balancing the salt budget

for the

Shepparton Irrigation Region

Victoria
The Place To Be

Department of Sustainability and Environment
Department of Primary Industries

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Preface

In a changing environment of water reform, political pressures and priorities for sharing salt disposal entitlements there are many challenges facing the future delivery and capacity of the Shepparton Irrigation Region Catchment Strategy to maintain the salt budget.

All staff involved in delivery of activities for the Shepparton Irrigation Region Catchment Strategy should be encouraged to contribute to policy and decision-making regarding activities that lead to catchment and river health. It is our responsibility first and foremost to support salinity mitigation and our local communities, however, there needs to be an appreciation that what we do impacts on communities dependent on a healthy Murray River.

The following information has been compiled as a reference document for enhancing agency staff knowledge and understanding of Salt Disposal Entitlements. Underpinning the capacity to dispose of a quantity of salt from a catchment is balancing the need to dispose of the salt whilst minimising the impact to the environment and communities dependent on a healthy Murray River. This paper documents the management principles, accountability and aspirations of the Goulburn Broken Catchment Management Authority to meet this balance.

Current in February 2005.

Russell Pell
Chair
Shepparton Irrigation Region Implementation Committee

Murray-Darling Basin Salinity Management Principles

Acceptable guidelines for managing salinity and drainage along the Murray River were put together with the cooperation and input of community, industry and government representatives of Queensland, New South Wales, Victoria and South Australia. The outcome was the 1988 Murray-Darling Basin Salinity & Drainage Strategy, which is driven by the Murray Darling Basin Commission in Canberra, ACT.

The Murray-Darling Basin Salinity & Drainage Strategy ensures that communities do not undertake activities that worsen the salinity problem in other areas. Under the 1988 Salinity and Drainage Strategy, Salt Disposal Entitlements (SDEs) were estimated on the basis of the downstream impacts that any discharges might have caused if they had occurred over a benchmark period from 1975 to 1985. Under that Strategy, any works in the catchment which increased salt loads leaving the catchment required a Salt Disposal Entitlement, but increased salt loads resulting from existing processes did not. A line was drawn in the sand that meant after 1988, all works that had an impact on river salinity needed a Salt Disposal Entitlement.

To achieve these outcomes, agreement was needed as to what was "acceptable" water quality in the Murray River. The salinity level of the Murray varies naturally depending on the time of year. The river also becomes more saline as it travels downstream and interacts with groundwater that naturally seeps into the river system.

Prime consideration was given to the water quality needs of the last users in the system, the people of the city of Adelaide, South Australia.

Adelaide's drinking water is drawn from the Murray River at a riverside town called Morgan, also in South Australia. In addition, the health of the Murray River and Murray mouth were important considerations. The salinity level of the water in the Murray River at Morgan was identified as one of the key factors in setting the benchmark for 'average' acceptable Murray River water quality.

Discharging saline water into the Murray River by catchments upstream of Morgan would only be possible if 'savings' or reductions in saline discharges were made elsewhere along the river.

In 1985, when these discussions began, the salinity level at Morgan averaged 850EC. The Murray-Darling Basin Commission determined that this should be the maximum level, the benchmark, for Murray River water quality throughout the implementation of all salinity mitigation works upstream. In fact, the Murray-Darling Basin Commission set a vision for reducing salinity levels in the lower Murray and determined that the salinity of the Murray River at Morgan should be less than 800EC for 95% of the time. This meant that communities upstream were not permitted to dispose of saline water in such a way as to increase the average salinity of the Murray River at Morgan, above 800EC.

The Murray-Darling Basin Salinity & Drainage Strategy was the culmination of 20 years of discussion about how to resolve the conflicting needs of each state. South Australia wanted lower river salinity levels and Victoria and New South

Wales wanted to drain irrigation areas. The Strategy is a signed agreement that binds the States and the Commonwealth to jointly fund works that reduce Morgan salinity by at least a net 80EC. In return for their investment, both NSW and Victoria are then entitled to increase Morgan salinity by up to 15EC each. These entitlements are often referred to as EC credits. These EC credits are allocated to States and regions based on irrigated Land and Water Salinity Management Plans. The remaining 50EC is solely for river improvement through salt interception schemes.

1.1 Salinity Credits and Debits Registers and Reporting

Expanding on the Salinity and Drainage Strategy, the Basin Salinity Management Strategy included a major focus on dryland salinity. The Basin Salinity Management Strategy set aggressive targets for a 61EC program of salt interception schemes over a seven year period to off-set the impact of future dryland salinity on Murray River salinity and to provide States with SDEs. In addition, end-of-valley targets were set for each tributary valley to improve accountability and tracking of river impacts from dryland salinity. Setting end-of-valley targets and establishing their contribution to the Basin salinity target will provide the basis for Basin-wide application of EC credits and debits (Basin Salinity Management Strategy factsheet no. 5).

To ensure transparent accountability, progress towards targets are monitored and reported to the Murray-Darling Basin Ministerial Council annually. States are required to collate data on all actions undertaken or proposed that will have an impact on Murray River salinity and report firstly against end-of-valley targets and subsequently against Commission registers. This information is consolidated in a report card that is prepared for each valley in the State. This report card is assessed in terms of salinity credits and debits contributing towards the Morgan target. The report card includes details of end-of-valley baseline conditions; predicted impacts from historical developments ('legacy of history') agreed end-of-valley targets and assessed effects of in-valley actions undertaken to date.

The system of credits and debits for achieving the Basin target at Morgan is managed through the Commission 'A' Register (for tracking SDEs) and the Commission 'B' Register (for actions to address the 'legacy of history') (Basin Salinity Management Strategy factsheet no. 3).

