programs through NHT3 for major tributary valleys;
- Support salinity investment through NHT3 where multiple benefit outcomes can be demonstrated noting that in the short to medium term, most dryland interventions through redesigning farming systems and vegetation management will not significantly contribute towards in-stream targets;
- Continue to invest in the development of modelling tools capable of exploring both salinity and non salinity related impacts of natural resource management interventions;
- Develop a BSMS level implementation plan to ensure that the targets in NRM regional plans and the BSMS are synchronised; and
- Establish a joint commitment to integrate and align the BSMS with regional NRM plans and investment strategies.

**Recommendations**

- *Increase emphasis on Catchment Actions to address the causes of salt mobilisation and more innovative and sustainable measures to deal with the effects, such as real time operations; and*
- *Promotion of the BSMS as a robust basin scale salinity management strategy suitable for incorporation into the National Plan for Water Security.*

**3.2.6 Reporting arrangements**

Effective accountability requires straightforward, transparent reporting arrangements. Reporting arrangements have been prescribed within Schedule C and include preparation and submission to Commission and Ministerial Council of:

- Annual implementation reports from jurisdictions
- An annual IAG-Salinity report;
- A Commission report on implementation progress of the BSMS as a whole.

In implementing these obligations the partner governments and the Commission have progressively improved the quality of their reporting. In their 2005-06 report, the IAG-Salinity commented on the substantial progress in implementing the BSMS which was emphasised by the reports from partner governments and consultations.
While comprehensive and thorough, the scale of reporting has meant that this approach to informing Commission and Ministerial Council is becoming increasingly resource-intensive. The efficiencies and practicalities of this process could be improved significantly through an agreed reporting framework that avoids duplication and focuses upon the reporting required to meet the obligations prescribed within Schedule C.

There is also significant potential to report on the BSMS within an Integrated Basin Reporting framework. The IBR framework recognises that efficiencies can be improved and information gained when the outcomes of key MDBC programs are viewed together, rather than in isolation. An MDBC Research, Data and Reporting Group has been set up to do this.

**Future Directions**

- Reporting requirements need to be reviewed by June 2009 with the aims of making them more flexible, removing the duplication of effort while ensuring delivery of an end product that remains relevant;
- Minimise the capacity and resources needed to meet requirements while meeting outcomes by establishing a new reporting framework for multiple purposes which:
  - fulfil legislative requirements;
  - build upon monitoring and evaluation activities to inform planning for future activities;
  - provide some of the elements for successful communication of achievements; and
  - establish a channel into the Integrated Basin Report being established by the Commission; and
- Review the IAG-Salinity Terms of Reference taking into account the findings and recommendations of the Mid-Term Review.

**Recommendation**

- The BSMS annual reporting requirements should be aligned with the MDBC integrated basin reporting initiative and NAP/NHT reporting obligations.

### 3.3 Emerging issues

A clear emerging issue in the sections above is recognition of the impact of salinity on floodplains, with salt accumulating within floodplains under the current dry climate regime. This could have a potentially catastrophic impact on water quality and the river environment, should large quantities of salt be released. Salt stored on the floodplains may be mobilised during and after the next flood event. Improved understanding of salt mobilisation processes and improved capacity to deal with these have been identified as priorities in the last three IAG-Salinity reports.

A second emerging issue is the stronger impetus to take explicit account of the environment in decision making, to ensure a triple bottom line to BSMS implementation actions.

It has been identified that the key to addressing these issues is to integrate with other relevant Commission programs such as The Living Murray to manage and account for risks associated with salt accumulation on, and mobilisation from, floodplains. Investigation is also needed into how real-time operations may assist in putting effective management practices in place. This is covered in the following section.
3.4 New implementation directions

3.4.1 Integration with other programs

Background

Since the BSMS was initiated in 2001, there have been a range of new initiatives and strategies that have contributed to broader economic, social and environmental aspirations of catchment management – the triple bottom line. Some aspects of this integration require a more detailed understanding of matters associated with accountability and ecological targets.

Through the BSMS partnership with the National Action Plan, regional groups have made significant achievements in implementing salinity related on-ground works in rural communities.

Significant work has been completed on improving understanding of ecological responses to salinity since the inception of the BSMS. There is a need to integrate this information into programs such as The Living Murray and provide explicit links to the BSMS to ensure joint objectives and outcomes are achieved. To this end, there is a TLM/BSMS Coordination Task Force working to integrate activities under these two programs.

