6.7 Surface water salinity (including wetlands)

Surface water and wetlands are high value assets that are vulnerable to salinity increases. The likelihood of degradation by salinity and the consequence are both high. Salt can enter wetlands and other surface water bodies via:

- Runoff over saline land;
- Direct discharge of saline groundwater;
- Wind blown salt from the ocean;
- Runoff from irrigation with brackish water;
- Direct or indirect discharge of brackish-saline water from groundwater pumps;
- Rainfall; and/or
- Ocean or lake inflow.

Therefore, any activity that reduces groundwater levels, the area of saline land and/or ocean influxes or increases flushing with fresh water has the potential to reduce salt levels to wetlands and other surface water bodies (with the exception of discharge into wetlands from groundwater pumps).

This section defines the resource condition targets for surface water and wetland salinity and summarises the key management actions to achieve the desired resource condition changes. A large number of the management actions covered by the irrigation, dryland and ocean induced salinity programs impact on surface water and wetland assets. This section will summarise these management actions and outline additional actions which are specific to the surface water and wetland asset class.

6.7.1 Management Actions and Resource Condition Targets

The current state of knowledge on wetlands in the region is limited. There is a large disparity between the knowledge of different wetlands; detailed salt and water balance studies have been undertaken of wetlands such as Dowd Morass, Clydebank Morass and Lake Coleman while there is almost no information available on wetlands such as Morley Swamp, Tucker Swamp and Backwater Morass.

A project commissioned by the Department of Sustainability and Environment developed an Index of Wetland Condition, which is a methodology for assessing the condition of wetlands in Gippsland. A number of high value wetlands were assessed using this methodology. This project needs to be expanded to include all wetlands in West Gippsland so that a baseline is available as a benchmark against which management activities can be measured. The Regional River Health Strategy has identified the need for a regional wetland plan to be developed. A Project Officer is due to commence in late May 2005 and salinity impacts will be one of the key issues assessed for wetland condition.

The process that needs to be undertaken for setting resource condition targets for wetlands in the region is as follows:

1. Audit of all wetlands and prioritisation of the key wetlands;
2. Monitoring established in priority wetlands;
3. Interim targets set based on current salinity levels and desirable salinity levels based on technical information;
4. Specific management options leading to attainment of the targets determined and set; and
5. Interim targets reviewed.

For most wetlands in the region this process is at Stage 1. For a number of wetlands surrounding the Gippsland Lakes such as Clydebank Morass, Dowd Morass and Lake Coleman, the process has been completed up to the end of Stage 3.

The resource condition targets for key wetlands in the area are shown in Table 54. Resource condition targets for many of the wetlands have not been defined due to the lack of available information. For these wetlands, the setting of resource condition targets should follow the five step process detailed above. The management actions are summarised in Table 53 and are detailed in the following section.

Table 53: Management Action Targets to address Surface Water Salinity

Management Actions	MAT Number	5 Year Management Action Targets	Salinity Management Program			Asset Class							Priority
			Sal Mapping	Environmental flows	Monitoring, eval, reporting	Water	Land	Biodiversity	Atmosphere	People	Infrastructure	Production	
Map wetland salinity	**SA1**	Research and investigation work complete including prioritisation of wetlands for further work. Monitoring regimes established in priority wetlands, management options investigated and implemented	●	○	○	●	○	●	○	○	○	○	Priority 1
Map surface water salinity	**SA2**	Complete characterisation of surface water quality issues and prioritisation of key river reaches for implementation of management options	●	○	○	●	○	●	○	○	○	○	Priority 1
Complete environmental flow assessments	**SB1**	Environmental flow assessments complete. Stream flow Management Plans complete for Avon and Tarra Rivers	○	●	○	●	○	●	○	○	○	○	Priority 3
Monitor surface water salinity	**SC1.1**	Continuation of current surface water monitoring	○	○	●	●	○	●	○	○	○	○	Priority 1
	SC1.2	Complete 2 yearly report on compliance with SEPP of receiving waters pumps are discharging to, 5 yearly reports for other waterways	○	○	●	●	○	●	○	○	○	○	Priority 1
Monitor and report on salinity in Clydebank Morass	**SC2.1**	Continued spot salinity monitoring of Clydebank Morass. More intensive monitoring may be required prior to salinity control option implementation	○	○	●	●	○	●	○	○	○	○	Priority 1
	SC2.2	Yearly reporting on sallinity and trends to commence once control options are implemented	○	○	●	●	○	●	○	○	○	○	Priority 1
Monitor and report on salinity in Dowd Morass	**SC3.1**	Continued monitoring of bores in and around Dowd Morass, and current continuous salinity and level monitoring	○	○	●	●	○	●	○	○	○	○	Priority 1
	SC3.2	Yearly reporting on sallinity and trends to commence once control options are implemented	○	○	●	●	○	●	○	○	○	○	Priority 1
Monitor salinity in other wetlands	**SC4**	Monitoring of other wetlands to be addressed following prioritisation	○	○	●	●	○	●	○	○	○	○	Priority 3