The registers and reporting are a requirement of Schedule C in the Murray Darling Basin Agreement. The Victorian Manual of Salt Disposal in the Murray-Darling Basin (1993) states that the purpose of Schedule C is to:

- promote works and measures to reduce average salinity in the Murray River at Morgan;
- provide for assessment of the potential and actual impact of works and measures in terms of their salinity effects; and
- ensure that actions taken under the Murray-Darling Basin Agreement do not have a cumulative effect of increasing Murray River salinity

History of Salinity Management in Victoria

The accelerating salinisation of Victoria's land and water resources in the 1980s imposed a major economic and environmental cost to the state. In 1981, the Victorian Draft Decade of Landcare Plan estimated that production losses in agriculture due to salinity were $68 million/year in the irrigation areas and $8 million/year in the dryland areas of the state.

Since 1986, Victoria's Salinity Program has been a major ongoing initiative of the community and the State Government. In 1988, the State strategy for managing land and water salinity in Victoria "Salt Action: Joint Action" was released.

The strategy divided the state into nine catchment-based salinity control regions and identified a need for 20 sub-regional salinity management plans or regional salinity strategies. This included the strategy for the Shepparton Irrigation region. These strategies covered regions either affected by salinity or contributing to salinity damage in Victoria and downstream within the Murray-Darling Basin. Together, the 20 plans and strategies cover approximately 60% of the area of Victoria.
The preparation of salinity management plans was a major emphasis and achievement of the Salinity Program.

2.1 Development of Land and Water Salinity Management Plans

On the basis of recommendations from the catchment community, the State Government in 1986 appointed the Salinity Pilot Program Advisory Council. The Shepparton Irrigation Region Land and Water Salinity Management Plan was developed in accordance with guidelines provided by the Victorian Government, under the control of the community and Salinity Pilot Program Advisory Council.

In June 1990, the Shepparton Irrigation Region Land and Water Salinity Management Plan was one of the first four sub-regional plans to be endorsed by the Victorian Government.

2.2 An integrated approach to salinity management

With the inception of the Catchment and Land Protection Boards in July 1995, the Salinity Pilot Program Advisory Council voted itself out of existence and transferred the role of policy oversight and strategic development of salinity control activities to the Catchment Boards. The Goulburn Broken Catchment and Land Protection Board was one of ten groups established by the Victorian Government to oversee natural resource management issues within the state. The Catchment Board developed a key strategic document, the Regional Catchment Strategy. This has been adopted as the blueprint for achieving effective integration and delivery of all land and water management programs in the catchment.

On 1 July 1997, Catchment Management Authorities, endowed with the Regional Catchment Strategy and expanded roles, were appointed to replace the existing Catchment and Land Protection Boards. The responsibility for implementing the revised Shepparton Irrigation Region Land and Water Management Plan passed to the Shepparton Irrigation Region Implementation Committee of the Goulburn Broken and North Central Catchment Management Authorities. Previously this was managed by the Salinity Pilot Program Advisory Council Irrigation Sub-committee and the Irrigation Committee of the Catchment and Land Protection Board.

2.3 Describing the Shepparton Irrigation Region Salinity Problem

Before the advent of irrigation, summer pastures and tree clearing, winter and spring rainfall not used by plants could soak deep underground.

The change in water balance due to irrigation and other land management practices permitted greater amounts of water to enter the soil. The result was excess water gradually filling up the soil profile. The effect is similar to having a small hole in a bucket, then adding more water to the system than the small hole can let out. Eventually the level of water in the bucket rises. This is what has happened under the Shepparton Irrigation Region. The result is mobilisation of salt that had been previously accumulated and stored safely deep in the soil profile for thousands of years. The soil moisture dissolves the salt and, as the water level in the soil rises, it brings salt with it. When the water level is within two metres of the surface, the salt can actually reach the surface, without the soil appearing to be waterlogged. This is because of the combined action of:

- plant roots drawing moisture up,
- the natural tendency of moisture to move through soil at a micro level (capillary rise – similar to water moving up a length of paper towel) and
- the warmth of the sun, drying out the soil moisture near the surface, leaving the salts behind.

Salts that accumulate within the rootzone of plants can affect plant health and soil structure, leading to reduced productivity and typical 'salinity' symptoms.

Solutions – Groundwater control in the Shepparton Irrigation Region
Altering the type of agriculture to include more salt tolerant plants is one way of dealing with the problem but is not always the most attractive option. In most of the Region this is the last resort because of the high value of agricultural production. This means there is scope to invest more money in other methods of managing the high watertable.

Physical lowering of the watertable can be achieved by installing and managing groundwater pumps or bores (large diameter single bores, or small diameter multiple well-point systems) or tile drainage. These systems drain the water away from the vicinity of plant roots, reducing waterlogging and allowing the leaching of accumulated salts from the surface. However, this drained water has to be managed either by transferring it to the surface drainage system or via some other disposal method. Conjunctive reuse (mixing of pumped groundwater with surface water supplies) is the most common method of managing disposal of saline groundwater. The other option is to export the salt out of the region. The other key methods include surface drainage and irrigation system management and improvement.

Salt Disposal Entitlements

- what are they and where do they come from?

It is primarily through the sub-surface drainage and surface water management programs of the Shepparton Irrigation Region Catchment Strategy that the greatest impact is had on the River Murray salinity level.

Savings, or reductions in Murray River salinity provide the 'currency' for EC Credits. Actions that require EC Credits include extension of surface drainage networks, installation of groundwater pumps which discharge to the river, new irrigation developments which will lead to increased groundwater flows to the rivers and increased diversion of irrigation water upstream of Morgan.

Most of the activities in the Shepparton Irrigation Region Catchment Strategy either have an EC saving or require a EC Credit also known as a Salt Disposal Allocation (SDA). The continued delivery and provision of activities through the Shepparton Irrigation Region Catchment Strategy is dependent on availability and sharing of EC Credits with other irrigation regions in the State of Victoria that also have an impact of salinity levels in the Murray River. But how are these EC Credits generated in the first place?

