CRC for Catchment Hydrology
CSIRO Land and Water
Murray-Darling Basin Commission

ON-FARM AND COMMUNITY–SCALE SALT DISPOSAL BASINS ON THE RIVERINE PLAIN

MANAGING DISPOSAL BASINS FOR SALT STORAGE WITHIN IRRIGATION AREAS: FINAL REPORT

Murray Darling Basin Commission
Strategic Investigation and Extension
Project I7034

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1. BACKGROUND

The significance of irrigation and irrigated agriculture in the Murray-Darling Basin (MDB) is often underestimated. It represents about:

- 73% of all water used for agriculture and human consumption in Australia
- 80% of land irrigated (1.8 million hectares)
- 90% of cereal, 80% of pasture, 65% of fruit and 25% of vegetable production
- $4 billion annually.

The majority of this irrigation occurs in the south-central part of the Basin widely known as the **Riverine Plain**.

Irrigation requires that some water drains past the root zone of the irrigated agriculture. This, together with the leakage of water from the associated network of water distribution and drainage channels has caused water tables to rise in the Riverine Plain and has resulted in soil salinisation, waterlogging and increased movement of salt to drains, streams and rivers. It was estimated in 1987 that 96 000 ha of irrigated land in the Murray-Darling Basin were visibly affected by soil salinisation and that 560 000 ha had water tables within 2 metres of the surface (MDBMC, 1987) and that, by 2015, this would increase to 869 000 ha. Groundwater control to avoid these problems can be attained through engineered drainage (Tanji, 1996), such as surface drains, sub-surface drains, and groundwater pumps.

Such drainage works cause large volumes of drainage disposal water to be brought to the land surface. GHD (1990) predicted that by the year 2040, between 335 000-608 000 ML/yr of groundwater in the Riverine Plain will require disposal. The main drainage disposal options, which are in use or have been considered, are:

- by local or regional re-use - with dilution as required;
- to streams and rivers on an opportunistic basis – used in most irrigation areas;
- to disposal basins - in use in some irrigation areas; and
- by a pipeline to the sea - feasibility studies conducted.

One of the primary drainage management objectives is to minimise disposal volumes by implementing improved irrigation practices and promoting the re-use of drainage water wherever possible. However, because of the need to prevent salt accumulation in the root zone by maintaining an adequate leaching fraction, saline drainage will always be a consequence of irrigation. Some types of drainage, such as surface drainage, are suitable for re-use. Disposal basins will only be viable for disposal of highly saline water because of the high cost of basin construction and loss of productive land.

Some saline water is currently disposed of into river systems in periods of high flows and thus exported downstream. However, the salinity of pumped groundwater and drainage effluent is such that continuous unmanaged disposal to rivers and streams may result in unacceptable impacts on the environment and downstream users. The Salinity and Drainage Strategy of the Murray-Darling Basin Commission (MDBC, 1999) imposes constraints on the amount of river disposal that is possible. Moreover, there appears to be declining political and community tolerance of continued disposal to river systems. Export of saline drainage to the sea via a pipeline is an option which has been considered a number of times in the past (SRWSC, 1978; Earl, 1982; GHD, 1990). However, these studies have each indicated that this option was relatively uneconomic when compared to other available disposal options. Moreover, the impacts of this option on the marine environment remain unclear.

Saline disposal basins (also referred to as evaporation basins) have been an important option and will continue to be so into the future, at least in the short to medium term (50 years). As was shown by Evans (1989), saline disposal basins are the lowest cost option for disposing of high salinity drainage water. Hostetler and Radke (1995) collated all available hydrogeological, engineering and operational data on more than 150 existing basins in the Murray-Darling Basin. While the data for many basins is incomplete, the study provides a summary of available information:

- 107 basins were reported as being active, with a total area of >15 900 ha, a total storage capacity of >113 000 ML, and an annual disposal volume of >210 000 ML/yr.
- Of the 107 active basins, 90 were reported as being used for drainage disposal (i.e. not for groundwater interception schemes or groundwater discharge), with a total area of >14 500 ha, almost all of the total storage capacity (>113 074 ML), and an annual disposal volume of >181 000 ML/yr.
- Of the 90 active drainage disposal basins, only 9 (representing 3338 ha) were located on the Riverine Plain, the rest being concentrated mostly in the Riverland (SA) and Sunraysia (Victoria) regions.