- **Table 54: Resource condition targets for surface water and wetland salinity**

Asset	Salinity Management Area	Salinity Management Objective	Resource Condition Target (RCT)	Time frame for RCT	Assumptions for RCT	MATs contributing to RCT
Clydebank Morass	Clydebank	Manage as a freshwater wetland that periodically undergoes complete drying. (generally less than 4000 µS/cm)	RCTS1: Increase in the period of time water salinity is below 4,000µS/cm from 27% to 35% of the time	15 years	Based on the results of a salt and water balance modelling study undertaken by SKM (2003c)	MAT OA1.1 + MAT OA1.2 + MAT SB1 + MAT IA2 + MAT IA3 + MAT IC2.2 + MAT IC2.3
Wetlands – Dowd Morass	Rosedale	Manage as a freshwater wetland that periodically undergoes complete drying (generally less than 1,500 µS/cm)	RCTS2: Increase in the period of time water salinity is below 1,500µS/cm from 55% to 60% of the time	15 years	Based on results of a salt and water balance modelling study undertaken by SKM (2003d)	MAT OA1.1 and OA1.2 relating to structures to prevent saline water entering wetlands
Wetlands – Lake Coleman	Rosedale	Manage as a freshwater wetland that periodically undergoes complete drying (generally less than 4000 µS/cm)	RCTS3: Increase in the period of time water salinity is below 4,000µS/cm from 4% to 10% of the time	15 years	Based on results of a salt and water balance modelling study undertaken by SKM (2004f).	
Wetlands – Heart Morass	Clydebank	Manage as a freshwater wetland that periodically undergoes complete drying (generally less than 4,000 µS/cm) (agreed for Crown land only).	RCT should be determined in consultation with the land manager once technical information is available			
Wetlands – Lake Kakydra	Clydebank	Manage as a saline lake of 5,000-20,000 µS/cm.	RCT should be determined in consultation with the land manager once technical information is available			
Wetlands - Curtin's Flat	Clydebank	Private land - no objectives known	RCT should be determined in consultation with the land manager once technical information is available			
Wetlands – Sale Common	Clydebank	Manage as a freshwater wetland that periodically undergoes complete drying (generally less than 1,500 µS/cm).	RCT should be determined in consultation with the land manager once technical information is available			
All other wetlands	All SMAs	To be determined	RCT should be determined in consultation with the land manager once technical information is available			MAT SA1 and DC1 to fill knowledge gaps followed by MATs DC2, DC3 and DC5 and OA1.1
Lake Wellington	Wellington	SEPP requires median TDS to be <8000mg/L (12,500µS/c,) and not prejudicing the beneficial use	RCTS4: Increase in the period of time the SEPP objective of a median salinity of 12,500µS/cm is attained (as required under Schedule F3 of the SEPP WoV)	15 years		
Lake Reeve	Reeve	Maintenance of background level	RCT should be determined in consultation with the land manager once technical information is available			