The salt levels in the Murray River can be managed in part, thanks to a series of groundwater pumps located along the Murray, upstream of and around Mildura, Victoria. These pumps intercept very saline groundwater (50,000EC - 80,000EC) that would otherwise seep into the Murray River. This water is pumped to evaporation basins located 'inland' from the river.

The EC units by which the river salinity is reduced becomes the EC Credits that can be shared by upstream communities that are wanting to drain irrigation areas.

Operating and maintaining the salt interception pumps and evaporation basin is expensive. The communities discharging salt pay charges for salt disposal that is equivalent to their proportional share of operating the salt interception schemes.

The Salinity & Drainage strategy allocated each State an initial limited number of EC Credits for discharging saline water to the Murray River. Any additional EC Credits are either Murray-Darling Basin Commission works that Victoria contribute to or EC Credits that the State needs to consider obtaining through 100% contribution to works. This allocation system is proportional to the State contribution of running the salt interception system ie. 100% contribution means 100% of the EC Credit and 50% contribution means 50% of the EC Credits.

For example, the Shepparton Irrigation Region contributes towards the operation and maintenance of these pumps at a cost of $90,000 - $140,000 per EC unit that the Region can discharge to the Murray River.

Each State determined how they would allocate their share of EC Credits to the communities that were relying on disposal to the Murray River outlined in the salinity management plans prepared for their catchments.

In Victoria, each Basin community that prepared a draft Land and Water Salinity Management Plan that identified the costs and benefits of the proposed activities were allocated a portion of Victoria's precious EC Credits.

These allocations are referred to as Salt Disposal Entitlements or SDEs.
Other actions that can generate SDEs for Victoria include:

- improving irrigation management where this reduces saline drainage into the Murray River;
- ceasing irrigation in areas where the irrigation dislodges extremely saline groundwater to the River;
- reducing sewerage disposal and other point source discharges to the River;
- ceasing activities that mobilise salt which were in place before 1988, the agreed base line (e.g.. eliminating irrigation drainage water into groundwater bores in the Mallee, which dislodges highly saline groundwater into the River and decommissioning Phase A pumps in the Shepparton Irrigation Region); and
- investing in further salt interception schemes where this is agreed to by the Murray-Darling Basin Commission.

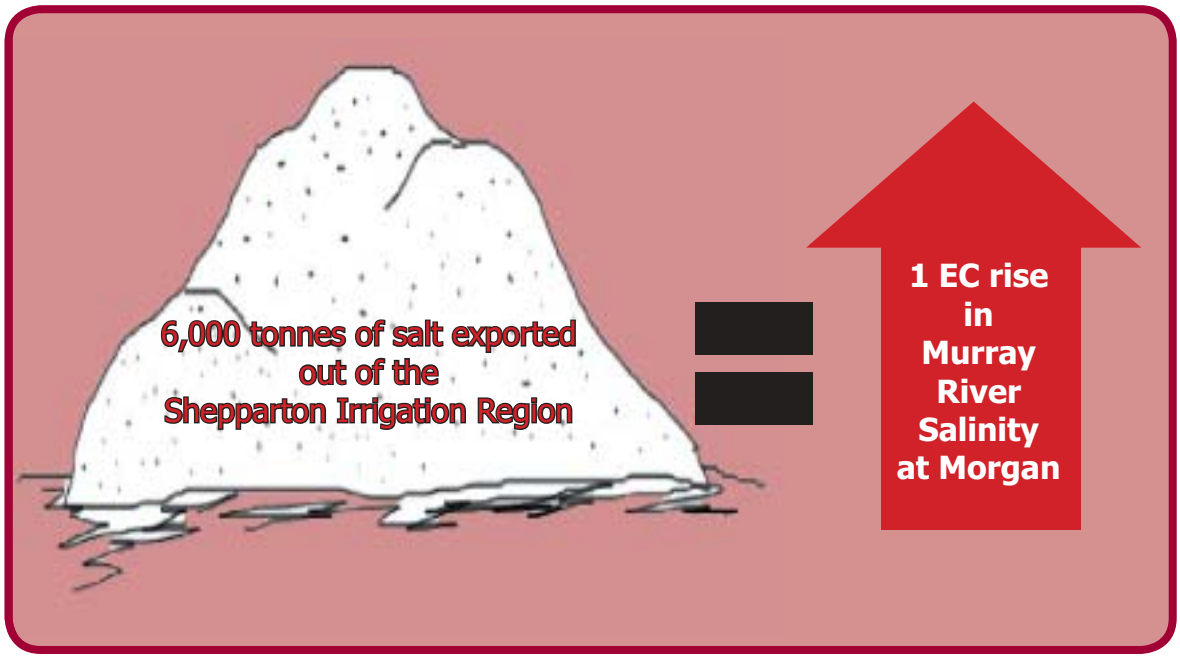


Figure 1. Key assumption for Salt Disposal out of the Shepparton Irrigation Region

