

# Guidelines for the Lower Murray Reclaimed Irrigation Area (LMRIA)

3rd edition



## **Guidelines for the Lower Murray Reclaimed Irrigation Area (LMRIA)**

For further information please contact:

Information Officer  
Environment Protection Authority  
GPO Box 2607  
Adelaide SA 5001

Telephone: (08) 8204 2004

Facsimile: (08) 8124 4670

Free call (country): 1800 623 445

Website: <[www.epa.sa.gov.au](http://www.epa.sa.gov.au)>

Email: <[epainfo@epa.sa.gov.au](mailto:epainfo@epa.sa.gov.au)>

ISBN 1-876562-59-5

1<sup>st</sup> edition 2003, prepared with the assistance of Tonkin Consulting and MBP Consulting

2<sup>nd</sup> edition July 2009

3<sup>rd</sup> edition July 2014, prepared with assistance of the South Australian Murray–Darling Basin Natural Resources Management Board, Louise Stock Project Services and MBP Consulting

### **Disclaimer**

This publication is a guide only and does not necessarily provide adequate information in relation to every situation. This publication seeks to explain your possible obligations in a helpful and accessible way. In doing so, however, some detail may not be captured. It is important, therefore, that you seek information from the EPA itself regarding your possible obligations and, where appropriate, that you seek your own legal advice.

© Environment Protection Authority

This document may be reproduced in whole or part for the purpose of study or training, subject to the inclusion of an acknowledgment of the source and to it not being used for commercial purposes or sale. Reproduction for purposes other than those given above requires the prior written permission of the Environment Protection Authority.

# Contents

Summary .....	1
1 Introduction .....	3
2 Water management.....	4
3 Land management .....	7
4 Effluent management .....	10
5 Monitoring and reporting .....	11
6 Further information.....	12



# Summary

These guidelines have been prepared for use by irrigators and other landholders in the Lower Murray Reclaimed Irrigated Area (LMRIA). This is the 3<sup>rd</sup> edition of the guidelines and contains updated information in several areas.

The LMRIA was rehabilitated between 2006 and 2008 with new water delivery, excess irrigation runoff capture and reuse structures installed to reduce water use and reduce pollutant loads returned to the river. Laser levelling of irrigation bays was also a key component of the rehabilitation program to reduce irrigation and drainage volumes. Each irrigator also had a specific Environment Improvement and Management Program with timelines to undertake further on farm management actions to reduce pollutant runoff and retain nutrients on farm. At the completion of rehabilitation approximately 4,200 ha of the 5,200 ha LMRIA area had been rehabilitated with the remaining area retired from active farming.

Many of the environmental management and infrastructure improvements made in the LMRIA during rehabilitation have since been lost as a result of low river levels and restricted water allocations during the 2006–10 drought. Cracking, heaving, and slumping of the soil profile plus damage to public and private infrastructure occurred during the drought. The low availability of, and practical difficulties in accessing irrigation water also lead to large scale loss of farm productivity in the region due to an inability to grow pasture for stock. There is a continuing legacy from the drought with soil and infrastructure damage, and acidic subsoils and drainage water persisting several years after the return of water levels to normal in the Lower Murray.

While recognising the LMRIA is still on a recovery pathway from the drought, appropriate application of these guidelines will assist in the management of these issues and also help protect the long term integrity and environmental outcomes from the region. These guidelines have been updated to reflect new learnings from the drought period (e.g. on acid sulfate soils, recovery from soil cracking and heaving). The guidelines are based on best management practices (BMPs) developed by agricultural consultants, irrigation engineers and the Environment Protection Authority, with extensive consultation with the irrigators and the SA Murray Darling Basin Natural Resources Management Board.

BMPs are provided in four categories:

- Water management
- Land management
- Effluent management
- Monitoring and reporting

It is up to each irrigator to assess the risks that apply to their property and use these BMPs, or appropriate modifications, accordingly.

Appropriate application of these guidelines underpins some of the policies in the Water Allocation Plan for the River Murray and should be used as a key reference when considering the relevant principles of the plan.