Asset	Salinity Management Area	Salinity Management Objective	Resource Condition Target (RCT)	Time frame for RCT	Assumptions for RCT	MATs contributing to RCT
Natural water courses	All management areas		RCTS5: To maintain the current compliance levels with SEPP salinity requirements (or ANZECC guidelines where the SEPP doesn't apply) except for the following target increases in compliance levels with the SEPP 90th percentile salinity guidelines: 1) Avon River at Stratford: >98% compliance (currently 94%) 2) Latrobe River at Swing Bridge: >98% compliance (currently 96%) 3) Thomson River at Swing Bridge: >98% compliance (currently 94%) 4) Bundalaguah Main Drain at outfall: >65% compliance (currently 54%) 5) Nuntin Creek at outfall: >30% compliance (currently 21%) 6) Perry River at Perry Bridge: >50% compliance (currently 35%) 7) Merrimans Creek at Prospect Rd: >80% (currently 67%) 8) Andersons Creek at Yallourn North Rd: >50% (currently 26%) 9) Bennetts Ck at Jeeralang Rd: >85% (currently 82%) 10) Flynns Ck at Princes Hwy: >70% (currently 60%) 11) Sheepwash Ck at Princes Hwy: >20% (currently 16%)	15 years	Based on a nominal increase in compliance for those rivers with a less than 95% compliance with the 90th percentile SEPP salinity guidelines. Greater compliance increases in Salinity Management Areas where recharge control works are likely to be concentrated and containing rivers known to be expecting increases in environmental flows (eg Thomson and Macalister Rivers).	Mainly MATs SA2, DC1, DC2, DC3, DC4, DC5, IC2.4 + SB1

On-ground works

The key activities mentioned in the previous sections that will reduce surface water and wetland salinity include:

- **Irrigation Salinity Program (Section 6.4):** Increased irrigation efficiency, surface and subsurface drainage (including groundwater pumping) and the planting of salt tolerant crops/pastures on saline land can beneficially affect key surface water and wetland assets within and bordering the Macalister Irrigation District including Latrobe, Macalister, Thomson and Avon Rivers, Newry Creek, Clydebank Morass, Heart Morass, Sale Common and the Ridge Morass. These activities will have the following beneficial effects:
  - Reduces the amount of saline land in the catchment area of the wetlands/rivers therefore reducing the saline overland flow discharge; and
  - Reduces the volume of saline groundwater discharging directly to the wetlands and rivers.

  These activities may also result in a slightly lower base flow component to river flow and wetlands but the overall effect on salt loads is expected to be positive.
- **Dryland Salinity Program (Section 6.5):** Increased plant water use in dryland areas and planting of salt tolerant crops and pastures will reduce salt input to some of the key rivers and wetlands affected by salinity including Perry River, Merrimans Creek, Andersons Creek, Bennetts Creek, Flynns Creek and Sheepwash Creek. However, increasing plant water use can also reduce runoff inflows to rivers and wetlands. In particular, tree planting can significantly reduce catchment yields. The net effect is potentially a slightly reduced flow and reduced water salinity.
- **Ocean Induced Salinity Program (Section 6.6):** Using engineering means to reduce the influx of saline water to key wetlands will significantly reduce the salinity of these wetlands. (Eg. Lower Latrobe, Thomson, Avon and Perry Rivers, Tom's Creek, Dowd Morass, Lake Coleman, Clydebank Morass and Backwater Morass.
- **Appropriate management of groundwater disposal:** Groundwater disposal (mainly through groundwater pumping, but also through deep drains) is generally into irrigation drains that outfall into rivers or lakes. Improved management of groundwater disposal, such as re-use of the pumped groundwater on farm where possible or disposal into channels where it can be re-used, can help to reduce surface water salinity. This is a complex issue as saline groundwater disposal can lead to increased surface water salinity while also reducing land salinity.

An additional activity to reduce salinity levels in rivers and wetlands, is to increase environmental flows in key rivers and flushing of wetlands affected by salinity, where diversion and/or storage has significantly modified the natural flow regimes (eg Latrobe, Avon, Thomson and Tarra Rivers and their floodplain wetlands). From a salinity perspective, the purpose of increasing environmental flows is to increase the level of compliance with the relevant State Environment Protection Policies for water salinity in defined waterways. Also increased environmental flows are potentially an important management action to decrease wetland salinity where they provide a source of fresh water to the wetlands. Examples include:

- Macalister, Thomson and Latrobe Rivers as a source of fresh water to Sale Common, Heart Morass, Dowd Morass and Lake Coleman;
- Avon River and Perry River as a source of fresh water to Clydebank Morass;
- Toms Creek as a source of fresh water to Victoria Lagoon, Lake Betsy and Red Morass; and

- Merrimans Creek and Carrs Creek as a source of freshwater to Lake Reeve.

