# Sunraysia Drainage Strategy

## Issues Paper no.5 - Scope and Management Options

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GOULBURN-MURRAY WATER

SUNRAYSIA RURAL WATER AUTHORITY

LOWER MURRAY WATER

Mildura Rural City Council

EPA VICTORIA

MURRAY-DARLING BASIN COMMISSION

# Contents

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# 1. Introduction and Background

Prior to developing the Management and Implementation Strategies for the Drainage and Stormwater Management Plan it is essential that there is broad agreement on the most feasible future drainage disposal options. This paper aims to discuss and identify possible future drainage management infrastructure options, for both the urban and rural drainage network.

# 2. Receiving Waters

The values associated with the various receiving water bodies for the Study Area's drainage systems were identified and discussed in Issues Paper 2, "Threats and Values". This information is summarised in Table 2-1. These values need to be considered in developing drainage disposal options.

■ **Table 2-1 Receiving Water Values**

| Receiving Environment | Environmental | | Cultural | | Amenity | | | Eco-nomic | Drainage | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Instream | Riparian | Indigenous | Non-indigenous | Recreational | Amenity | Tourism | Water Supply | Flood reductions | Salt & nutrient reductions to Murray River |
| **Environments receiving urban stormwater runoff (& irrigation drainage)** | | | | | | | | | | |
| Murray River | V high | V high | V high | V high | V high | V high | V high | V high | High | Low |
| Kings Billabong | V high | V high | V high | V high | V high | V high | V high | High | Low | Mod. |
| Basin 12 | High | High | Mod. | Low | Mod. | Mod. | Low | Low | High | V high |
| Rifle Butts Swamp | Mod. | Mod. | Mod. | Low | Low | Mod. | Low | Low | High | Mod. |
| Lake Ranfurly East | V high | V high | High | Low | Low | High | Low | Low | High | V high |
| Lake Hawthorn | V high | V high | Mod. | Low | High | High | Mod. | Low | V high | V high |
| **Environments receiving irrigation drainage** | | | | | | | | | | |
| Cardross Lakes | V high | V high | Low | Low | Low | Low | Low | Low | Mod. | Mod. |
| Koorlong Basins | Low | Mod. | Mod. | Low | Low | Low | Low | Low | Mod. | V high |
| Lamberts Swamp | Low | Low | Low | Low | Low | Low | Low | Low | Low | V high |
| Lake Ranfurly West | V high | V high | High | Low | Low | Low | Low | Low | Low | V high |
| Wargan Basins | V high | V high | Mod. | Low | Mod. | High | Low | Low | V high | V high |
| Psyche Bend Lagoon | Low | Low | Mod. | Low | Low | Low | Low | Low | Mod. | V high |

# 3. Previous Studies, Issues and Constraints

## 3.1 Previous Studies

The following section briefly outlines the key recommendations and findings of previous studies.

### 3.1.1 Draft Salinity Management Plan from Nyah to the South Australian Border (1992)

This Plan's findings and recommendations included:

- Future irrigation developments must have water licences that specify an acceptable disposal method and site (eg. reuse or on site disposal). No drainage disposal to the River, wetlands or to disposal bores are to be permitted for future irrigation development.
- Where drainage disposal is currently to the River, all pipes must extend completely to the waterline rather than dispose of drainage onto the floodplain.
- Although diverting existing pipes away from the River has salinity benefits and associated economic benefits, if an alternate drainage site cannot be found within 100 metres of a property, the cost of redirecting drainage will generally be greater than the financial benefits of reducing river salinity.
- Incentives should be made to encourage water trading away from high impact zones (that is, zones where increased groundwater accessions would have a high impact on salt loads to the River)

### 3.1.2 Sunraysia Draft Salinity Management Plan (1991)

This Plan's findings and recommendations included:

- Lake Hawthorn water now released to the River should instead be pumped to the Wargan Basins.
- It was recommended that existing infrastructure be used to divert a greater amount of drainage water through to Cardross Lakes before it reaches Psyche Bend Lagoon system. This is now being addressed by pumping from the drainage system to Cardross Lakes via a pump station to the north west of Red Cliffs. Psyche Bend Lagoon receives highly saline groundwater discharges. It was recommended that it be isolated from the drainage system to prevent increased pressures on this groundwater, which would in turn result in an increase in highly saline discharges to the River. Works to achieve this isolation have subsequently been constructed, and comprise a pipeline from Basin 12, around Psyche Bend Lagoon to the Murray River just downstream of the FMIT pumps.
- Suggested works to reduce the volume of water from Lamberts Swamp discharging to the River. It was recommended that water from the Yelta private diversion area and the Merbein West and North West Drain be collected in a sump near Lamberts Swamp and then pumped to Wargan basins. None of these works have been implemented to date.