# 1 Introduction

Historically, there have been approximately 5,200 ha of irrigated area on the former floodplain of the Murray River in South Australia known collectively as the Lower Murray Reclaimed Irrigation Area (LMRIA). Environmental management on irrigated farms in the LMRIA can impact on the water quality of the River Murray.

In 2008, a major rehabilitation and restructuring program was completed in the LMRIA to reduce water use and pollutant loads returned to the river from surface irrigation. Infrastructure improvements undertaken in the project included:

- new water delivery infrastructure (eg siphons/sluices, meters, inlet channels)
- water metering
- laser levelling of paddock surfaces
- constructing surface irrigation and stormwater runoff capture and reuse systems to recycle excess surface irrigation runoff water and pollutants back onto the farm.

Approximately 4,200 ha of LMRIA land was rehabilitated under the project with some 1,000 ha retired from farming and not rehabilitated. Each irrigator also had a specific Environment Improvement and Management Program (EIMP) with timelines to undertake further on farm management actions (e.g. fencing of stock from channels, bunding to prevent runoff into drains) to reduce pollutant runoff and retain nutrients on farm.

When completed, this rehabilitation project was expected to greatly reduce drainage volumes and pollutant loads returned to the river. However, between 2006 and 2010, the LMRIA was affected by drought conditions, resulting in a further 1,000 ha of rehabilitated land being retired from farming. The total area of 'productive' farms in the LMRIA is therefore estimated to be approximately 3,200 ha in 2013. The drought made it difficult to evaluate the effectiveness of the rehabilitation program. However it is clear many of the environmental management and infrastructure improvements made in the LMRIA during rehabilitation have since been lost as a result of low river levels and restricted water allocations during the 2006–2010 drought. Cracking, heaving, and slumping of the soil profile plus damage to public and private infrastructure occurred during the drought. The low availability of, and practical difficulties in accessing irrigation water also lead to large scale loss of farm productivity in the region due to an inability to grow pasture for stock. There is a continuing legacy from the drought with soil and infrastructure damage, and acidic subsoils and drainage water persisting several years after the return of water levels to normal in the Lower Murray.

These environmental guidelines were first produced to help irrigators continue to meet their general environmental duty of care (section 25 of the Environment Protection Act 1993) by managing their farm enterprises responsibly and minimising the impacts of their activity on the river. The *Environment Protection (Water Quality) Policy 2003* describes the obligations of the irrigator to meet their environmental duty of care and these specific guidelines should be used to help irrigators meet those obligations.

The guidelines have now been updated to reflect current irrigation best management practices (BMPs) in the context of the recent (2007–2010) drought, Environmental Land Management Allocations (ELMA) of irrigation water and the River Murray Water Allocation Plan (WAP).

Four categories of BMPs have been identified and are listed below with examples of how they reduce impacts on the river, whether from dairying or other livestock or cropping enterprises. Not all BMPs will apply to each farm, and other BMPs may be applicable or are still to be developed. Each irrigator will need to continually assess the pollution risk potential of all farm activities (including managing acidic drainage water) and identify the BMPs that will reduce or minimise their risks in order to meet the objectives and targets of the environmental guidelines.

## 2 Water management

Use best available management practices to:

- optimise the volume of water applied
- minimise the volume of drainage water generated while meeting the water requirements of the crop and not exceeding the property's water allocation.

**Target** – It has been shown that volumes of approximately 0.7 ML/ha/watering can be achieved through careful irrigation on rehabilitated areas.

**Why** – Surface irrigation drainage water contains relatively high levels of nutrients and bacteria. Inefficient irrigation generates large volumes of excess drainage water which, if disposed of to the river, degrades water quality. Irrigators who are water efficient will also improve their ability to cope during times of drought.

### 2.1 Key water best management practices

#### 2.1.1 Water delivery

- Ensure the water meter is operational and calibrated.
- Ensure delivery channels are well formed, no deeper than required and do not leak.
- Ensure bay outlets do not leak.
- Provide a uniform paddock surface of suitable slope (laser levelling steeper than 1:800 gradient) to significantly improve water application efficiency.
- Fence off infrastructure, including channels, drains and storage areas to prevent damage by stock.
- Keep side check banks intact to prevent surface water entering the side drains. Consider replacing side drains with check banks during laser levelling to keep water on the paddock and direct runoff into the reuse system where not required to maintain drainage.
- Maintain irrigation infrastructure, particularly keeping drains and channels free of weeds and obstructions to flow.