Salt Disposal in the Shepparton Irrigation Region

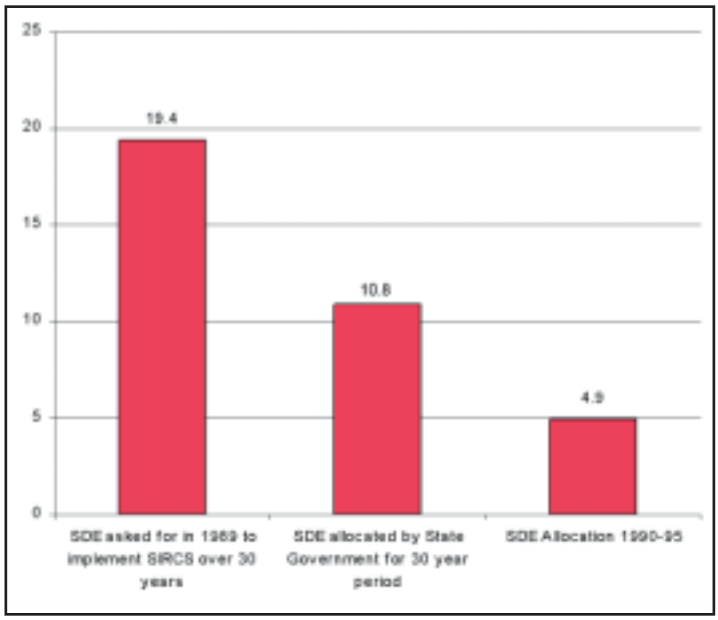
The Shepparton Irrigation Region Land and Water Salinity Management Plan in the Goulburn-Broken Catchment of Victoria, is one of the earliest and most successful plans in the Murray-Darling Basin. Launched in 1989, the Plan has since been incorporated into the overarching Goulburn Broken Regional Catchment Strategy and is today known as the Shepparton Irrigation Region Catchment Strategy in recognition of a fully integrated implementation program.

The initial request for the Shepparton Irrigation Region Land and Water Salinity Management Plan was for an SDE of 19.4 EC. This was made up with 16.7 EC for sub-surface works and 2.7 EC for surface drainage works. The initial formal allocation to the region for the period 1990 to 1995 provided by the Victorian Government was 3.4 EC. An additional 1.5 EC was allocated to the Goulburn Broken Catchment Management Authority in 2001 for priority surface and sub-surface drainage works. This brought the formal SDE allocation for the region to 4.9 EC.

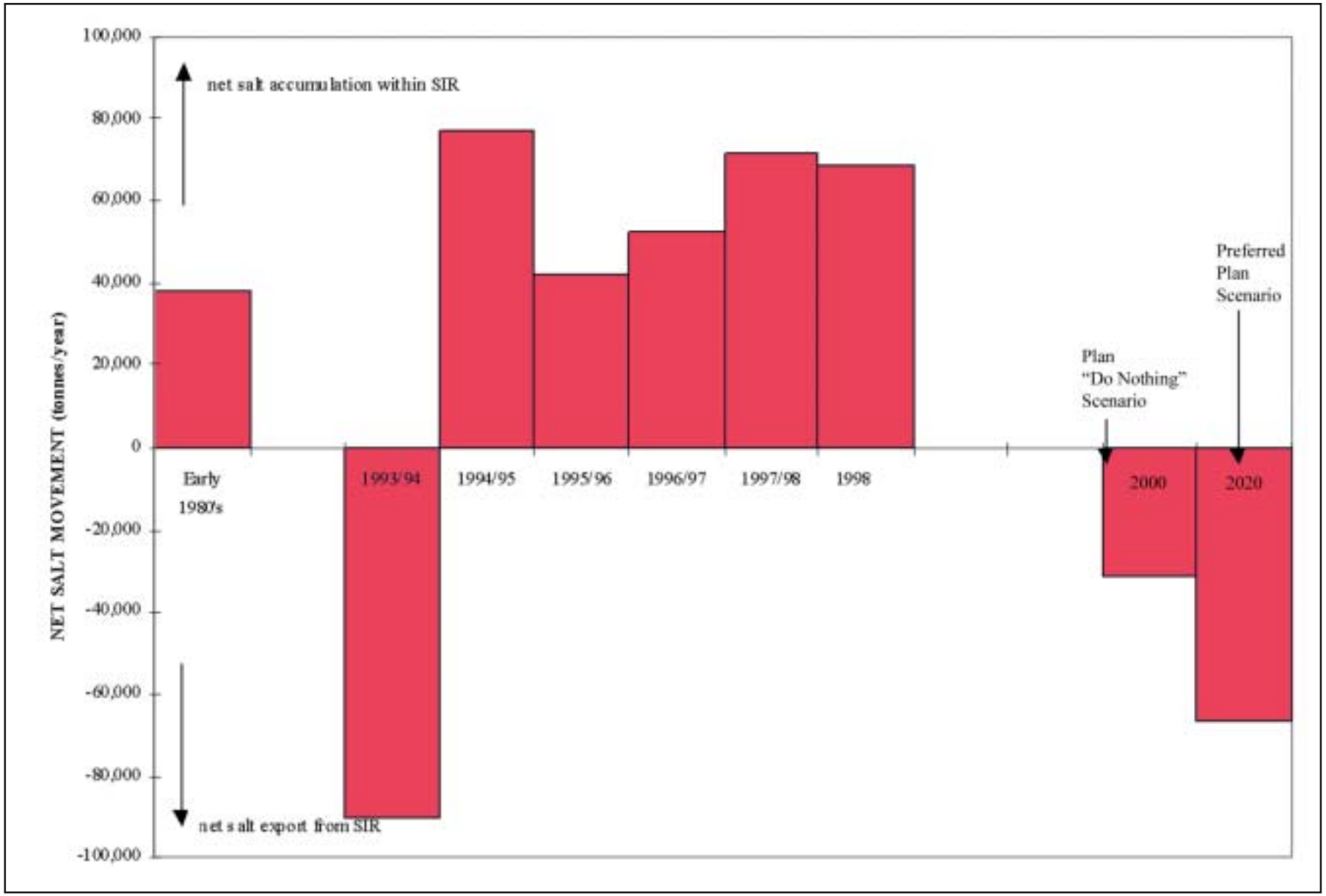
An indicative 30-year allocation of 10 EC as been provided for implementation of the Shepparton Irrigation Region Catchment Strategy.