Six threats to the security of water resources have been identified - climate change, increased number of farm dams, increased groundwater use, bushfires, afforestation, and reduced return flows from irrigation. Early indications are that flows to SA will be barely changed as a result of these, suggesting little effect on river salinity at Morgan.

Future Directions

- Accountability arrangements for achievement of salinity targets should be explicitly incorporated within Commission Integrated Catchment Management programs. This may include:
  - the BSMS Joint Works and Measures Program being fully accountable for water consumption or use under the Cap;
  - the Living Murray program being fully accountable for salinity impacts of The Living Murray actions under the BSMS, as discussed in section 3.2.3 and BSMS Joint Works and Measures Program explicitly recognising the ecological benefits of investment decisions; and
  - expanding the existing economic based accountability framework to incorporate ecological outcomes; and
- Investment in predictive tools should focus on tools that program understanding of floodplain processes.

Recommendations

- Develop methods to account for and achieve environmental outcomes from salinity mitigation actions through integration across Commission programs; and
- Support integration and alignment of national funding initiatives and reporting with regional catchment strategies that reflect BSMS objectives and integrated catchment management outcomes.
3.4.2 Real Time Operations

Background
There is scope for BSMS implementation to make greater use of river operational rules that provide agreed real time management responses to river salinity issues, to meet BSMS objectives and the Basin Salinity Target. This has particular relevance to the management of post-flood salt accessions either during a major wet period, or following environmental watering activities undertaken through The Living Murray. There is also potential to release salt to the river at certain times of year and not cause adverse environmental or economic harm by utilising the dilution effects of high flow periods.

Operational issues also arise for salinity management during low flow periods. As a consequence of repeated years of low inflows to storage, there is now a risk arising on an annual basis that the system will have insufficient capacity to deliver surface flows to the Lower Murray that are essential to dilute the impact of saline water from aquifers and wetlands. Careful river management is essential during these critical periods to minimise the impacts on urban, agricultural and environmental uses of the river. In addition, the way the Salinity Registers work, or are calculated, would have to be revised as the way they are currently set up inhibits event management, especially salt dumping.

Real time targets, as discussed in Section 3.2.2, together with a strategic monitoring program would be essential components of the water quality related operational rules. A strategic monitoring program would reflect the spatial and temporal dynamics of river salinity which are a function of flow and salt load within individual reaches of the river. The monitoring program would be required to target improved understanding of the dynamics of river salinity, as well as reflecting the data necessary to assess progress against real time targets.

Future Directions
- Develop real time operational salinity targets for the Basin’s shared water resources that reflect the acceptable extent and duration of peak river salinity;
- Develop operational rules for salinity management so as to achieve agreed salinity targets; and
- Develop and implement a strategic stream salinity monitoring program for the shared water resources to inform operational management of the risks of salt mobilisation from the floodplain following flood events, and saline water accessions from wetlands and aquifers during periods of low dilution flow.

Recommendation
- By December 2008, the MDBC should investigate options for:
  - real time river operations that manage large salt loads mobilised to the river; and
  - real time in-stream targets that are integrated with the accountability framework.
References


Appendices

Appendix A. Background to the BSMS

Overview

The BSMS superseded the 1988 Salinity and Drainage Strategy and is the Murray-Darling Basin Ministerial Council’s response to the salinity impacts identified in the 1999 Basin Salinity Audit (MDBC, 1999). It addresses both dryland and irrigation salinity. The BSMS provides a basis for communities and Governments to work together to control salinity and protect key natural resource values in the Murray-Darling Basin and is consistent with the principles of the Integrated Catchment Management Policy Statement (ICM). This Strategy also provides a framework for implementing salinity management actions across the Basin, including those associated with the National Action Plan (NAP) for Salinity and Water Quality and State salinity initiatives, under a 15 year program of action.

Salinity management approaches prior to 2001

Prior to the BSMS, River Murray salinity had been significantly reduced through implementation of the 1988 Salinity and Drainage Strategy, aimed at an in River reduction in salinity of 80 EC. This was achieved through undertaking the rehabilitation of degraded lands while limiting the amount of salt entering the river through construction of salt interception schemes. Implementation of effective State salinity action plans and land and water management plans to oversee new irrigation development also played a key role.