#### 2.1.2 Irrigation scheduling

- Apply water at the appropriate intervals to match the crop's requirements. Use an evaporation gauge, or similar device, to schedule irrigation to best meet the crop's demand for water.
- On properties with only an ELMA water allocation, water application during drought conditions should be scheduled in a manner that will maintain subsoil hydration for as long as possible.
- Delay irrigation after grazing for at least three days to allow sunlight to disinfect manure and kill bacteria, and reduce the potential for fresh manure to 'wash off' the paddock.
- Water individual bays rather than many bays at one time to allow better water management if bays water at different rates and increase water application efficiency.

#### 2.1.3 Irrigation management

- Apply the correct flow rate and volume of water to minimise water use and prevent runoff.
- Correct use of soil moisture monitoring equipment will maximise the benefit of water available for irrigation.
- Use a marker or alarm to indicate when water should be turned off to prevent generating runoff from the end of the irrigation bay ('watering short'). The last portion of the bay accumulates fertiliser and manure and consequently has very high nutrient levels that must be prevented from entering drainage channels.
- Where practicable, on properties with only an ELMA water allocation, ensure that ELMA is applied in full, annually, to maintain soil health (prevention of cracking and slumping, salinisation and acid sulfate soil exposure).



### 2.1.4 Drainage recovery and reuse

The simple philosophy behind the capture and reuse systems is to keep non-saline surface flows carrying fertiliser, manure and bacteria separate from saline groundwater seepage which can be returned to the river. By keeping this in mind when managing water on a property, EPA requirements built into the rehabilitation scheme will be adhered to.

- Design tail water drains to capture excess water during irrigation, in particular after rainfall events rather than for every irrigation event.
- Capture all surface irrigation and stormwater runoff in a tail water and/or main salt drain reuse system, and reuse on the floodplain or adjacent highland areas.
- Retain and reuse the first 5ML/100 ha (50 kL/ha) of stormwater from the flood irrigated areas. During large rainfall events, where the storage capacity is exceeded, excess can be drained from the system.
- Reuse water as soon as possible (preferably during the irrigation cycle) to maintain the storage capacity of the system and minimise seepage losses.
- Keep surface water flows (from irrigation or stormwater) separate from saline groundwater flows.
- Maintain the reuse pumps and pipe work regularly to ensure reliable operation
- Maximise the land area used to irrigate with recycled drainage water.
- Monitor salinity levels in the reuse water to determine if diluting ('shandyng') with river water is necessary to prevent pasture/crop damage, particularly from main drain reuse systems.
- Rotate saline water with freshwater from the river to prevent damage to crops and pastures.
- Allow manure to dry out for three days before irrigating even though the capture system will prevent any excess from returning to the river. The bacteria in the manure will stay alive if kept moist and by using this water on other paddocks without allowing sufficient time for desiccation; the bacteria could reinfect other stock during grazing.

### 2.1.5 Salt drain management

Where salt drain reuse systems are in use:

- The salt drain is not to be pumped out to the river when it contains any irrigation runoff water (which is required to be reused on farm), even if it accumulates saline seepage.
- Water can be used from the salt drain for irrigation, subject to metering requirements by Department of Environment, Water and Natural Resources.
- Check salinity (and pH if acid drainage is suspected) levels prior to irrigation to manage damage to crops and pastures.

For all shared salt drain management:

- No blocks are allowed in the salt drain, except where approval has been given by the EPA as part of main drain reuse systems and rehabilitation.
- Seepage water (high salinity) accumulating in the salt drain can be pumped out when required.
- Salt drain water levels should be kept as low as possible to maximise storage capacity for rainfall events.
- During large rainfall events, the capacity of the reuse system may be exceeded and overflow into the salt drain. The salt drain can then be pumped out when the water level starts to affect the water table in the paddock by artificially raising the ground water. The remaining water should be held for a minimum of two weeks before release or irrigation elsewhere.
- All water in the salt drain must be allowed to freely flow between neighbours to the river.