Since the publication of the Hostetler and Radke (1995) report, at least another 10 on-farm basins have been constructed on the Riverine Plain in the Murrumbidgee Irrigation Area (MIA). If disposal basins were the only way to deal with the drainage water, the GHD estimates of drainage volumes would represent between 9 and 16 times the current area of disposal basins in the Riverine Plain. Not surprisingly, drainage disposal is one of the most important components in the L&WMPs of irrigation areas in the Riverine Plain.

In the past, use of regional-scale basins has been a common approach. These accept drainage water from multiple farms and irrigation districts, and may even be situated outside the districts themselves (hence salt is exported from the area in which it is produced). Regional basins were sometimes developed on the most convenient sites from an engineering standpoint, sometimes with detrimental environmental, socio-economic and aesthetic impacts, leading to poor community perceptions of regional disposal basins. Furthermore, there is a view in some quarters that there is a need to depart from the existing "export the problem" mentality and that the beneficiaries of irrigation should be responsible for their own drainage management. The assumption being that this would encourage more efficient irrigation and drainage management and hence minimise the environmental and other impacts of disposal basins and irrigation on downstream users.

The above concerns have led to the use of **local-scale basins**. These can be in the form of on-farm basins that occupy parts of individual properties and are privately owned (such as those being used for new horticultural developments in the Murrumbidgee Irrigation Area). They can also be in the form of community basins that are shared by a small group of properties and are either privately or authority owned (such as the Girgarre Basin near Shepparton). It is these local-scale on-farm and community basins which are the subject of this project. While it is clear that basins can be an attractive means of disposing of saline drainage water, it is important to note that they may not be suitable for all areas. Strict siting and management criteria are required for the environmentally safe use of basins. When properly sited and managed, local-scale basins can be important environmental assets (Roberts, 1995). Previously, there has been no detailed guidelines for the siting, design and management of such basins. This has led the MDBC, together with the CRC for Catchment Hydrology and CSIRO Land and Water to develop a project to produce such guidelines and supporting information. This should enable Land and Water Management Plans on the Riverine Plains to consider the relevant issues with regard to a disposal strategy in order to meet a defined salt balance.

2. PROJECT OBJECTIVES, OUTPUTS AND INTENDED OUTCOMES

2.1 Contracted Objectives

2.1.2 Provide **guidelines** for siting, design and optimal management of on-farm and community disposal systems to meet regional salt balance requirements.

2.1.2 Determine the physical and economic factors, which influence salt disposal basins siting and design decisions, for the Riverine Plain of the Murray Basin.

2.1.3 Provide a method for optimising on-farm/community disposal basins siting to achieve defined salt balance within Land and Water Management Plans (*L&WMPs*) for the Riverine Plain of the Murray Basin.

2.1.4 Determine what physical and economic conditions are required for successful on-farm (single landholder) disposal basins in the Riverine Plain, to maintain an on-farm salt and water balance.

2.1.5 Assess the impact of variable physical/economic factors on the success of on-farm basins to achieve defined salt balance.

2.1.6 Broadly identify those areas of the Riverine Plain in the Murray Basin in which successful salt and water balance can be achieved using:
a. on-farm basins alone
b. community basins alone and
c. a combination of on-farm and community basins.

2.2 Contracted Outputs

2.2.1 An integrated model linking on-farm processes of recharge and sub-surface drainage with salt and water movement in and around disposal basins.

2.2.2 A set of criteria for resource managers and *L&WMPs* for the siting, design, and management of disposal basins.

2.2.3 Reports on the behaviour of on-farm disposal basins including leakage, design criteria and possible management scenarios based upon an integrated modelling approach.

2.2.4 A report detailing economic evaluation of on-farm/community based disposal basins.

2.2.5 Workshops to integrate and disseminate all necessary information for establishing a long-term strategy for community-based groundwater and salt management within irrigation areas.