The 1999 Basin Salinity Audit showed that salt - previously stored in the landscape - was being mobilised on a massive scale by rising groundwater tables, due to land use changes across the Murray-Darling Basin. This was a new dimension to the 1988 Salinity and Drainage Strategy where the emphasis was constrained to irrigation and water quality in the Murray. An approach of 'business as usual' would mean that the reduction in lower River Murray salinity achieved over the decade to 1999 would be cancelled out within 20 to 30 years, and median salinity levels would exceed the Australian Drinking Water Guidelines for good quality water within 50 to 100 years. The findings of the 1999 Basin Salinity Audit led to agreement for catchment action that benefited local communities as well as the River. Also, by 1999 the initial Salinity and Drainage Strategy program was drawing to completion and decisions were needed as to whether the program should be extended or not.

There were substantial shifts in salinity management approaches over the 15 to 20 years to 2001. This included a significant shift in public environmental policy from a national growth focus to management of the resource base for the future. In particular, this could be seen as the period in which separate management of land, water and vegetation at the State level (for example, through agency consolidations and catchment management organisations) were merged towards integrated natural resource management supported at the national level and delivered at the regional level.

Development of the BSMS

The BSMS was developed out of a need to review the Salinity and Drainage Strategy to fit with the improving natural resource management arrangements, especially the development of regional delivery models. The three levels of government were not well coordinated but
relationships and programs with respect to salt and water were better than for most other natural resources management programs.

In addition, there was clear recognition of a need:
- to cap and trade resources, particularly water (the Cap was in place for surface water in the Murray-Darling Basin);
- for end-of-valley targets as a means of managing sub-catchments as well as contributing to salinity outcomes within the Murray channel;
- for adaptive management based upon monitoring and review (this lead to firmer arrangements being prescribed through Schedule C);
- for a range of time scales to be considered to assess management progress and the impacts of actions (this lead to emergence of Salinity Registers A and B under the BSMS).
Appendix B. Provisional estimates for future Joint Works and Measures Program

Purpose

1. To inform the Mid-Term Review of the future requirements for the Joint Works and Measures Program (JW&MP) beyond the current 61 EC program.

2. A 40 EC program by 2015 is suggested illustrated by the following table.

Table 1: Predicted Salinity Impacts in the Murray River

<table>
<thead>
<tr>
<th>Salinity Impacts in river at 2015</th>
<th>Net Db -Cr at 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net ‘legacy of history’ from pre 1988 irrigation &amp; dryland actions</td>
<td>35</td>
</tr>
<tr>
<td>TLM on-ground activity (07-15 could be either credit or debit)</td>
<td>15</td>
</tr>
<tr>
<td>Shortfall in the Basin Target (after 61 EC stage#1 JW&amp;MP)</td>
<td>36</td>
</tr>
<tr>
<td>Joint Responsibility</td>
<td>86</td>
</tr>
<tr>
<td>Net Accountable Actions (States)</td>
<td>13</td>
</tr>
<tr>
<td>Net ‘liability at 2015</td>
<td>100</td>
</tr>
<tr>
<td>Current BSMS stage#1 JW&amp;MP (2001 - 2010)</td>
<td>-61</td>
</tr>
<tr>
<td>Future BSMS stage#2 JW&amp;MP (2001 - 2015)</td>
<td>-39</td>
</tr>
<tr>
<td><strong>Balance in river at 2015</strong></td>
<td><strong>0</strong></td>
</tr>
</tbody>
</table>

Background

3. The Joint Works and Measures Program (JW&MP) is a collaborative effort by four governments in the Basin for the shared rivers of the Murray and lower Darling and to date has mainly focused on engineering salt interception schemes.

4. The agreement to invest in JW&MP to date, have been based upon B/C criteria underpinned by a cost function that establishes the benefits arising from improved water quality.

5. The first program was undertaken between 1989 and 2001 and targeted a 30 year rolling average EC reduction of 80 EC (amounting to 15 EC salinity credits for each of Vic & NSW and an improvement in river salinity of 50 EC).

6. The second program initiated in 2002 targets a reduction of 61 EC (average) of which 31 EC is assigned to the ‘legacy of history’ with 30 EC being available to the three states to offset Accountable Actions. This program is expected to be completed by 2010 and investigations for projects for a future program have already been initiated.

7. The Mid-Term Review report “must include a description of any additions to, or alterations of, the Joint Program proposed to ensure that the Basin Salinity Target is met…..” (Schedule C, Cl. 35(2)(b)).