## **Summary**

- Where runoff water is to be reused, this should happen immediately.
- Where runoff is to be pumped to the river (only following large rainfall events) – it should be held for two weeks (where practical).

## 3 Land management

Use best available management practices to optimise the crop uptake of nutrients being applied to paddocks, and reduce or minimise nutrients and chemicals contaminating the drainage system from any source on the farm.

**Target** – To minimise nutrients and pathogens leaving the farm in drainage or runoff, reduce or minimise the risk of any chemical runoff or contamination, and maximise plant uptake.

**Why** – Irrigation runoff generated after applying fertiliser, and to a lesser extent grazing, can account for a significant proportion of the total nutrient load being discharged into the river which, in turn, increases the risk of blue-green algae growth. Other sources of nutrients and chemicals, including leakage from silage pits, chemical storage and mixing areas, and farm dumps, can also contribute significant pollution to the river.

Fertiliser and manure leaving the farm via runoff is also a financial loss of inputs which are better retained on farm.

### 3.1 Key land best management practices

#### 3.1.1 Pasture and soil management

- Minimise cultivation. Only cultivate prior to laser levelling, otherwise use direct drilling.
- Maintain efficient irrigation (including the use of ELMA) as much as possible to prevent cracking.
- Re-compact over rip line after mole ploughing.
- Minimise construction of structures that may alter the water table, eg drains, channels, bores.
- Minimise works that artificially raise or lower the water table as this can cause acid sulfate soil conditions.
- Do not irrigate for three days after harrowing, scarifying or fertilising.
- Investigate cut and carry pasture management to reduce stock numbers on the floodplain.

#### 3.1.2 Fertiliser management

- Match fertiliser application with crop demand and herd requirements (eg use a balance sheet approach).
- Leave an unfertilised zone or 'buffer strip' at the drain end of the bay of between 20–50 m (to reduce the quantity of nutrient in the irrigation runoff). This strip traditionally has the highest level of fertility on the bay.
- Do not irrigate for three days after applying fertiliser.
- Fertilise paddocks when they are trafficable after irrigating.
- Apply fertiliser in smaller amounts more often to match plant use and minimise leaching.

#### 3.1.3 Grazing management

- Use grazing management strategies to optimise the growth of the pasture, and maximise plant water use and nutrient uptake. Use 6-inch (stock in) and 2-inch (stock out) rules.
- Do not irrigate for three days after grazing. This allows bacteria to dry out and die. Continual moisture will enable the bacteria to survive and possibly reinfect stock when next grazing.
- Move water troughs into bays. This reduces the distance stock move for water and keeps manure in the bays, rather than on laneways.
- Maintain stocking rates equal to pasture production.
- Consider feed out areas for stock to reduce grazing pressure on floodplain (subject to EPA assessment and Development Application approval).

#### **3.1.4 Riparian (river access) management**

- Fence off the river, riparian zones, all drains and channels, native vegetation areas and salt affected areas.
- No livestock are allowed direct access to the river or drains leading to the river.
- Consider replacing willows with native vegetation (eg reeds, indigenous trees and shrubs) to protect the levees which draw less water, contribute less pollution and sustain native fish and birds.

#### **3.1.5 Runoff management**

- Plant buffer strips around and/or between laneways, walkways, channels and roads to minimise contamination of runoff and the receiving environment. Buffer strips may include trees, shrubs, groundcovers and grasses appropriate for the site conditions.
- Manage runoff from dairy and calf rearing areas to ensure this does not enter drains leading to the river.
- Manage runoff and leaching from farm dumps and chemical (including fuel) storage, and mixing/use areas by adhering to legislative guidelines. For example, use bunds or banks to confine runoff in case of accidental spillage, dispose of containers appropriately and do not dispose of chemical or fuel containers in farm dumps.
- Where bunded runoff areas are used for excess water, plant appropriate species for the conditions.

#### **3.1.6 Contamination management**

- Do not construct silage pits or bunkers on the floodplain (swamp) to prevent leakage into drains and channels.
- Do not bury carcasses within the floodplain to prevent contamination of the groundwater.