2.3 Intended Outcomes as per Proposal

2.3.1 This project will provide the MDBC with the tools to ensure that the objective of on-farm salt and water balance using on-farm or community basins can be achieved. Specifically the project will enable:

- investment decisions on basin location and size within the Riverine Plain of the Murray Basin to be made on a consistent basis.
- physical and economic constraints on properties are recognised at the planning stage to ensure defined salt balance.
- risk based decisions involving trade-offs between objectives and investments can be made in the light of a consistent framework for the Riverine Plain of the Murray Basin.

2.3.2 Rational prioritisation of the areas suitable for on-farm, community or regional disposal basins in the Riverine Plain will be achieved.

2.3.3 Optimisation of the potential for the reaching of on-farm salt and water balance using basins will be achieved.

3. PROJECT RESULTS

3.1 Guidelines for Siting, Design and Optimal Management of On-farm and Community Disposal Systems to meet Regional Salt Balance Requirements

This section describes the set of guidelines, that meets objective 2.1.1 and output 2.2.2. In addition to the detailed guidelines, a summary guidelines has been developed after feedback from a workshop suggested these would be useful. The specific outputs are:

Christen, E.W., Jolly, I.D., Leaney, F.W.J., Narayan, K.A., and Walker, G.R. (2000) O*n-farm and community-scale salt disposal basins on the Riverine Plain: Underlying principles for basin use*. CSIRO Land and Water Technical Report 26/99, CRC for Catchment Hydrology Technical Report 99/15, CSIRO Land and Water, Canberra.

Jolly, I.D., Christen, E.W., Leaney, F.W.J., Gilfedder, M., Narayan, K.A., Trewhella, N.W., and Walker, G.R (2000) O*n-farm and community-scale salt disposal basins on the Riverine Plain: Guidelines for basin use*. CSIRO Land and Water Technical

Report 12/00, CRC for Catchment Hydrology Technical Report 00/7, CSIRO Land and Water, Canberra.

Leaney, F.W.J., Christen, E.W., Jolly, I.D., and Walker, G.R (2000) *On-farm and community-scale salt disposal basins on the Riverine Plain: Guidelines summary*. CSIRO Land and Water Technical Report 24/00, CRC for Catchment Hydrology Technical Report 00/15, CSIRO Land and Water, Adelaide.

3.1.1 Aim and scope of guidelines

The aim of the **guidelines** is to describe the technical and financial issues that need to be considered for the effective and environmentally safe use of local-scale saline disposal basins on the Riverine Plain of the Murray-Darling Basin. They can not be transferred to other regions without some modification, although the same issues will generally need to be considered. They are underpinned by a set of **principles** and are supported by technical information obtained from research carried out in this project and previous studies of basins in the Riverine Plain. The **guidelines** do not deal with the use of disposal basins to dispose of surface drainage and runoff; sub-surface drainage from urban salinity control; or groundwater from interception schemes to protect stream salinity. They should not be considered as regulation or law as they have not received endorsement from any of the jurisdictions they encompass.

Any development of disposal basins should also be carried out within the framework of the MDBC Salinity and Drainage Strategy and catchment *Land and Water Management Plans* (*L&WMPs*). It is expected that a disposal strategy is prepared as part of all *L&WMPs*. It is also very important that the community, local government, environmental protection and other regulatory and catchment management authorities are involved in the planning of the use of local-scale basins in a region. The **guidelines** have been developed by the authors, in consultation with a broad group of stakeholders through the Project Steering Committee and two workshops.

The **guidelines** are not prescriptive due to the variability in conditions across the Riverine Plain. They do not encompass social and political issues associated with these basins, as these are generally specific to individual situations and are more appropriately handled by the communities concerned, their land and water management planning groups, and local authorities. At the time of writing there is no legislation at Federal, State or Local Government level which specifically deals with the use of local-scale saline disposal basins. However, various aspects of disposal basin siting and use may fall under a range of legislation, regulation and by-law (*e.g.* VIC EPA, 1994; NSW EPA, 1997). This is in addition to compliance with all local government planning rules appropriate to the area.

3.1.2 Principles

The following set of **principles** is defined to provide a general over-arching philosophy for the **guidelines**. The intention of the **principles** is to define desirable objectives for basin siting, design and management.