Specific studies of the relationship between rivers and their adjacent wetlands are required before environmental flows to reduce wetland salinity can be appropriately recommended. For the most part, these studies have not been completed, with the exception of salt and water balance studies for Dowd Morass (SKM, 2003d), Clydebank Morass (SKM, 2003c) and Lake Coleman (SKM, 2004f). It is also important to note that salinity implications are just one of a myriad of other factors in determining the appropriate environmental flows. It is not the role of this plan to be prescriptive on the actual environmental flows adopted. Rather this plan provides direction on some of the salinity implications of changing environmental flows.

Implementation mechanisms

The implementation of the activities related to the Irrigation, Dryland and Ocean Induced Salinity programs have been previously discussed in Sections 6.4, 6.5 and 6.6.

Plans to increase the environmental flows in the Thomson and Macalister Rivers are already well advanced. *Our Water Our Future* (DSE, 2004) proposes increasing the Thomson River and Macalister River flows by 18,000ML/yr and 7,000ML/yr respectively. The increased flows are proposed to be sourced from:

- Thomson River: 10,000ML/yr reduction in Melbourne Water diversions and 8,000ML/yr from system savings; and
- Macalister River: 5,000ML/yr saved through improved distribution infrastructure in the Macalister Irrigation District and 2,000ML/yr from systems savings.

These increases in environmental flows are expected to reduce salinity levels in both of these key rivers and in the case of the Thomson River, increase the level of compliance with the relevant State Environment Protection Policy for salinity (the Macalister River already has 100% compliance). The increase in environmental flows will also provide opportunities for flushing and dilution of wetland salinity in the Heart Morass, Sale Common and Dowd Morass.

The environmental flow requirements of the Latrobe River are currently being assessed. From a salinity perspective, the key objective is to increase the level of compliance with the relevant State Environment Protection Policy for salinity and increase the opportunity to utilise fresh river flows to dilute salinity in Dowd Morass, the Heart Morass and Sale Common.

The West Gippsland Regional River Health Strategy (2005) provides the strategic direction for the protection, maintenance and enhancement of river health in West Gippsland. There are many synergies between the River Health Strategy (RHS) and the Salinity Management Plan for addressing surface water salinity. The management actions identified in the RHS that are expected to help reduce in-stream salinity range from revegetation of riparian zones with indigenous vegetation to increasing environmental flows in the rivers to provide additional flushing and dilution. The priorities given in the RHS to address water quality in river and stream reaches identified as currently exceeding the SEPP objectives for salinity (Table 78 – Appendix B) are shown in Table 55.

Table 55: Priorities as stated in the West Gippsland River Health Strategy (WGCMA, 2005) for rivers exceeding the SEPP salinity objectives

Waterway reaches currently exceeding the SEPP	River basin	Sub-catchment	Priority*	River reaches
Avon River at Stratford	Thomson	Lower Avon	Priority 3	ISC 20, 21, 26, 27
Latrobe River at Swing Bridge	Latrobe	Lower Latrobe	Priority 1	ISC 1, 2, 3, 4, 16
Thomson River at Swing Bridge	Thomson	Lower Thomson	Priority 3	ISC 1, 2, 16
Bundalaguah Main Drain at outfall	Thomson	Lower Thomson	Priority 3	ISC 1, 2, 16
Nuntin Creek at outfall	Thomson	Lower Avon	Priority 3	ISC 20, 21, 26, 27
Perry River at Perry Bridge	Thomson	Lower Avon	Priority 3	ISC 20, 21, 26, 27
Merrimans Creek at Prospect Rd	South Gippsland	Merrimans Creek	Priority 3	ISC 39
Andersons Creek at Yallourn North Rd	Latrobe	Upper Latrobe	Priority 1	ISC 23
Bennetts Ck at Jeeralang Rd	Latrobe	Discharges to Hazelwood Pondage	Not a priority in the RHS	All
Flynns Ck at Princes Hwy	Latrobe	Lower Latrobe	Priority 1	ISC 1, 2, 3, 4, 16
Sheepwash Ck at Princes Hwy	Latrobe	Lower Latrobe	Priority 1	ISC 1, 2, 3, 4, 16

*Priority 1: Very high and high risks, Priority 2: Very high risks, Priority 3: High risks

Barriers to adoption

The barriers to the adoption of management actions in the dryland, irrigation and ocean induced salinity programs that effect surface water and wetland salinity are given in Sections 6.4, 6.5 and 6.6.