#### **3.1.7 Acid sulfate soil management**

- Orange-brown water can indicate acid sulfate soil and drainage conditions are present in an area. Please contact the EPA if you observe these unusual drain colorations.
- Ensure salt drains, reuse drains and pumps are operating efficiently to keep the acidic groundwater table below the root zone (> 0.5 m below ground level) where practical.
- Provided drainage is adequate, irrigation should be beneficial as this will provide acid-neutralising/alkalinity, push acid down out of the root zone, and re-establish saturated conditions in the soil. On farms with only an ELMA allocation, ensure this water is applied in full, annually, where possible.
- Ensure that livestock are kept away from areas containing acid drainage water. If animals come into contact with acid drainage water, rinse them off with tap water and seek additional veterinary advice if required.
- Where practical, keep acid drainage water away from metal and masonry infrastructure.
- Having an irrigated green crop/pasture production system in the LMRIA may aid the protection of the top one metre of soil from changes in soil pH due to underlying acid sulfate soil and acidic water tables. Deep rooted species including paspalum, fescue, kikuyu and couch (up to 30% of pasture cover) may also help by adding soil carbon to the deep soil profile. Application of limestone may be effective if acidic conditions are present near the soil surface.

#### **3.1.8 Cracked soil management**

- Paddocks with small shallow cracking that received some water during the drought may be treated with a light rip and rotary hoe and laser levelled for the purpose of improving irrigation efficiency prior to shallow sowing.
- Paddocks with severe deep cracking that received little or no water during the drought require different treatment: a deep rip lengthwise and possibly across, cultivation with a chisel plough or similar, rotary hoe, laser level and a roll, prior to sowing. The aim is to break up and fill deep cracks to enable soil particles to wet up.

- There may be a need for further laser levelling as the soil settles and swells in following seasons, so returning to permanent pasture initially may not be advisable. A rotation that includes either winter mix or a cereal with millet sown in summer may be necessary.
- For paddocks in good condition, maintenance of soil hydration is essential to minimise the risk of soil cracking, slumping and generation of acid sulphate conditions. The use of ELMA and irrigation water (however limited) will provide beneficial outcomes. During the drought some irrigators also found benefits in maintaining their salt drain level high (not pumping) to prevent soil cracking. The downside to this may be some soil salinisation and it is not recommended if acidic groundwater is present.

## 4 Effluent management

Use best available management practices to minimise the effluent generated and prevent contamination of the drainage system. Where possible, use all effluent on-farm.

**Target** – To adhere to the *Code of Practice for Milking Shed Effluent* (2003) and the Environment Protection (Water Quality) Policy 2003.

**Why** – Effluent from dairy surrounds, hard stand areas and laneways is a significant potential pollution source containing high levels of nutrients and bacteria. This pollution may find its way to the river, particularly during wet years and increase the risk of bacterial contamination of the river and water off takes. Manure from other livestock types could also contaminate the drainage system and the River Murray.

Calves produce very high levels of *Cryptosporidium* (100 times greater than adult cattle) so no calf manure can be allowed to enter the river, drains or channels.

### 4.1 Key effluent best management practices

#### 4.1.1 Using effluent

- Follow the requirements of the Environment Protection (Water Quality) Policy 2003 and Code of Practice for Milking Shed Effluent. These LMRIA guidelines do not override any information in this legislation.
- It is preferred to use manure and effluent to build up highland soils rather than on the flood irrigated area.
- Do not apply fresh manure or effluent on the flood irrigated area and within 50m of drains or channels.
- Use banks and/or cut-off drains to prevent manure entering drains or channels.
- Do not use manure from calf rearing sheds/areas on the flood irrigated area (use only on highland soils and remove regularly).

#### 4.1.2 Managing effluent

- Adhere to local council requirements for scraping manure from public roadways and disposing/using appropriately.
- Regularly scrape stock access areas (e.g. laneways, yards, watering points, other gathering areas) to prevent build-up of manure and use/dispose appropriately. Keep less than 50 mm thick.
- Use bunding (soil, rubber, plastic, sleepers or other material) and contouring of bridges and paddocks to divert faecal material and contaminated stormwater runoff from entering drainage channels.
- Calf rearing sheds/areas should be located on the highland and well above any drains or channels leading to the river. Runoff from these areas is not allowed to enter the drainage system. If such areas need to be located near drains or channels they must have cut-off banks or bunds to prevent runoff from entering drains and channels.