1. Evaporation basins should only be used for the disposal of saline drainage effluent, after all potential productive uses have occurred or the water is shown to be economically and environmentally unsuitable for use.
2. Salts remaining in a basin due to evaporation may be stored in the ponded water and also in the soil and aquifer system below and adjacent to the basin
3. Salt stored below the basin should remain in the area of influence of the drainage system, or within a specific salt containment area around a basin located outside the limits of a drainage system.
4. Leakage from a basin should not pollute groundwater with existing or potential beneficial use.
5. Water stored in disposal basins should not be released to surface drainage systems or other inland water bodies not designed as disposal basins.
6. Basins should be sited, designed, constructed, maintained and managed to minimise detrimental environmental, socio-economic and aesthetic impacts.
7. Basin owners are responsible for the consequences of the design, construction, operation and maintenance decisions related to their basin and its associated drainage system.

3.1.3 Strategic planning for *L&WMPs*

The **guidelines** cover the following steps used in developing a disposal strategy for *L&WMPs*:

- Estimating drainage volumes
- Investigation of options to re-use water or improve irrigation efficiency
- Investigation of options for disposal
- Estimation of required area
- Decisions on likely areas for disposal
- Decisions on mix of community and on-farm basins
- For community basins, a consultation process to decide cost-sharing arrangements
- With local government and other environmental and catchment regulatory bodies, decide on planning approvals, monitoring requirements, risk assessment and contingency processes, decommissioning requirements and statements of accountability

3.1.4 Site-specific decisions to make for individual basins

The **guidelines** cover the following key steps required for individual basins:

- Maximising irrigation and drainage efficiency
- Determination of volume of drainage water in need of disposal
- Determination of the disposal capacity of a basin at this site
- Determination of required basin area
- Determination on appropriate basin design
- Development of management and monitoring programs
- Determination of impact on the financial viability of farm enterprises

- Assessment of other possible productive enterprises for the basin
- Preparation of contingency and decommissioning plans

3.2 Physical Factors Affecting Salt Disposal Basins Siting and Design Decisions for the Riverine Plain of the Murray Basin

3.2.1 Outputs

This section describes the work that meets objectives 2.1.2, 2.1.4 and 2.1.5 and outputs 2.2.1 and 2.2.3. The specific outputs are:

Leaney, F., and Christen, E.W. (2000) O*n-farm and community-scale salt disposal basins on the Riverine Plain: Basin leakage: Site studies at Girgarre, Victoria and Griffith, New South Wales.* CSIRO Land and Water Technical Report 16/00, CRC for Catchment Hydrology Technical Report 00/10, CSIRO Land and Water, Adelaide.

Leaney, F., and Christen, E.W. (2000) O*n-farm and community-scale salt disposal basins on the Riverine Plain: Evaluating basin leakage rate, disposal capacity and plume development.* CSIRO Land and Water Technical Report 17/00, CRC for Catchment Hydrology Technical Report 00/11, CSIRO Land and Water, Adelaide.

Wu, Q., Christen, E.W., and Enever, D. (1999) O*n-farm and community-scale salt disposal basins on the Riverine Plain: BASINMAN – A water balance model for farms with subsurface pipe drainage and an on-farm basin*. CSIRO Land and Water Technical Report 1/99, CRC for Catchment Hydrology Technical Report 00/6, CSIRO Land and Water, Griffith.

3.2.2 Results

Two key biophysical decisions for local-scale basins are:

1. *For a given drainage area, what land area needs to be devoted to disposal basins?* If the area devoted to disposal basins is too small, then they will not be able to cope with all the drainage water required to adequately provide groundwater control. On the other hand, if too much area is used, it is likely to take out potentially productive land and hence become uneconomic. Thus, a key physical factor in the design of the disposal basin is the volume of drainage water that can be pumped into an evaporation basin over a specified period of the time (**disposal capacity**). This is related to climatic conditions at the site and the leakage rate of the basin.

2. *What is a desirable leakage rate and how is this affected by siting, design and management?* If the leakage rate is too high, it can lead to problems of salinisation in surrounding areas and migration of highly saline plumes. This can be partly overcome by interception and by placing the basin within a drainage network or drawdown cone of a pumping scheme. Interception means recycling of drainage water and this can become expensive. If the leakage rate is too small, the water within the disposal basin becomes very saline, decreasing the rate of evaporation of the water in the disposal basins.