4.1 The Challenge

From the Shepparton Irrigation Region perspective, the challenge is to balance the amount of salt that comes into the region in irrigation water, with the amount of salt leaving the region in the drainage network (refer to Graph 1). Before the Catchment Strategy was implemented, it was estimated that about 100,000 tonnes of salt entered the region every year in irrigation water, but only 60,000 tonnes could be accounted for as leaving the region via the drainage network (drains, rivers and streams). This implies that 40,000 tonnes of salt was being added to the region's soil, every year *(Graph 2, page 10)*. These figures are based on a number of "best guess" assumptions and should not be used in determining SDE requirements for catchment works. However, the message is quite clear - with the development of high watertables across the region, there is no room for storage of salt within the catchment, therefore there needs to be a discharge of salt to reduce effects of salinisation.



Graph 1. Original SDE asked for to implement SIRCS and what has been formally allocated



Graph 2. Salt export and accumulation in the Shepparton Irrigation Region

4.2 The Solution

The Shepparton Irrigation Region Catchment Strategy component of the Goulburn-Broken Regional Catchment Strategy has 5 key programs to address the salinity problem. The Farm Program focuses on private land use: improving water use efficiency, irrigation layout and adoption of sustainable irrigation practices. The Environmental Program provides the framework for protection and enhancement of natural features in the Region on private land, including wetland management and biodiversity. The Waterways Program oversees the River Health Strategy for the Goulburn Broken Catchment Management Authority and addresses issues associated with riparian zone protection, nutrient and sediment reduction, river flow and in-stream habitat. However, the two programs which have the most direct impact on regional salt loads are the Surface Water Management Program and the Sub-surface Water Management Program.

Underpinning these programs are a number of assumptions that describe the relationship between works and impact on river salinity. One of the main assumptions is that for every 6,000 tonne of salt discharged from the Shepparton Irrigation Region, there is a 1 EC increase in the river salinity at Morgan.

4.2.1 Surface Water Management Program

The Surface Water Management Program aims to address the problems associated with having intensive irrigation across the region and irrigation induced rainfall runoff from farms. When the irrigation infrastructure was originally set up, the priority for investment was to get the water onto the land. As a result, we have a very comprehensive water distribution network. However, the improved drainage required to complement the irrigation network still has to be completed. The Surface Water Management Program aims to speed up the construction of drains where appropriate (Surface Water Management Strategy Review, 2002).

When the program was developed it was quickly recognised that as more drains were constructed, more water would leave the catchment and at different times of the year than would have prior to 1988.

This meant that, to be compliant with the Murray Darling Basin Salinity & Drainage Strategy Agreement, the Surface Water Management Program required SDEs. In fact, an SDE assessment has been carried out on the entire proposed program which determined that the Surface Water Management Program works will add 1.3 EC: Primary drains using 0.7964 EC and Community drains using 0.50488 EC. From this, an average EC impact per kilometre of new drain constructed has been determined. This calculation was based on an assessed average 0.0022EC/km for Primary drains and 0.00024 EC/km for Community Surface Water Management Schemes.

Even with a comprehensive drainage system in place, the amount of salt exported in the irrigation induced rainfall run-off carried in 'new' surface water management schemes will not give the Region the salt balance it needs to be sustainable. Other actions are designed to reduce drain flow. These include reduced channel outfalls, reduced farm runoff and increased drain diversion.

4.2.2 Sub-surface Drainage Program

In simple terms, the Sub-surface Drainage Program manages the movement of groundwater. It is through the control of groundwater that land managers can have the biggest impact on reducing salinity effects in the short term and in helping to reset the balance of salt imported into the region and salt exported from the region.
In the Shepparton Irrigation Region, salinity and waterlogging is largely the result of rising groundwater levels bringing salt to the surface.

Shallow groundwater salinity in the Shepparton Irrigation Region is highly variable.

The Sub-surface Drainage Program further divides the regional SDE into Salt Disposal Allocations which are allocated to individual groundwater pumping systems that are registered with the Murray Darling Basin Commission Salinity Register. These Salt Disposal Allocations reflect the volume and salinity of the groundwater being pumped.

For example, private groundwater pumps less than 800 EC do not have an attached salt disposal impact because of low groundwater salinity.

There are two main categories of groundwater pumping systems, Private and Public.

Private Groundwater Pumping and Management

Private groundwater systems are those owned and operated by individual landowners and generally are used by the owner to supplement irrigation supplies in summer.

A desire to better manage the amount of groundwater pumped, coupled with salinity and conservation issues relating to shallow (< 25m depth) groundwater were driving factors in the declaration of the Shepparton Irrigation Region as a Groundwater Supply Protection Area in September 1995. This resulted in the development of a draft Groundwater Management Plan. The primary objective of the Groundwater Management Plan, launched in July 1997, is to support the Shepparton Irrigation Region Catchment Strategy by encouraging regular and responsible groundwater pumping to provide salinity control while protecting both the groundwater resource and the rights of the groundwater user. For more information on management principles of shallow groundwater, the Shepparton Irrigation Region Groundwater Management Plan (July, 1997) is a useful reference document.

On the topic of groundwater management, it is important to note that the Shepparton Irrigation Region Groundwater Management Plan only covers salinity management issues and therefore does not deal with management issues associated with deep lead aquifers. What also needs to be appreciated is that unlike the deep lead aquifers (which are relatively permanent and substantial groundwater resources) the shallow groundwaters are a direct result of local land management activities. Changes in land management and irrigation usage can directly affect both the quantity and quality of the available shallow groundwater.

Public Groundwater Pumping
Public groundwater pumps are managed by Goulburn-Murray Water on behalf of the Goulburn Broken Catchment Management Authority. Public Pumps are operated for an average of two months during the irrigation season and two months during appropriate conditions in late winter early spring (outside the irrigation season).

During the irrigation season, the pumped groundwater is discharged to appropriate public irrigation channels where it is diluted by the fresh channel flows and used by irrigators downstream. Discharging to the public irrigation network is dependent on suitable flows in the receiving channel and a suitable number of irrigators downstream to pick up and use the water before it leaves the catchment.