## 5 Monitoring and reporting

Keep accurate records of water, land and effluent management practices as required for compliance with these environmental guidelines.

**Target** – To ensure all irrigators adequately report their compliance with the guidelines.

**Why** – Adequate monitoring and reporting will ensure that all irrigators are treated equally and fairly in meeting the requirements of the guidelines and that water quality impacts in the river are reduced. Good records will determine highest feed producing paddocks, and also which may need renovating. It also allows correlation between the water meter and paddock waterings to calculate your water efficiencies.

### 5.1 Key monitoring and reporting best management practices

- Develop an environmental management system that specifies best management practices to be implemented on the farm over a specific timeframe in accordance with these guidelines.
- Use an environmental management system that incorporates all farm management into a logical prioritised system.
- Continually assess the farm to ensure the highest standards possible are maintained in water efficiencies and environmental impacts.
- Use a simple self-assessment annual reporting procedure (such as a daily dairy diary).
- Use a farm management record folder that can be easily updated.
- Records should show a three-day break between grazing, fertilising or harrowing activities and irrigation.

## 6 Further information

For more information on specific best management practices refer to the [Code of practice for milking shed effluent](#) (2003) and the Environment Protection (Water Quality) Policy 2003, available from <[www.epa.sa.gov.au](http://www.epa.sa.gov.au)> or telephone (08) 8204 2004.

Be familiar with the following existing requirements and guidelines:

- [Manual for spreading nutrient rich waste on agricultural land](#) (available from PIRSA on CD-ROM only – call 8226 0995).
- Farm chemical user course and legislative requirements call Chem Cert SA on 1800 444 228 or visit <[www.chemcert.com.au](http://www.chemcert.com.au)> for details.
- *Occupational Health, Safety and Welfare Act 1986* and its requirements available from <[www.workcover.com.au](http://www.workcover.com.au)> or call 13 18 55.
- Development regulations on earthworks, dam construction, dredging and building work, contact your local council.
- *EPA Guideline 509/10 Wastewater lagoons, draft for consultation* (2013) – available from <[www.epa.sa.gov.au/xstd\\_files/Corporate/Public%20consultation/wastewater\\_lagoons.pdf](http://www.epa.sa.gov.au/xstd_files/Corporate/Public%20consultation/wastewater_lagoons.pdf)> or call (08) 8204 2004.
- Environment Protection Act 1993 requirements such as section 25, general environmental duty of care. Copies of legislation are available from <[www.legislation.sa.gov.au](http://www.legislation.sa.gov.au)> or call Service SA Government Legislation Outlet— call 13 23 24.
- River Murray Water Allocation Plan 2009, SA Murray darling Basin Natural Resources Management Board – available from <[www.naturalresources.sa.gov.au/samurraydarlingbasin/water/water-allocation-plans/river-murray](http://www.naturalresources.sa.gov.au/samurraydarlingbasin/water/water-allocation-plans/river-murray)>

Other useful information:

- *Acid sulfate soils in the LMRIA*, EPA website reports and information available from <[www.epa.sa.gov.au/environmental\\_info/water\\_quality/acid\\_sulfate\\_soils\\_ass/lower\\_river\\_murray\\_reclaimed\\_irrigation\\_area\\_lmria](http://www.epa.sa.gov.au/environmental_info/water_quality/acid_sulfate_soils_ass/lower_river_murray_reclaimed_irrigation_area_lmria)> or phone (08) 8204 2004
- [Options for management in the LMRIA](#), Dairy SA Fact Sheet available from <[www.dairysa.com.au](http://www.dairysa.com.au)> or phone (08) 8766 0127
- Other LMRIA land and water management fact sheets are available from <[www.dairysa.com.au/OnFarmAction/HandyTipsandTools/SoilWatermore.aspx](http://www.dairysa.com.au/OnFarmAction/HandyTipsandTools/SoilWatermore.aspx)>