To answer these questions, the following approach was adopted:

- Extensive field studies at Girgarre community basin (Victoria) and on-farm basins in the MIA.
- Comprehensive literature survey of other existing basins in the Riverine Plain.
- Analysis and the interpretation of the above and development of a spreadsheet model of impacts of leakage on basin disposal capacity.
- Development of a model of impacts of management of sub-surface pipe drainage on basin area: BASINMAN.

The disposal capacity is related to climatic conditions as these govern how much energy is available to evaporate water. Evaporation is also governed by the salinity of the basin water that builds up over time, as evaporation removes water and not the salt. The salt build up in the basin water can be moderated to a large degree by basin leakage, the rate of which is highly dependent on two controlling factors. For most basins on the Riverine Plain, the main controlling factor is the ability for the groundwater mound under the basin to expand outwards. This being the case, the leakage rate per unit area will reduce, as the basins become larger. In one example, Girgarre (Victoria), the leakage was limited by the permeability of the basin floor. It is thought that this ‘outlier’ is due to the Girgarre basin being in the vicinity of the drawdown cone of the groundwater pumps that provide drainage to the area and hence is not limited by the ability of the groundwater mound to move away from the basin. The leakage rate from smaller basins is likely to be higher than the ‘desirable’ range of leakage and care needs to be taken to reduce the permeability of the basin floor by the use of compaction and not allowing the basins to dry.

Given the range of estimates of leakage from these basins, it is possible to estimate the disposal capacity of basins in the presence or absence of interception drains. This has been done for the Riverine Plain for a number of conditions, including variable leakage, groundwater salinity and climate. The spreadsheet model enables this to be carried out for any location in the Riverine Plain that has long-term climatic data available.

A water balance model (BASINMAN) for farms with sub-surface pipe drainage and an on-farm evaporation basin was developed, tested and used. Previous studies of evaporation basins have tended to concentrate on the basin processes whilst ignoring the linkages to the drainage system and the farmed area. The BASINMAN model was developed with the aim of increasing our understanding of the hydraulic relationships between the farmed area and basin system.

BASINMAN was used to find the balance between the basin area being large enough to reduce waterlogging in the farm to an acceptable level, and being so large that the basin evaporative capacity is under utilised. The appropriate basin ratio is highly dependent upon the required extent of protection for the cropped land and irrigation efficiency. For example, if water tables are only allowed to be less than 1m for 10% of the time, then this ratio is about 6.5% for the modelled farm in the MIA, assuming efficient irrigation. For less efficient irrigation, the basin area to drained area ratio becomes larger.

3.3 Economic Factors Affecting Salt Disposal Basins Siting and Design Decisions for the Riverine Plain of the Murray Basin

3.3.1 Outputs

This section describes work that meets objectives 2.1.2, 2.1.4 and 2.1.5 and output 2.2.4. The specific outputs are:

Singh J. and Christen, E.W. (1999) *On-farm and community-scale salt disposal basins on the Riverine Plain: Minimising the cost of basins: siting, design and construction factors*. CSIRO Land and Water Technical Report 12/99, CRC for Catchment Hydrology Technical Report 00/5, CSIRO Land and Water, Griffith.

Singh J. and Christen, E.W. (2000) *On-farm and community-scale salt disposal basins on the Riverine Plain: Effects of basins on the financial viability of subsurface drainage for grapevines and citrus in the MIA*. CSIRO Land and Water Technical Report 13/00, CRC for Catchment Hydrology Technical Report 00/4, CSIRO Land and Water, Griffith.

Singh J. and Christen, E.W. (2000) *On-farm and community-scale salt disposal basins on the Riverine Plain: Cost comparisons of on-farm and community basins - Case studies of the MIA and Wakool*. CSIRO Land and Water Technical Report 14/00, CRC for Catchment Hydrology Technical Report 00/8, CSIRO Land and Water, Griffith.

Singh, J., Kleindienst, H., Dickinson, P., and Christen, E.W. (2000) *On-farm and community-scale salt disposal basins on the Riverine Plain: Financial analysis of subsurface drainage with a basin for pasture production*. CSIRO Land and Water Technical Report 15/00, CRC for Catchment Hydrology Technical Report 00/9, CSIRO Land and Water, Griffith.