Demand for a future JW&MP

8. The need for the JW&MP over next seven years involves consideration of the current status and need for credits including:

   a. ‘Legacy of history’ offsets
b. Meeting the shortfall in the Basin Target of less than 800 EC for 95 per cent of the time over the Benchmark Period

c. Accountable Actions offsets (debits) and residual credits (since 1988).

d. Environmental improvements (TLM & State – debits & credits)

e. Real time operational targets that may be established over the next few years

9. Other matters that need consideration in the development of a future JW&MP include:

   a. Sustainability of the existing and future SIS program (particularly constraints on disposal capacity and potential for in-stream salt disposal)

   b. A preference for initially pursuing economically viable programs of actions to address the cause of salt mobilisation (for example, improved irrigation practices).

   c. A scope that considers options beyond SIS such as:

      i. irrigation reconfiguration (partnerships with jurisdictions)

      ii. collaborative interventions with programs such as TLM

      iii. flow manipulation

   d. The operation of the two Salinity Registers

10. Given the above, there is potential for a multi-objective approach involving partnership arrangements both within the Commission’s programs and in conjunction with state and national initiatives.

11. In order to determine the actual scale of works and measures it is necessary to consider the ongoing impacts of processes already in train and then to consider actions yet to be taken. Attachment A illustrates the various estimates currently available and some indication of the imminent issues.

Scale of Future JW&MP (Beyond 61 EC)

Legacy of history

12. The current predictions indicate a significant increase in salinity for the lower Murray over the next 30 to 50 years (due largely to salt mobilisation from irrigation and dryland activity in the Mallee). Even after taking account offsets to the ‘legacy of history’ predictions arising from the current 61 EC JW&MP an increase in average salinity of 86 EC is currently estimated for 2000 to 2015)

Meeting current (and potential future) water quality targets

13. The program will be required to take increased emphasis on actions which address salinity peaks and consequently the Basin Salinity Target at Morgan (<800 EC/95 per cent). At 2006 levels of development, Morgan EC was modelled at 857 EC/95 per cent over the 1975-2000 Benchmark Period. Without further intervention; this expected to become 942 EC by 2015; noting the current 61 EC program will bring this down. Further works are therefore required to meet the target (in the order of 36 EC average reduction) if it includes both engineering works and flow manipulation.

State Accountable Actions

14. The JW&MP provide each of the States (NSW, Vic and SA) with cost effective salinity offsets to meet their obligations for post 1988 impact (as with the S&DS 80 EC and BSMS 61 EC Programs). States are currently in credit having brought post 1988 actions to account retrospectively. Demand by the states for credits through JW&MP at a collective level of 13 EC have been assumed which will leave a residual credit at 2015; States should review their current programs and declare their future credit requirements.
Environmental improvements

15. Environmental recovery and protection programs including TLM may generate a demand for credits depending upon the net effect of the full TLM package which itself may offset increased salt mobilisation by water recovery and flow manipulation activities. State environmental initiatives will also affect salinity, for example Victoria indicated a requirement for salt disposal entitlements for environmental actions when the BSMS targets were reviewed in 2005. Given the uncertainties, an estimate of a net 20 EC impact at 2015 has been used.

Operational targets

16. The MTR is recommending the investigation of operational targets that may ultimately replace or complement the 800 EC target. There may be a future role for the JW&M program in pursuing such a target however this cannot be quantified until the options are thoroughly explored.

Economic Justification & Cost Sharing Principles

17. The current JW&MP is targeted towards economically justified water quality objectives. Cost sharing principles and contributions will be required if other objectives are sought.

Summary

18. The table overleaf (Attachment A) indicates the relative significance of the various drivers and the mitigation measures. The analysis is based primarily on the 2006 Salinity Registers but with new data introduced where appropriate and available.

19. Based upon the above, & taking a precautionary view and continuing using average EC at Morgan as an indicator of the scale of program, it is suggested that a further program of at least 40 EC (average) extending the current 61 EC to around 100 EC by 2015 is justified. Depending upon some options taken and some uncertainties, this may increase over time and so should be reviewed progressively. Beyond 2015 an even more innovative approach will be essential.

20. Current SIS investigations are being pursued which could deliver this scale of program. Modelling / economic analyses have also indicated justifiable flow manipulation actions. In addition approaches to pursue salinity credits through partnership arrangements with other National and state initiatives such as irrigation infrastructure reconfiguration and targeted water acquisitions and delivery have been identified.