Winter disposal can only occur provided there is an appropriate public drainage network and that all appropriate conditions for winter disposal are met.

Each megalitre of saline groundwater discharged in this way helps to reset the imbalance in the regional salt import: export equation.

Note: There was a large network of groundwater pumps installed in mid-1970s to protect horticultural areas across the region. This network of pumps were part of a Phase A Groundwater Pumping program for waterlogging and salinity control. The Phase A pumping program was established prior to the 1st January 1988 and included in the benchmark period for the region. Therefore, no Salt Disposal Allocation is required for Phase A pumps.

4.2.3 Savings in Salt Disposal Entitlements from other Actions

Under the banner of the Salinity Program, the Farm Program provides a number of activities that individual landowners can do to reduce regional scale groundwater accessions. Activities including Whole Farm Planning and re-use systems aim to reduce the need for groundwater pumping, hence have an impact on saving EC Credits.

Whole farm planning is a very important activity conducted as part of the Farm Program in the region. It has a focus on improving water management on land with a range of benefits, ultimately leading to the reduction of groundwater accessions, soil salinisation and waterlogging on farms. Whole Farm Plans are also used to protect and enhance environmental features whilst increasing farm productivity.

Reduction in post-irrigation ponding of water and farm accessions to watertables has been mainly achieved through the works associated with Whole Farm Plans and the accelerated adoption of re-use systems. While there is no salt load reduction figure attributed to Whole Farm Planning specifically, installing farm re-use systems (a key component of the implementation of most plans) across the region will save about 14EC.

Control and Monitoring of Saline Groundwater Discharge

Strict guidelines for salt disposal are in place to ensure the Shepparton Irrigation Region component of the Goulburn Broken Regional Catchment Strategy is meeting the obligations of the Murray Darling Basin Commission Salinity & Drainage strategy and the members of the wider Murray Darling Basin community.

Part of this obligation is undertaking an annual independent audit of catchment works to monitor expected impacts on river salinity. This audit determines whether the works are doing what was agreed. In addition, there is an annual report prepared on salt disposal for the Shepparton Irrigation Region that is presented to the Murray Darling Basin Commission as well as five yearly reviews of all programs implemented under the auspices of the Regional Catchment Strategy.

5.1 Murray River discharge trigger

Disposal of saline groundwater to the Murray River is broken into three critical times: prior to 1st June, from the 1st of June to 1st August and after 1st August and the triggers for each time are different as noted below.

Only when the trigger levels are reached are the private and public groundwater pump operators notified and permitted to commence discharging groundwater to the drainage network.

A series of 32 continuous monitoring sites have been set up in the Shepparton Irrigation Region surface drainage network to ensure the salt loads and discharge rates are within agreed limits.

Areas monitored include rivers, streams in the dryland parts of the region, drainage from irrigated areas, depressions and lagoons.

A recent report on flow and salt load data collected over a ten year period showed that there has been a big drop in surface water flows since 1995 and a general decline in the salinity of water leaving the Shepparton Irrigation Region. Further analysis highlighted there is on average about 7 tonnes of salt in every megalitre that leaves the catchment (Shepparton Irrigation Region Salt Load Monitoring for Goulburn-Murray Water, 2004).

This information is used in planning and setting agreed trigger levels for allowing extra export of salt out of the region. The timing is dependent on the flow of the receiving waters.

This framework for managing Shepparton Irrigation Region salt disposal to the River Murray is described on page 13.

5.2 Secondary stream triggers

It is essential that tributary rivers to the Murray River (Goulburn, Campaspe & Broken Rivers and Broken Creek) that are receiving waters for discharge of saline groundwater also have sufficient dilution flows. This ensures the blending and dilution of any groundwater outfalling into the river or stream, which protects riparian health and overall water quality.