3.3.2 Results

The key economic questions for local-scale basins are:

1. *Do community basins cost less than on-farm basins?*
2. *Is drainage with basins financially viable?*

The key difference between the two types of basin in financial terms is in the establishment cost. For a community basin, the water is transported from the farms or shared groundwater pumps to the basin, while for on-farm basins, there is minimal transportation required. However, there is some trade-off because the construction cost of a larger basin is cheaper per unit area than a small basin. Overall, an analysis on horticultural properties in the MIA showed that the community basin cost was 3-12% less than individual on-farm basins under conditions of land trading between the farms to optimise the basin siting. In other cases, the community basin cost was about 10-25% higher due to increased costs for additional land purchase and drainage water transportation. The cost to some individual farmers with a community basin increased considerably above the on-farm cost, despite the fact that the overall cost of the community basin was less than on-farm basins together.

An analysis of the current Wakool Basin compared to hypothetical replacement with 16 smaller community basins or 48 on-farm basins, found that there was negligible difference (2-8%) in the Net Present Cost (NPC) between each option. The increasing basin construction costs as the basins get smaller is almost balanced by the increasing drainage transportation costs. In both the MIA and Wakool analyses, the cost differences between community or on-farm basins were marginal. Thus, in deciding between on-farm, small community or large community basins, other environmental and/or social considerations should outweigh the negligible economic differences.

Drainage systems with disposal to local basins may not be financially viable in many cases. Sometimes, investment in improved irrigation infrastructure will be more financially attractive than investment in drainage works, especially when a basin is required. *L&WMPs* need to ensure that all proposals for new basins are based on property development plans, which include a high standard of irrigation infrastructure, and are accompanied by a comprehensive financial analysis.

A financial analysis was done for horticultural developments in the MIA and for dairying in Shepparton. The MIA analysis showed that successful drainage with local disposal basins is:

- Best suited to crops that have high yields and prices and crops which are sensitive to waterlogging as well as salinity.
- More economically viable for existing plantings than new developments.
- Related to the standards of irrigation management.

With groundwater pumping, benefits are likely to spread over more than one farm and thus analysis of profitability needs to consider all beneficiaries. The Shepparton analysis showed that a groundwater pumping scheme with a basin was not viable in the absence of cost-sharing arrangements with other beneficiaries.

3.4 Optimising On-farm and Community Disposal Basins Siting to Achieve Defined Salt Balance within L&WMPs

3.4.1 Outputs

This section describes work that meets objectives 2.1.3 and partially meets 2.1.6. The objective 2.1.6 was discussed at the project Steering Committee and was developed as far as the data allowed. This provided some useful insights but fell short of the objective on the contract. This was accepted as reasonable by the Project Steering Committee.

Dowling, T.I., Walker, G.R., Jolly, I.D., Christen E.W., and Murray, E.A. (2000) O*n-farm and community-scale salt disposal basins on the Riverine Plain*: *Testing a GIS-based suitability approach for regional planning*. CSIRO Land and Water Technical Report 3/00, CRC for Catchment Hydrology Technical Report 00/2, CSIRO Land and Water, Canberra.

3.4.2 Results

The use of local-scale basins raises a number of questions regarding the availability of suitable land and the impact of these basins. Currently available spatial data can assist in regional planning for local-scale basins. A GIS-based approach was developed during the project using suitability criteria expected to minimise the risk of off-site effects of basin leakage. This was applied to the Murrumbidgee Irrigation Area, the Shepparton Irrigation Region, Coleambally Irrigation Area, Murray Irrigation Limited area and Kerang/Cohuna areas at 1:250,000, (the scale at which data are available over the entire Riverine Plain). Despite the limitations of the data, the method was able to focus on some implications for the case study areas; namely that: (i) on-farm basins can only be used on an opportunistic basis in the easterly irrigation areas if the chosen environmental criteria are to be satisfied. For westerly areas, on-farm basins could be widely used; (ii) community basins can be used anywhere there is suitable land. However, the cost of purchasing good quality land and transporting water significant distances are important considerations; (iii) the results raise serious questions as to whether there is enough suitable land in the easterly areas to dispose of all of the drainage water produced.