### 3.1.3 Merbein Integrated Development Scheme (1997)

This scheme included recommended works to reuse drainage water mixed with channel water for use to the west of Meridian Road ('Wargan Dairies').

- The proposed scheme involved two pipelines (A and B) and a mixing/balancing storage. A third pipeline (C) would enable water unsuitable for reuse, or in excess of irrigation requirements, to be discharged to Wargan basins for disposal.
- Pipeline A would follow Meridian Road and collect water from the West and North-West drains, tile drainage from the Yelta and Riverside irrigators, and excess water from Lamberts Swamp.
- Pipeline B would collect stormwater runoff from part of the Merbein urban area, tile drainage water from part of the Merbein East drainage catchment, and drainage water from the irrigation district near the intersection of Fifth Street and Paschendale Avenue. This was found not to be viable.
- The proposed location for the balance/mixing storage is near the Merbein main channel crossing of Meridian Road.

None of these proposed works have been constructed.

### 3.1.4 TGM Studies

- Consultants TGM are currently working with Council to prepare a design for the so-called Sixteenth Street drain, which is proposed to serve the catchment centred on Sixteenth Street which drains by gravity to Lake Hawthorn. Recommendations from the ***Mildura South Stormwater Drainage Strategy*** will be integrated into the design. This strategy proposes a main drain running down the centre of blocks between Walnut and Deakin Avenues, linking several detention ponds in the area.
- The ***Elizabeth Street – Fifteenth Street Drainage Investigation*** recommended options to alleviate local flooding in and around the commercial area around the intersection of Deakin Avenue and Fifteenth Street. The recommended options have not yet been implemented. This report recommended that excess flow from Elizabeth Street be diverted from Fifteenth Street at Deakin Avenue, south west along Deakin Avenue to connect with a future outfall drain for the Sixteenth Street catchment. When funding becomes available, interim works at the Fifteenth Street and Elizabeth Street intersection will be undertaken to prevent flooding. These works will include the installation of a "Rocla Floodgate" (a top hinged gate, opening in only one direction, to seal the pipe outlet) at the outlet where the Elizabeth Street drain joins the Fifteenth Street drain, and the excavation of a temporary detention basin in Lot 14 of Elizabeth Court.
- Recommendations from the ***Calder Sub-Basin*** report have not been implemented, as funding is not yet available. The report recommends the construction of the Benetook detention basin(s) to manage the increased flows resulting from development in the Calder sub-catchment (bounded approximately by Fifteenth Street, Etiwanda Avenue, Benetook Avenue and Fourteenth Street). The proposed detention pond is designed to work in combination with the existing 'Calder' basin near the intersection of Fifteenth Street and Benetook Avenue.

### 3.1.5 Wetland Operational Plans

The Mallee CMA has a program for preparation of operational plans for key wetlands in the Study Area. These are at various stages of completion.

- ***Cardross Lakes*** – the Plan recommended that electrical conductivity levels of no more than 4000µS cm $^{-1}$ and maintenance of water levels would allow conservation of the existing fauna at Cardross Lakes, in the short term at least (Water ECOscience, 1997). NRE is able to use some of the environmental bulk entitlement to discharge freshwater to the Lakes via the SRWA supply system.
- ***Mallee Wetland Operational Plans –*** Wetland Operational Plans are currently being prepared for Kings Billabong, Basin 12 and Psyche Bend Lagoon. Recommendations have not yet been finalised for these studies. Wetland Operational Plans will also be prepared for Lake Hawthorn and Lake Ranfurly East and West in the near future.

### 3.1.6 Deakin Irrigation Development

- The proposed Deakin Development will cover a total area of approximately 50,000ha.
- Drainage Disposal options being considered are disposal to evaporation basins and re-using drainage water. Trials for commercial aquaculture, salt mining and serial biological concentration are underway but no conclusive results about their viability is available.
- In accordance with Salinity Management Plans, landowners are required to set aside 10% of their developed areas for drainage disposal purposes
- The feasibility study assessed three drainage options: on-farm management, local drainage schemes and regional drainage schemes. It is envisaged that a regional drainage scheme will be required, but no disposal sites have been recommended at this stage.