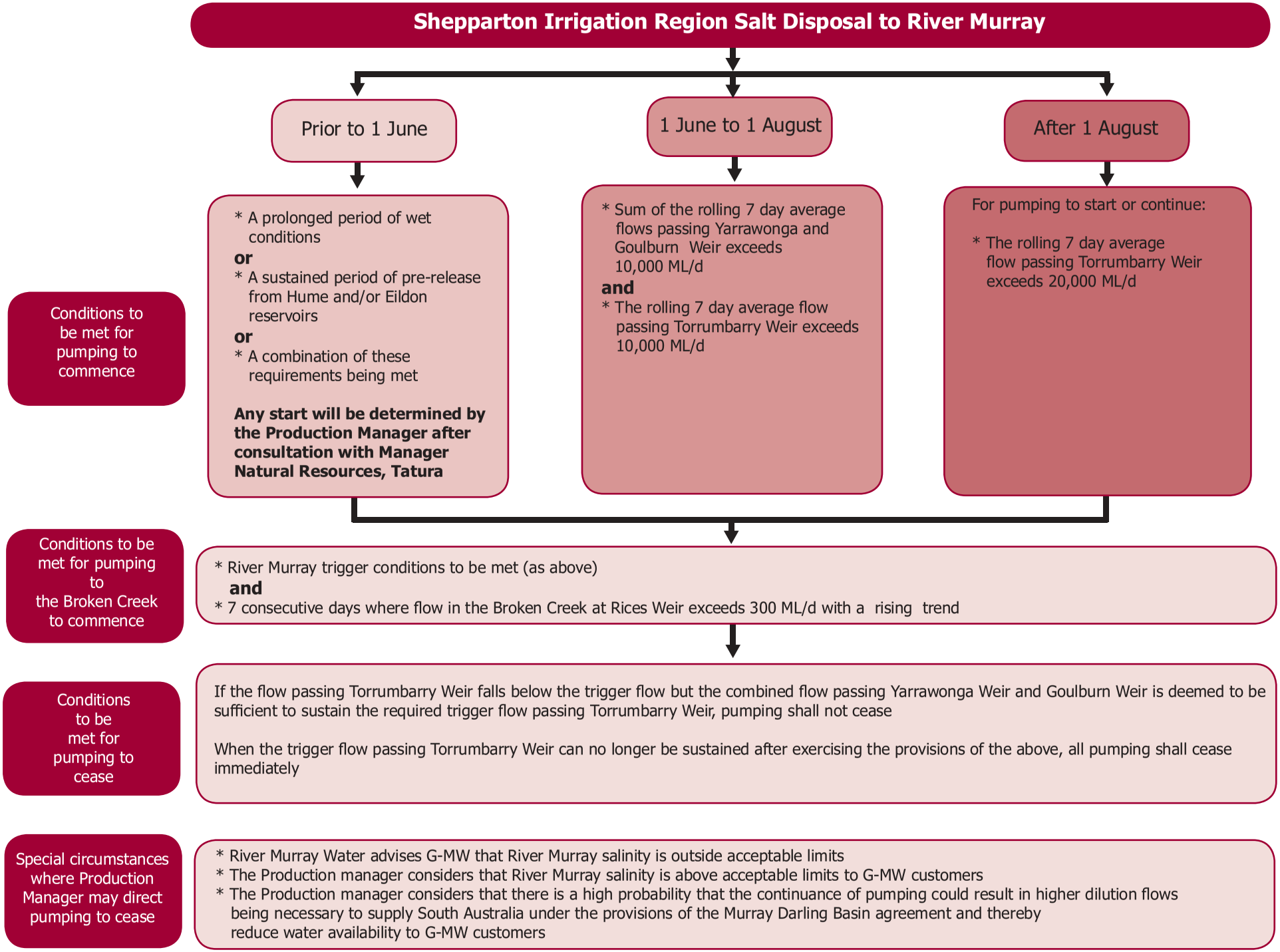


Table 1. Trigger for Managed Salt Disposal in the Shepparton Irrigation Region

5.3 Strategic salt disposal

The Shepparton Irrigation Region Catchment Strategy not only strives to maintain the health of the Murray River by managing the timing, volume and salinity of saline discharges but it has also recognised the potential impact of discharge activities on the smaller tributaries within the region. To protect the health of rivers and streams within the catchment a salt disposal assessment has been carried out and limits have been placed on salt loads allowed to be discharged and timing of flows.

This means that each catchment has a maximum salt load that it can safely dilute and discharge. Where a catchment has reached the limits for licensed salt disposal, either a roster system of operating discharge pumps must be put in place or a limit set to the number of off-site salinity disposal systems that can be accommodated. Ultimately, the remaining option is for disposal to evaporation basins.

The following figure shows the allocation of SDEs to date and the SDEs that have been used up and the remaining unused SDEs that are required for implementing Catchment Strategy works over the next 3 years. This is compared to the additional SDEs the Catchment Management Authorities expect to fully implement their Catchment Strategy.