4. RELATED POLICY ISSUES

The policy issues related to the disposal basins were themselves not a subject of this project but obviously are important as to how the results will be used. Feedback was obtained from stakeholders at a workshop considering the **guidelines**. More details are in the Appendix, but a brief summary is presented here. They do not necessarily represent the views of the authors or the MDBC.

At the moment, the use of basins as a salinity management tool is yet to be explicitly dealt with in policies and regulation. This may require that a distinction be made between basins and say, landfills to convince EPA's and Planning Authorities of the need to treat them differently. There is also a need to consider interaction with other legislation at both Federal and State levels involving environment or native vegetation.

Previous experience with existing basins has not given government credibility in properly managing basins. The **guidelines** represent the first step towards best management practice and as such, their use should be encouraged for each of the *L&WMPs* and/or the irrigation industry. Steps towards encouraging this include a communication strategy and information package, endorsement in the Basin Salinity Strategy, inclusion in supporting documentation to MDBC policy, and placement on the ANCID agenda. It is important to have recognition/approval of the **guidelines** by the relevant agencies at the State level, including those responsible for planning and for there to be monitoring (long term) of the process at State and catchment level.

At the moment, *L&WMPs* would adopt the **guidelines** as support for their plans and tailor them to their needs. Catchment planners/regulators could use this as a planning instrument, for example, in catchment and planning reviews. The **guidelines** could, and some people believe should, develop into a set of rules or standards that could be regulated, perhaps with rules that are specifically tailored to the needs of each irrigation area. The **guidelines** could provide a basis for an EIS assessment or component of licensing arrangements with EPA's and other authorities. It could be feasible at the Basin level or State level for public funding to be dependent on application of good management practice based on the **guidelines**. Also, local-scale basins used under best management practice could free up salt disposal credits to offset dryland impacts.

It was clear that the suggestions being made would take some time (2-4 years) to be implemented. During this time, the number of local-scale basins would be increasing quickly, and hence there is a need for these issues to be taken up almost immediately.

5. COMMUNICATION OF RESULTS

The **guidelines** are the key product, supported by a number of detailed technical reports. The end-users have been identified as those involved in the *L&WMP* process. The stakeholders include organisations involved in Federal and State policy, State planning/regulatory bodies, irrigation associations, conservationists, etc. Up to this stage, there have been two workshops (**cf: output 2.2.5**), one on the **principles** underlying the **guidelines** and one on the **guidelines** themselves. There have been a number of presentations at conferences, MDBC SI&E fora, Sunraysia Catchment Board and CSIRO/CRC for Catchment Hydrology seminar series. The reports have been packaged in a similar format and a ring binder has been produced to collate them. The reports are available in Portable Document Format (PDF) files on the CRC web page (http://www.catchment.crc.org.au/disposalbasins). One draft scientific paper is available and two more are expected.

Having said all of the above, it is clear that a communication strategy needs to be put in place now that the **guidelines** are complete. The nature of that will depend on the response to the different policy options suggested above. At the minimum, there would be the need to make all of the *L&WMPs* aware of the **guidelines**. In addition, there may be briefings to other stakeholder groups. However, because of the specific nature of the stakeholder group, the communications need to be specifically targeted. This is outside of the current grant.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Immediate Action

1. The **guidelines** developed as part of this project be the basis for best management practice in the siting, design and management of on-farm and community basins on the Riverine Plain of the Murray Basin and be adopted and promoted as current best practice. These **guidelines** were developed in consultation with key stakeholders and were the subject of two industry workshops.

2. The **managers of *L&WMPs*** be encouraged to incorporate a long-term (100-200 years out) salt disposal strategy in their plans. These strategies should cover where basins should be strategically placed so that they fit in with the longer-term disposal plans and include other aspects such as, potential for water re-use, disposal volumes, definition of suitable areas, financial analyses, decommissioning etc., as described in the **guidelines.**

3. **A communication strategy** be developed to promote the use of good management practices with respect to local-scale basins on the Riverine Plain.
4. A policy framework, or code of practice, which includes the **guidelines** developed as part of this project be developed so that current practice for disposal of drainage water will be improved. A basis for discussion is in Section 4 and the Appendix of this report.