## 3.2 Other Issues

### 3.2.1 Reuse Potential and Options

There are a number of constraints on the ability to implement a large scale formalised reuse scheme in the Study Area:

- Water availability – large scale reuse schemes inevitably require major storages, as water is most available when it is in least demand, and vice versa. Evaporation loses from storages are likely to be high.
- Water quality – the quality of water collected may not be suitable for the required water use. The salinity of irrigation drainage in particular is likely to be too high for a lot of uses. It would be necessary to put in measures to guarantee water quality, and it is likely that the quality would be lowest when the water was most in demand.
- Infrastructure requirements – costly separate infrastructure would almost certainly be required, and thus it may not be economically viable.

Having identified these obstacles, there is still potential to reuse water in the Sunraysia region on a smaller, individual level.

- Council could reuse stormwater runoff to supplement traditional water supply used to irrigate public parks and gardens.
- It is difficult to retrofit existing infrastructure to allow recycling. However, new developments could be encouraged to implement recycling schemes on a domestic level. Rainwater tanks and underground storage could provide water for gardens or in-house non-potable use. This would have the added benefit of reducing the peak flow entering the drainage infrastructure. Examples of such developments exist in Adelaide, Sydney and Newcastle. The design of the system is based around the 'supply' and 'demand' patterns.
- There are numerous environmentally important water bodies in the region, and stormwater runoff from Mildura, Merbein and Red Cliffs could be used to meet the environmental requirements of these water bodies. This could be particularly feasible for Cardross Lakes where the alternative may be to purchase water to meet environmental needs. In a sense this could just be regarded as an alternative disposal option, but it should really be regarded as reuse, or at least more appropriate use, of a valuable resource.
- Lower Murray Water has been running a successful woodlot using recycled water. It may be possible to reuse stormwater and irrigation water at other woodlot sites (for example at the Etiwanda drain outlet).

### 3.2.2 Nutrients to the Murray River

The ***Mallee Water Quality Management Plan Investigation Report (August 2000)*** states that there was no apparent increase in phosphorus in the Murray at Merbein but a slight increase in nitrogen levels (when compared to upstream locations). Increase in nitrogen levels at Merbein possibly result from irrigation and urban stormwater runoff from Mildura and Red Cliffs. Overall, the total nitrogen exceedence level in the Murray River at Merbein against ANZECC guidelines is 38%, and 20% for total phosphorus.

The report also found that the majority of irrigation drains in the Merbein, Mildura and Red Cliffs districts exhibited poor water quality with respect to nitrogen and phosphorus.

The Mallee CMA also conducted a ***Cost Benefit Analysis of Nutrient Management Strategy Proposed for the Mallee CMA Region (March 2001)***. This report quantified the economic impacts of a toxic algal bloom in the Murray River and estimated the costs of activities directed at nutrient reduction. The activities investigated included nutrient management through improved irrigation agriculture, dryland agriculture, urban stormwater management, public land management, in-stream source management, point source management and groundwater monitoring. A comparison of the benefits and costs of nutrient management activities was made, finding that the costs of implementing the strategy far outweighed the benefits. The findings derive mainly from the Mallee CMA region contributing only small amounts of nutrients to the Murray River, around 1% from the Study Area, relative to upstream inputs.

It is acknowledged that in the cost benefit assessment, it is difficult to quantify some aspects of the study, for example reduced amenity, reduced animal production, and poor image for regional economy.

### 3.2.3 Implications of Large Storms

Increased urbanisation is likely to cause a decrease in the total volume of drainage water in the area. However, the peak flow from a large storm event will be significantly higher than current average drainage rates. This may require a change in operation of receiving water bodies such as Lake Hawthorn. This might include increasing the operating range, and reducing normal operating levels to provide storage for storm runoff. This may have other implications, such as an impact on aesthetics.

### 3.2.4 Future of Salinity Interception Schemes

Work has recently commenced on a project to investigate future options for salinity interception in the region.

One of the possibilities being investigated is the option of constructing a large pipeline from Colignan to Morquong Basins (NSW) via the Victorian bank of the Murray River, to collect high salinity groundwater. If this scheme proceeded, whilst it might be technically feasible to use or augment the pipeline for disposal of drainage and urban stormwater that currently discharges to the River, this would certainly be politically unacceptable, and this option is not considered further.

There may be advantages in topping up Ranfurly West with low salinity urban stormwater, which is less dense than hypersaline water, thus reducing the pressure on the groundwater. It should be noted that the Wargan basins have a high evaporative disposal capacity, and this is currently significantly underutilised.

### 3.2.5 Salinity Credits

As mentioned in the Salinity Management Plans and other previous investigations, there is generally a very low cost/benefit ratio associated with inland disposal of drainage waters that currently gravitate to the River. This is based purely on comparing infrastructure costs to the economic value of salinity credits.