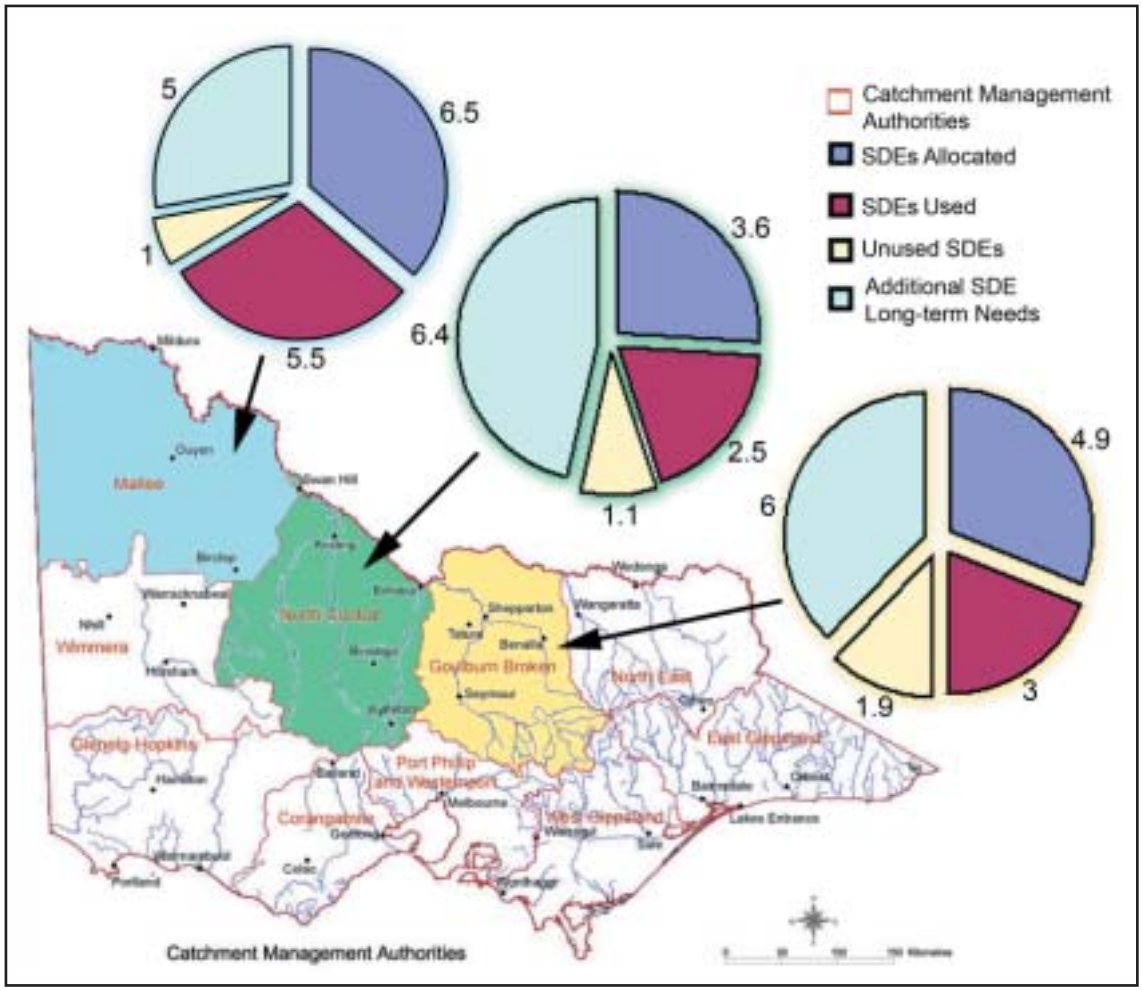


Figure 2. Distribution of SDE allocation, uptake and expectations across Mallee, North Central and Goulburn-Broken Catchment Management Authorities

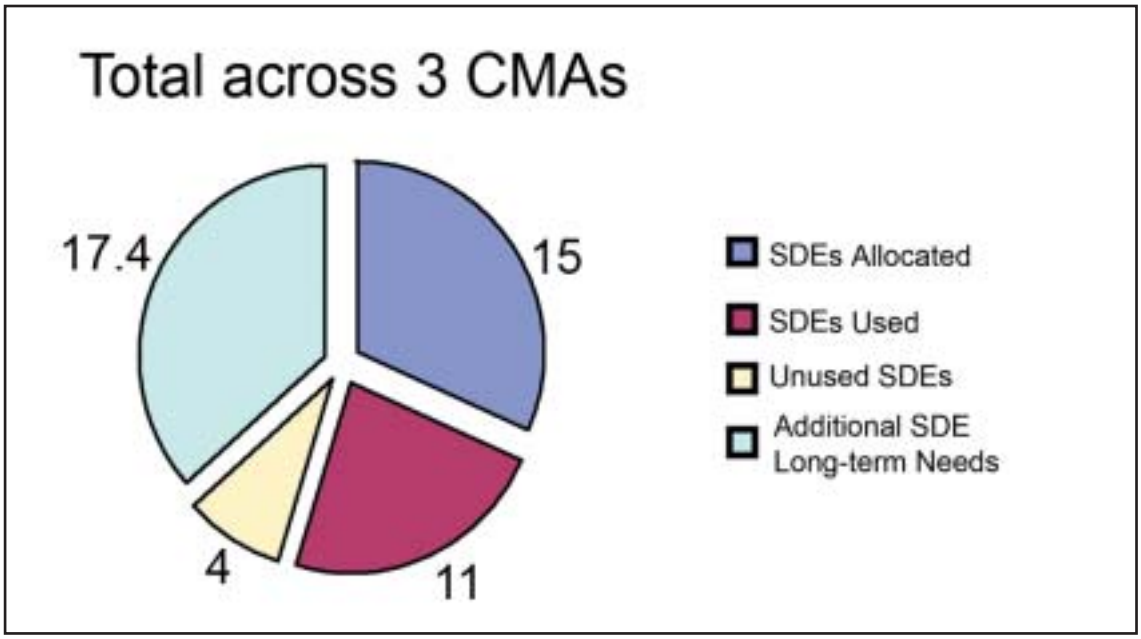


Figure 3. Amalagmated SDE Allocation, uptake and additional long-term needs across 3 catchments

The above comparison highlights the future scarcity of SDEs. So while building a salt interception scheme will earn Victoria SDEs, the State Government has to consider how it shares those SDEs between new irrigation development, installing infrastructure to protect existing irrigation areas and to provide for salt disposal to enhance and protect environmental values. It has done this by developing a detailed set of guidelines to judge competing claims for SDEs. Compounding this, each Catchment Management Authority has these issues to varying degrees within their own region. The Victorian Government also has to share the SDEs in a way which is seen as fair and equitable between the regions and which maximises the economic, environmental and social benefit to the State. Previously, this was not such a significant issue. Whilst never abundant, there were sufficient SDEs to ensure continued implementation of the Catchment Strategies. In 3-5 years, there may not be sufficient SDEs to satisfy the Catchment Management Authority implementation programs for their Regional Catchment Strategies.

Conclusion

For the longevity and sustainability of any irrigation region, a critical balance needs to be maintained between salt brought into the region through supply of irrigation water and salt leaving the region. While managed salt disposal is fundamental to the implementation of the Shepparton Irrigation Region Catchment Strategy it is the guidelines and SDE management framework set by the State Government of Victoria and the Murray-Darling Basin Commission that challenge the Shepparton Irrigation Region Catchment Strategy programs, in particular the sub-surface and surface water management programs to access, manage and continue to demonstrate the need for SDEs.

Other challenges that require ongoing consideration and refinement on the fairness and equity in sharing future SDEs just at a State level include, but are not limited to:

- Building more salt interception schemes (e.g. Pyramid Creek)
- Review of irrigation development (particularly in the Mallee)
- Victoria contributing to the cost of 'joint' salt interception schemes under the Murray-Darling Basin Agreement
- State Government to consider how to equitably share SDEs between the Catchment Management Authorities on issues relating to:
    - New irrigation development
    - Installing infrastructure to protect existing irrigation districts and to provide for salt disposal to enhance and protect valuable environmental features
- End of Valley Targets
- Victorian Salt Disposal Allocation procedure

Whatever guidelines and frameworks are put in place, one thing remains the same: a major component of achieving a salt balance is to reduce accessions to the watertable by improvements in irrigation efficiency. However, even with rapid improvements in irrigation management, some form of salt disposal will be necessary into the future.

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