21. Such a program would provide the opportunity and flexibility to meet the Basin target as well as providing offsets for possible environmental recovery programs. However it should be noted that the net requirements are based upon an assumption of the States having continued residual Register A credits until 2015 which are available to offset the joint liabilities on Register B. As beyond 2015, states may require their current Register A credits, a further review of the register balance and implications for the JW&MP should be initiated in 2012 when the next BSMS review is proposed to be initiated.

22. Whilst there are many uncertainties in the predictions, Figure 1 overleaf attempts to illustrate the anticipated salinity regime at the peak, average and the costs to water users from the combined effect of the anticipated drivers and a JW&MP resulting in a 100 EC reduction between 2000 and 2015.

23. Over the next two years, an approach to evaluate the technical, economic and environmental benefits and dis-benefits of proposals should be developed incorporating relationships with the Salinity Registers.
Commentary on this chart:
This table is provided as an illustration of the trends in average EC, peak EC (95th percentile) and costs to water users.

The values quoted in this chart are based on the Commission's 2006 Registers and its supporting spreadsheet summary which draws on the results from numerous MSM-BIGMOD model runs; this model takes its inputs from a range of process models in particular groundwater models.

The costs are based on the endorsed salinity cost functions. Some relevant scenarios have not been modelled and the values have therefore been extrapolated from similar scenarios.

The chart is based on the modelled analyses of the predicted trends rather than the Salinity Registers which would involve using 30 year rolling averages and 1/50th ticking clock linear trends.

The data underlying the chart incorporates the available data on:
- The ‘legacy of history’ predicted trends
- The progressive impacts of actions after allowing for lag-times
- The impacts of mitigation works and measures including an extended Joint W&MP and State actions

It is clear that there is a strong overall relationship between the three ‘measures’ of salinity (average, peak and costs), but it is recognised that individual component actions affect these measures differently:
- ‘anticipated actions’ are not well represented because the modelling has not been done;
- the subtleties in the data around 2006 reflect the model scenarios which account for those works (SIS) which have been declared effective and a large part of the construction of the 61 EC program will occur in the next 2 – 3 years.
### Table 2: A basis for estimating the requirements of the Joint Works and Measures Program to 2015

<table>
<thead>
<tr>
<th>Drivers for BSMS JW&amp;M Programs – the 2007 perspective</th>
<th>Version #2 Aug 07</th>
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<tbody>
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<td><strong>Demand</strong></td>
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<td><strong>Impact on Average EC by 2015</strong></td>
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<td><strong>Impact on peak EC</strong> (95th% by 2015)</td>
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<tr>
<td><strong>Comments on the estimates and assumptions</strong></td>
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<td><strong>Modelling (75-90) Current Conditions at year 2015</strong></td>
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<td><strong>The Legacy of History (Delays Salinity Impacts)</strong></td>
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<tr>
<td><strong>Debits</strong></td>
<td><strong>Credits</strong></td>
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<td>Upland Dryland</td>
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<td>Riverine Plains</td>
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<td>Malia Dryland (post 2000)</td>
<td>6</td>
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<tr>
<td>Malia Irrigation (pre 1988 action post 2000 impact)</td>
<td>54</td>
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<tr>
<td>Future best practice IIP</td>
<td>7</td>
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<tr>
<td>TLM Activity (95-14 could be either credit or debit)</td>
<td>8</td>
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<tr>
<td>Meeting the shortfall in the Basin Target (after 61 EC)</td>
<td>36</td>
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<tr>
<td><strong>Joint Responsibility</strong></td>
<td><strong>445</strong></td>
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<tr>
<td><strong>Accountable Actions - Current (on-ground now)</strong></td>
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<tr>
<td>Water Trade (Irrigation Development)</td>
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<tr>
<td>Drainage &amp; Irrigation Systems rehab / reconfig</td>
<td>3</td>
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<tr>
<td>Environmental Works and Measures (State initiatives)</td>
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<td><strong>Net Salinity Neutral - Integrating State actions with MDCC JW&amp;M actions; generating local offsets credits will always equal the local debits</strong></td>
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<td><strong>Joint Programs (ongoing SIS - current investments)</strong></td>
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<tr>
<td>Flow manipulation</td>
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<td>Opportunistic sali export</td>
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<td>Irrigation reconfiguration</td>
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<tr>
<td><strong>Future needs for JW&amp;MP to 2015 beyond 61 EC</strong></td>
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<tr>
<td><strong>Total JW&amp;M 2000 - 2015</strong></td>
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<td><strong>Balance</strong></td>
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<tr>
<td><strong>On current information there is a need for 100 EC_m</strong></td>
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</tbody>
</table>