### 3.2.6 Drainage Shafts

As noted in the Current Situation Report, there is a small catchment of approximately 160 ha in the Merbein District, around the intersection of Fifth Street and Paschendale Avenue, that currently disposes of drainage water to shafts into the Parilla Sands aquifer. This displaces highly saline groundwater directly to the River. The Merbein Integrated Development Project report estimated that this resulted in annual salt load of approximately 5,000 tonnes, which equates to more than 2 EC units to the River. It is essential that an alternative disposal measure be implemented for this catchment.

# 4. Option Development and Discussion

The Study Area has been subdivided into a series of coarse areas based on current disposal locations and nature of existing and proposed future land. Broad scale disposal options have then been developed for each of these coarse areas, based on the previous studies, constraints and issues presented in Chapter 3. These options are presented in Table 4-1.

■ **Table 4-1 Options**

| Area | Disposal Options | Details | Rationale | Advantages | Disadvantages | Notes/comments |
|---|---|---|---|---|---|---|
| Mildura urban area that can drain by gravity to Murray River | 1. Combine all outfalls and direct to single wetland on Murray floodplain | Pipeline, and possibly pump station, required to redirect flows to single collection point | Probable low cost option, whilst providing some treatment to remove nutrient inputs to the River | Low cost | Some residual nutrient discharge to River. | |
| | 2. Redirect majority of runoff to Rifle Butts Swamp | Pumping station and pipeline required. Would be sized to convey all low flows. High flows and post-first flush flows would continue to discharge to the River. | Satisfies requirements of Salinity Management Plans of no future disposal to the River. Discharge is to nearest available inland water body. | Reduces nutrient discharge to River | High capital and operating costs | |
| | 3. Reuse in nearby gardens, parks, woodlots | Reuse storage on floodplain | Enables some reuse | Reuse | Relatively high cost of storage | |
| Mildura urban area that currently discharges by gravity to Lakes Hawthorn and Ranfurly, and Rifle Butts Swamp. | 1. Continued discharge to these water bodies. | | Lowest cost option | Low cost | | Distribution of runoff between Lake Ranfurly East and Lake Hawthorn will depend on consideration of issues such as future of Mildura-Merbein Groundwater Interception Scheme, topographic feasibility, amenity value of Lake Hawthorn, and need to maintain salinity of Lake Ranfurly East and West for bird habitat. |
| | 2. As 1, with reuse on nearby gardens, parks | Reuse storages upstream of lakes | Enables some reuse | Reuse | Cost of storages | |
| Irymple Basin, and other landlocked catchments around Irymple identified for future urban development | 1. Pump to Lake Hawthorn and/or Lake Ranfurly East | Several basins and pumping systems servicing individual subcatchments likely to be required. | Likely to be lower capital and operating cost than Option 2, and can be integrated with some limited existing infrastructure. | Lower cost than available alternatives. | High capital and operating costs, but lower than other options. | |
| | 2. Pump to Cardross Basins. | Basins and pumping systems required, and long pipeline. May be possible to gravitate final section via existing subsurface drains, subject to more detailed investigations. May also be necessary to adjust connecting channels and infrastructure between the various Cardross Basins – the terminal Basin has the highest environmental value. | Provides much needed additional flow, of reasonable quality, to Cardross Basins. | Relatively fresh water supply to Cardross Basins, thus providing much needed additional environmental flows. Likely to reduce NRE reliance on environmental bulk entitlement. | Very high capital and operating costs | |
| | 3. As 1, with reuse in irrigation system at Lake Benetook | Requires pumping to reuse storage adjacent to Lake Benetook | Enables some reuse | Reuse | Cost of storage and rising main. Disposal capacity to Lakes till required | |
| Irrigated catchments that currently drain to the River upstream of the weir pool | 1. Pump inland | | | Reduced nutrient and salt loads to the River. | Very high capital and operating costs, and low benefit:cost on basis of salinity credits. Unlikely to have enough impact on nutrients levels to reduce algal blooms, or have much impact on economic viability. | |
| | 2. Do nothing | Drainage flows are expected to reduce over time due to improved irrigation practices | Rely on lower flows to assist in keeping algal blooms down, although this is unlikely to be effective | Low (no!) cost | Unlikely to be of any real benefit in reducing incidences of algal blooms | |
| | 3. Provide end of drain treatment | Could take catchment 7 (which currently discharges to River between Kings Billabong and Bruces Bend) back into Kings Billabong. This would almost certainly require a pipe, and possibly also a pump.<br><br>Outlets to the south of Basin 12 could be piped right through to the River (instead of into South East Drainage Basins and onto floodplain) or into Basin 12. | Would provide some reduction in salinity, and nutrients discharging to the River. Nutrients reduced by filtration in reeds and sedimentation in a large water body. | Reduces impact on Floodplain and River.<br><br>Uses existing water bodies to assist in treatment. | May have little impact on frequency and severity of algal blooms.<br><br>Moderate to high capital cost. | For sub-option of piping Catchment 7 to Kings Billabong, would need to assess impact of increased nutrient levels on Kings Billabong, which forms part of the FMIT supply system.<br><br>Feasibility of and required areas for wetlands would need to be assessed on a case by case basis |
| | 4. Discharge to large scale pipeline (from Colignan to Morquong Basins (NSW)) as part of regional salinity interception scheme | A review of the current Salinity Interception Program is currently being undertaken. One of the possibilities under consideration is the installation of a large pipeline from the south of the study area through to Morquong Basins in NSW. This will only go ahead if the pipeline can collect saline groundwater inflows. It would be relatively easy, if this went ahead, to connect drainage outfalls to this pipeline. | This would again assist in reducing salinity and nutrient loads to the River. It incorporates other schemes and studies that are occurring in the area, thus providing some integration. | Major costs covered by Salinity Interception Scheme, and incremental cost likely to be relatively low. Highly effective in reducing salt loads to the River. | May not proceed, depending on other options under consideration for integrated salinity interception.<br><br>Likely to be politically unacceptable to dispose of Victorian drainage waters to NSW. | Ruled out on basis of political unacceptability. |