The key barrier to adoption of increased environmental flows is the demand on the surface water resources for irrigation, stock and domestic supply and urban water supply. The balancing of the environmental flow requirements of rivers with the resource demands is beyond the scope of this plan and is part of the West Gippsland River Health Strategy (WGCMA, 2005).

Knowledge gaps

The key knowledge gaps are:

- Lack of information on many private and public wetlands and billabongs in the region including their ecological value, their management objectives and their threat from secondary salinity. In particular, there are a number of billabongs in and around the Macalister Irrigation District that are potentially being affected by irrigation salinity;
- For those wetlands or billabongs that are threatened by secondary salinity, little is known about the causes of salinity and the hydrology of the wetlands (exceptions include Lake Coleman, Dowd Morass and Clydebank Morass which have had detailed salt and water balance studies);
- Surface water salinity is only known at specific sampling locations but the extent and significance of the salinity is unknown;
- The lack of information on environmental flow requirements of key surface water resources including the Latrobe, Avon River and Perry Rivers; and
- There is little information on the biological and ecological salinity tolerances and optimal water regimes of the aquatic systems being managed.

Current activities that will partially fill these knowledge gaps include:

- Research projects being undertaken by Monash and Victoria Universities on Dowd Morass and Clydebank Morass;
- A water management plan is being developed by Parks Victoria for the wetlands fringing Lake Wellington;
- A West Gippsland wetlands management plan is planned to commence within the 2004/05 financial year as per the recommendations of the West Gippsland River Health Strategy (WGCMA, 2005);
- An environmental flow assessment has commenced for the Latrobe River and its lower wetlands as per the recommendations of *Our Water Our Future* (DSE, 2004) and the West Gippsland River Health Strategy (WGCMA, 2005); and
- Environmental flow assessments are planned for the Avon River and its tributaries (Freestone Creek, Valencia Creek and Perry River) and the Tarra River as per the recommendations of *Our Water Our Future* (DSE, 2004). These environmental flow assessments will aid in the development of Streamflow Management Plans for these rivers.

Recommended actions, prioritisation and management action targets

Recommended actions and projects based on the above discussion are outlined in Table 56.

- **Table 56: Recommended actions to address surface water and wetland salinity in addition to the actions stated in the irrigation salinity, dryland salinity and ocean salinity programs**

Management options	Potential future actions	Type of project	Benefit-risk score	Overall priority	2004-2005^	5 year management actions					5 year Management Action Targets	WGCMA partners
						2005-2006	2006-2007	2007-2008	2008-2009	2009-2010		
SA. Salinity Mapping												
SA1: Wetland Salinity Mapping	1) Complete an audit of the major wetlands and billabongs in the area using the Index of Wetland Condition methodology developed by DSE. The salinity status of the wetlands should be determined as part of this process; 2) Prioritisation of the wetlands for further work based on the results of audit. There are likely to be a few wetlands that are deserving of additional work including establishing appropriate monitoring regimes, hydrological investigations and studies of management options. 3) Information from technical work to be used to update West Gippsland Wetlands Management Plan	Research and Invest.	Not assessed	**Priority 1**							**MAT SA1:** Research and Investigation work complete including prioritisation of wetlands for further work. Monitoring regimes established in priority wetlands, management options investigated and included in West Gippsland Wetlands Management Plan and implementation commenced	DSE, Parks Victoria
SA2: Surface water salinity mapping	1) Further sampling required in streams currently showing saline stretches. 2) Further definition of the extent and significance of streams known to be currently exceeding SEPP or ANZECC guidelines from coarse first pass investigation	Research and Investigation	Not assessed	**Priority 1**							**MAT SA2:** Complete characterisation of surface water quality issues and prioritisation of key river reaches for implementation of management options	DPI
SB. Environmental Flows												
SB1: Environmental Flows	Provide input into environmental flow assessments for the Latrobe River, Avon River and Tarra River. Provide input into the Streamflow Management Plans for the Avon River and Tarra River on salinity issues. Implementation of the environmental flow recommendations.	Research and Invest. On-ground works	**37**	**Priority 3**							**MAT SB1:** Environmental flow assessments complete. Stream flow Management Plans complete for Avon and Tarra Rivers	WGCMA only