**Note:** The program will need to achieve 100 EC ave reduction from 2001 to 2015.

**Future impacts:**
- Current SIS proposals are expected to deliver 68EC.
- Current investigations have identified opportunities up to 45EC deliverable by 2015.
- Flow manipulation is better than SIS at mitigating peak EC and meeting the target.
- Irrigation reconfiguration is being driven by the `national agenda` and could generate credits from targeted actions, needing analysis and a business plan.
- The assessment uses `predictions of actual` rather than Registers - taking account of the debits and credits a minimum net 39 EC program is justified (say 40EC), this estimate is based on some good estimates and some judgement; ongoing review is essential.

**Future needs for JW&MP to 2015 beyond 61 EC**

### Mid-Term Review – Final Report

**Attachment A**

**Impact on Averages and Peak Salinity**

- **Impact on Average EC by 2015**
- **Impact on peak EC (95th%) by 2015**
- **Comments on the estimates and assumptions**

- **Modelling (75-90) Current Conditions at year 2015**

- **The Legacy of History (Delays Salinity Impacts)**

- **Debits**
- **Credits**
- **Increase**
- **Reduction**

- **Joint Responsibility**

- **Accountable Actions - Current (on-ground now)**

- **Net Salinity Neutral - Integrating State actions with MDCC JW&M actions; generating local offsets credits will always equal the local debits**

- **Joint Programs (ongoing SIS - current investments)**

- **Flow manipulation**

- **Opportunistic sali export**

- **Irrigation reconfiguration**

- **Future needs for JW&MP to 2015 beyond 61 EC**

- **Total JW&M 2000 - 2015**

- **Balance**

**Note:** At 2006 Morgan EC is 567 EC /95%; this program should achieve the Morgan target, but assessments at the peak are problematic.
Appendix C The Salinity Registers - a summary of delayed Accountable Actions and delayed salinity impacts

This section will include a copy of the December 2007 Salinity Registers following endorsement by the BSMS Implementation Working Group and review by the Independent Audit Group - Salinity.

Ministerial Council and Commission will be provided with a copy of the Salinity Registers (early in 2008) for consideration as part of the BSMS annual reporting process. This report will then contain an identical copy of the register to that contained in both the BSMS Annual Implementation Report 2007-08 and the BSMS 2007-08 Independent Audit Group - Salinity report. Both will be presented to Ministerial Council in April/May 2008.
Appendix D Mid-Term Review Terms of Reference

Purpose
The Mid-Term Review of the BSMS is a review of the implementation of the Strategy in accordance with Schedule C.

Scope of BSMS Mid-Term Review
The BSMS Mid-Term Review shall be governed via compliance with:
1. The Basin Salinity Management Strategy document, including:
   a) The four BSMS objectives:
      - maintain the water quality of the 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 farm land, cultural heritage, and built infrastructure at agreed levels Basin-wide; and
      - maximise net benefits from salinity control across the Basin.
   b) The nine elements of strategic action:
      - developing capacity to implement the Strategy;
      - identifying values and assets at risk;
      - setting salinity targets;
      - managing trade-offs with the available within-valley options;
      - implementing salinity and catchment management plans;
      - redesigning farming systems;
      - targeting reforestation and vegetation management;
      - constructing salt interception works; and
      - ensuring Basin-wide accountability: monitoring, evaluating, and reporting.
2. Clause 35 of Schedule C to the Murray-Darling Basin Agreement:
   (1) The Commission must, by 31 December 2007 and at intervals of no more than 7 years thereafter, prepare and give to the Ministerial Council and the Community Advisory Committee, a report upon:
      (a) the operation of this Schedule; and
      (b) its usefulness and effectiveness in implementing aspects of the Strategy.
   (2) Without limiting the contents of any report prepared under sub-clause 35(1), the Commission must include:
      (c) a summary of:
         (i) the Delayed salinity impacts; and
         (ii) the salinity impacts of every Accountable Action undertaken before the date of the report, within the Murray-Darling Basin, based on the reports prepared under clause 33 during the preceding 5 years; and
      a description of any additions to, or alterations of, the Joint Program proposed to ensure that the Basin Salinity Target is met, since the Commission's last report made under sub-clause 35(1).
   (3) A report prepared under sub-clause 35(1) may conclude that a State Contracting Government has not complied with one or more of its obligations under this Schedule.
3. BSMS Operational Protocols, and
4. Recognising where appropriate;
Timing and Duration of the Review

The BSMS Mid-Term Review will commence in July 2006 and be completed by December 2007, in accordance with Schedule C, Clause 35. A work plan will be developed that outlines tasks and milestones to achieve the Schedule C review timeline.