| Area | Disposal Options | Details | Rationale | Advantages | Disadvantages | Notes/comments |
|---|---|---|---|---|---|---|
| Irrigated catchments currently discharging to Cardross Lakes | Do nothing | Drainage inflows are expected to reduce over time due to improved irrigation practices. Flows to Cardross also reduced by piping of irrigation system, which has eliminated channel outfall discharges. | Cardross requires water to maintain very high environmental values. Total discharges to the Basins are generally decreasing, so important to maintain existing catchments. | Low (no!) cost. Water is required to maintain environmental values. | | This option alone is unlikely to be sufficient to provide sufficient water to maintain environmental values. Inlet works need to be modified to direct flows to main Lake first. |
| Irrigated catchments that currently discharge to Koorlong basins | 1. Maintain current system | | Low cost | Low cost | Koorlong Basins have relatively low environmental value – water might be used better elsewhere. | |
| | 2. Redirect all or part of area to Cardross Lakes. Catchment 2B in particular is close to Cardross and may be relatively easily diverted. | Pump station and pipeline required. | Koorlong Basins have low environmental value, so low impact of reduced flows. Cardross Lakes have high environmental value, which is threatened by reduced drainage inflows. | Enhancement of environmental value of Cardross Lakes. | Relatively high capital and operating costs.<br><br>Drainage water may be too salty. | Need to consider salinity impacts on Cardross. |
| Merbein Area | 1. Maintain current system, with minor enhancements including the following possible elements:<br><br>- provide alternative to current disposal to drainage shafts (possible disposal to Basin 1) | This would require the drainage shafts catchment to be disposed of elsewhere. Pumping station and would probably be required to achieve this. | Mandatory. Results in huge reduction in annual salt loads to the River. | Large reduction in salt loads to River | Moderate to high capital and operating costs | |
| | - direct connection of Merbein urban drainage to River, or via wetland (as improvement to current system of discharge to low wetland area on the floodplain) | | Reduced pressure on groundwater | Relatively low cost. Very minor reduction in salt loads to River. | | |
| | - reuse of Merbein urban runoff on Lower Murray Water woodlot via wet weather storage | | Reduced nutrient loads to River. More effective use of valuable resource | Relatively low cost | Negligible impact on algal blooms | |
| | 2. Merbein Integrated Development Option Scheme option – reuse of drainage water mixed with channel water for use to west of Meridian Road. | This scheme proposes to pump and pipe almost all the drainage water in the district back to a reuse dam next to the channel crossing of Meridian Road. From here it can be shandied with channel water for reuse to the west, or disposed of to Wargan Basins. | Source of scarce water resource for development to west of Meridian Road. | Reduction in salt and nutrient loads to River.<br><br>Provides some reuse of drainage waters. | Very high capital and operating costs. | |

Note: A number of small catchments have been excluded from this coarse analysis.

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