5. Any policies developed should recognise that, although environmental features and protection can be built into the design of disposal basins, the lack of management of groundwater and drainage water will cause considerable more environmental damage. In this context it should be recognised that not all drainage disposal water can be stored within most irrigation areas without compromising recognised (BMP) environmental standards.

6. Policies developed should recognise that irrigation with drainage associated with disposal basins is not financially viable for areas of low irrigation efficiency, small land size, low-value crops and where inappropriate cost-sharing arrangements are in place. Furthermore, the widespread use of local-basins should be considered as part of restructuring in these irrigation areas.

6.2 Further Work

7. Development of **decommissioning guidelines** be carried out by examining abandoned basins and documenting the lessons learnt.

8. Disposal **guidelines** be developed for other parts of the Murray-Darling Basin, making use of the current framework, while recognising the differences from the Riverine Plain.

6.3 To Note

9. A distinction be made between disposal basins which store saline water and other sites such as landfills that contain unnatural wastes.

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APPENDIX – RELATED POLICY ISSUES

The policy issues related to the disposal basins were themselves not a subject of this project. However, for the results of this project to be useful, these need to be considered. At a workshop to finalise **guidelines**, the participants were asked:

1. How they saw the **guidelines** being used?
2. What the policy framework that would be needed to support the **guidelines**? and
3. What were the policy implications of the **guidelines**?

Each of these questions was considered at a catchment level, State level and Federal policy level. The list of participants at the workshop is listed in the Appendix. There was reasonable consensus in the answers to these questions. The results are presented here to provide this feedback to the MDBC Irrigation Issues Working Group. They do not represent the views of the authors or the MDBC. It is clear that the number of local-scale basins would be increasing quickly and hence the need for these issues to be taken up almost immediately.

A1 How do you see the guidelines being used?

The participants saw this project established a set of best practice **guidelines** (cf Intended outcome 2.3.1). These could be used by the *L&WMPs* in a fashion that was consistent across the Riverine Plain. There was a question as to the level of accountability at the local (Govt/Catchment) level (reflected by existing basins). Perhaps, the uptake of the **guidelines** as best management practice should be driven by the irrigation industry.

A2 What policies or processes might be required to support their use?

A communication strategy and information package at the Basin level could help promote the **guidelines** and encourage the uptake of best management practice for local-scale basins. This would be strengthened if the **guidelines** could be endorsed in the Basin Salinity Strategy and be included in supporting documentation to MDBC policy. It was suggested that it would be useful for the **guidelines** on the ANCID agenda to gain acceptance by the irrigation industry.

At the State level, it is important to have recognition/approval of the **guidelines** by the relevant agencies, including those responsible for planning. Use of best management practice should be considered in processes such as the Victorian salinity review or similar in NSW. The **guidelines** could develop into an agreed set of rules. It was likely that new developments would require salt credits. Use of basins under best management practice provides an opportunity to make credits to reallocate. There was a need for both State and catchment levels driving implementation and for there to be monitoring (long-term) of the process at State and catchment level.

At the catchment level, there needed to be recognition by planners/regulators that this is a planning instrument to be used, for example, in catchment and planning reviews. There is a balance that needs to be attained between self-regulation and full-regulation. There is a need to drive the **guidelines** to become standards that can be regulated. There is a credibility issue in that past governments have not managed basins well. *L&WMPs* would adopt the **guidelines** as support for their plans and tailor to their needs.

A3 What may be some of the policy implications of these guidelines?

It could be feasible at the Basin level for funding to be dependent on application of best management practices. There would be a need for this to be agreed by the States. It is important that cost-sharing implications associated with Basins. How are these to be implemented? Investigations using in part public funds should follow **guidelines**. There is a need to consider interaction with other legislation at both federal and state levels to do with the environment or native vegetation.

At the state level, the **guidelines** could provide a basis for an EIS assessment or component of licensing arrangements with EPA/DLWC. At the state level, there need to be a legitimising of basins as a tool. This may require for a distinction to be made between basins and say, landfills to convince EPA's and Planning Authorities to be convinced of the need to treat them differently.

The participants in the workshop included:

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