Structure of the Review

The BSMS Mid-Term Review will be undertaken in three phases: an initial stocktake, a formal review process followed by implementation of recommendations where appropriate. The review will assess the assumptions underpinning the BSMS based on current knowledge and understanding and identify changes since 1999 and any implications for any other Basin programs and policies.

Roles and Responsibilities

The BSMS Mid-Term Review Task Force will provide oversight to the BSMS Mid-Term Review, including development and implementation of the work plan. Where relevant, the BSMS Mid-Term Review Task Force will report to the BSMS IWG and will draw on the expertise from other MDBC working groups and task forces as appropriate.

The BSMS Mid-Term Review Task Force will comprise representatives from each of the jurisdictions and the CAC as nominated by the BSMS IWG. The Chair of the BSMS IWG will also Chair the BSMS Mid-Term Review task force.

Modus Operandi of the MTR Task Force

1. Convene monthly meetings.
2. Develop a workplan to undertake the BSMS Mid-Term Review, including identifying resource requirements.
3. Develop a communications plan to support public release of information throughout the course of the Mid-Term Review.
4. Implement the BSMS Mid-Term Review work plan including managing individual projects.
5. Provide high level technical and policy advice during the BSMS Mid-Rerm Review.
6. Coordinate information and knowledge inputs supporting the BSMS Mid-Term Review.
7. Manage the peer review process of the BSMS Mid-Term Review where appropriate.

Executive Support

The MDBC Office will be responsible for convening the task force meetings on a monthly basis and providing executive support. Meeting decisions will be recorded and progress reports made to the BSMS IWG. The task force will be supported by external technical support as required.
Appendix E Independent Review Panel Report


for the Mid-Term Review
of the Basin Salinity Management Strategy

Dr Neil Byron (Chair), Mr Roger Wickes and Mr Andrew Campbell

October 2007

Key Findings

The Mid-Term Review has been comprehensive and indicates significant progress in salinity management in accordance with the Basin Salinity Management Strategy (BSMS) and Schedule C of the Murray-Darling Basin Agreement. The Independent Review Panel endorses the key conclusions and recommendations of the review and in particular the continuation of a basin salinity management program.

The first seven years of BSMS implementation concentrated on putting in place salt interception schemes, which was understandable given the focus on a fixed stream salinity target at one point in the river, and a costing framework that does not take ecological aspects into account. The Mid-Term Review rightly points out that the emphasis over the next seven years will need to shift to a more adaptive management approach, with a broader focus than just Morgan, that takes into account spatial and temporal variability rather than working to averages and fixed targets.

The Independent Review Panel believes that extra emphasis should be given to:

- The proposed new communications element, which should be based on the active engagement of key decision makers who affect salinity management throughout the basin – including landholders, catchment management authorities, water authorities and local government in addition to state agencies. The communication should provide an integrated message (including an updated synthesis of salinity knowledge) in a form that is accessible, informative and useful to the Basin community. Landholders and catchment bodies need such information in forms that will help them to integrate salinity considerations with all the other challenges they face in making land and water management and investment decisions.

- The impact of climate change, as it poses obvious challenges for salinity management including some of the technical parameters that underpin the current strategy, such as the benchmark period. It would be wise to take a precautionary approach to climate variability and change, and not to assume that the current extended dry period is an outlier.

- The move to an adaptive management approach will create additional demands for a comprehensive information base founded on real time monitoring of resource condition across the basin. It will demand a cadre of skilled and
experienced people at all levels, and a knowledge base that is designed to function well even with high levels of staff turnover. This will require a serious investment in building capacity, both in terms of knowledge systems and attracting and retaining talented people.

Comments on the Report Content

The Independent Review Panel finds the review to be technically sound and based on thorough background material and appropriate levels of expertise.

The Independent Review Panel endorses the recommendations of the Mid-Term Review Report — in particular the proposed additional element of Communication, the incorporation of irrigation within Land Management, and the need to revisit end of valley targets and the location of the “Morgan” target.