6.7.2 Monitoring, evaluation and reporting

The monitoring, evaluation and reporting program for this plan was guided by the Gippsland Monitoring Evaluation and Reporting Framework (SKM, 2004g). The monitoring, evaluation and reporting component of the salinity plan has a number of key objectives:

- To determine the progress towards the resource condition targets and the aspirational targets;
- To inform investors on the success or otherwise of salinity control works; and
- To allow new programs to develop taking into account previous successes and failures.

The key monitoring, evaluation and reporting activities for the irrigation, dryland and surface water salinity programs are shown in Table 57. Wherever possible, the monitoring of control sites should also be undertaken when determining the effectiveness of management actions or on-ground works.

- **Table 57: Key monitoring, evaluation and reporting activities for the Surface Water Salinity Management Program**

Resource Condition Targets	Timeframe for RCT	Monitoring to determine level of achievement of resource condition targets	Salinity Mangt. Area	Overall priority	5 year management actions						Evaluation and reporting to determine if resource conditions have been met	WGCMA partners
					2004/05^	2005/06	2006/07	2007/08	2008/09	2009/10		
To maintain the current compliance levels with SEPP salinity requirements (or ANZECC guidelines where the SEPP doesn't apply) except for the following target increases in compliance with the 90th percentile SEPP salinity guidelines: 1) Avon River at Stratford: >98% compliance (currently 94%) 2) Latrobe River at Swing Bridge: >98% compliance (currently 96%) 3) Thomson River at Swing Bridge: >98% compliance (currently 94%) 4) Bundalaguah Main Drain: >65% compliance (currently 54%) 5) Nuntin Creek: >30% compliance (currently 21%) 6) Perry River at Perry Bridge: >50% compliance (currently 35%) 7) Merrimans Creek at Prospect Rd: >80% (currently 67%) 8) Andersons Creek at Yallourn North Rd: >50% (currently 26%) 9) Bennetts Ck at Jeeralang Rd: >75% (currently 82%) 10) Flynns Ck at Princes Hwy: >70% (currently 60%) 11) Sheepwash Ck at Princes Hwy: >20% (currently 16%)	15 years	**MAT SC1.1:** Continuation of current surface water monitoring as part of the Victorian Water Quality Monitoring Network, the West Gippsland CMA network, the Southern Rural Water drain monitoring network and Waterwatch	All	**Priority 1**							**MAT SC1.2:** 2-yearly reporting on the compliance with the SEPP objectives in waterways where public groundwater control pumps are discharging. 5-yearly reporting of salinity against SEPP and ANZECC criteria in other waterways	SRW, GRWMP, Waterwatch, DSE
5% increase in the period of time water salinity is below 1,500µS/cm in Clydebank Morass (when salinity is >1,500µS/cm for an extended period of time, an associated loss in biodiversity occurs)	10 years	**MAT SC2.1**: Continued spot salinity monitoring of the morass by Waterwatch. More intensive monitoring may be required prior to implementation of salinity control options at the site.	Clydebank	**Priority 1**							**MAT SC2.2:** Yearly reporting on salinity values and trends should commence once control options are implemented.	Waterwatch
10% increase in the period of time water salinity is below 1,500µS/cm in Dowd Morass	10 years	**MAT SC3.1:** Continued monitoring of bores in and around Dowd Morass. Continuation of current continuous salinity and level monitoring.	Rosedale	**Priority 1**							**MAT SC3.2:** Yearly reporting on salinity values and trends should commence once control options are implemented.	
5% increase in the period of time water salinity is below 1,500µS/cm for all wetlands deemed to be affected by secondary salinity and be of high ecological value	15 years	**MAT SC4:** Monitoring of other wetlands should be addressed once prioritisation of wetlands is complete	All other wetlands	**Priority 3**								