However, it is of the view that the report could be improved by better articulation of the linkages to other programs within and beyond the MDBC such as the Bureau of Meteorology climate modeling and new hydrological accounting framework, The Living Murray (TLM), and the NHT and NAP driven Regional Investment Strategies. The review also would have been improved by some form of user needs analysis to explore how salinity information is used to make land and water management decisions by different stakeholders in particular parts of the system. Such an analysis would be useful input into the implementation plan for the outputs of the Mid-Term Review. The fact that the Review was primarily technical, and based on consultations involving a relatively narrow sample of basin stakeholders (notably not including sufficient depth from several of the key decision-maker categories mentioned above), makes such an analysis more essential in designing the next phase of the BSMS, in particular the new Communication element.

The Independent Review Panel is firmly of the view that the last five years of data should be included in the benchmark period, not assumed to be an outlier that would distort the benchmark dataset.

The Panel is concerned that the potential for large salt releases from the floodplains, following a return of substantial river flows, is a major risk for users of water resources and to many significant environmental assets. The Mid-Term Review is correct to point to the potential for such large floodplain salt releases. However it provides insufficient detail or priority about proposed responses. Analysis of various scenarios and potential response strategies (such as targeted investigations, a pre-prepared communication strategy, strategic releases of salt during high flow periods and so on) should be developed as a matter of priority.

The Panel is also concerned that the Strategy has a broad land management agenda but this is not sufficiently recognised in the Review. There needs to be additional emphasis on providing planning tools which help on ground decision makers (practitioners) to optimise revegetation and other land use and management changes that deliver against transparent criteria including salinity management, water yield, habitat, carbon etc.
The Panel agrees that the end of valley and end of system targets are very useful in driving the implementation of the Strategy, but endorses the need to review precisely how these targets are determined. The Panel is of the view that the Strategy should not focus on the end of system target (Morgan) alone as the sole measure of success in achieving the objectives of the strategy. This reinforces the need for meaningful end-of-valley targets to drive within valley planning and investment.

The Panel was disturbed to note from some of the background material, that our technical understanding of dryland and floodplain salinity processes is still far from complete (particularly as evidenced by the NSW key sites project summarised in Annex 2). The panel is concerned that strategic basic and applied research to explain the anomalies and develop further understanding of these processes, seems to have virtually ceased across the basin. Consequently, a targeted investment program of investigations should be a high priority in the next phase of the BSMS. The investigations could be focused on potential scenarios and the requirement for a management response at each of the operational, planning and reporting time steps.

**Principles for Salinity Management (irrespective of institutional arrangements)**

The Panel is of the view that salinity management is of such importance that a dedicated Basin Salinity Management Program should continue, notwithstanding any reorganisation of institutional arrangements for water resources in the Murray-Darling Basin.

The following principles are presented as a robust and constructive basis for ongoing management of salinity within the Basin:

- A basin-wide approach including an end of system target and end-of-valley targets with a logical and transparent relationship between them.

- Adaptive management based on real time operational salinity targets that reflect the acceptable peak and duration of salinity, operational principles that will achieve those targets, and real time operational management of salt load delivery to the river.

- A transition to real time operational management of salinity is essential and inevitable but represents a significant increase in operational complexity and risk. A shift to adaptive management that is sensitive to spatial and temporal variability (rather than operating to fixed targets based on averages as is the case now) will demand a much better information base, underpinned by comprehensive monitoring of resource condition across the Basin.

- Independent, regular auditing against a transparent accounting and reporting framework that covers a range of management actions against the full suite of targets. (It is obvious that the current audit focus primarily on the Morgan target is distracting attention from measures higher in the basin — for example the six identified threats to water security — that don’t have an immediate direct influence on the Morgan target.)
• Active engagement of, and assigning responsibilities to, relevant decision makers whose decisions affect salinity, including land owners, catchment management bodies, water authorities, local government, and of course state agencies.

• Integration of salinity with other strategies both within and beyond the MDBC, including those listed above.

• A realistic and representative Benchmark period that includes all available data of reliable quality, including the recent dry period.

• Ongoing investment, development and integration of the conceptual basis of the strategy and tools to support salinity management, including a targeted investigations program as a core element of the strategy.
Signed by the Independent Review Panel Members

Dr Neil Byron

Mr Andrew Campbell

Mr Roger Wickes

10 October 2007

9 October 2007

9 October 07