
UPPER SOUTH EAST DRAINAGE NETWORK MANAGEMENT STRATEGY

June
2011

PREPARED UNDER SECTION
43A OF THE *UPPER SOUTH
EAST DRYLAND SALINITY AND
FLOOD MANAGEMENT ACT
2002*

DEPARTMENT FOR
WATER



Government of South Australia
Department for Water

EXECUTIVE SUMMARY

The Upper South East Drainage Network Management Strategy has been prepared to meet the requirements of Section 43A of the *Upper South East Dryland Salinity and Flood Management Act 2002* (USE Act). The USE Act requires the Minister to prepare an **Upper South East Drainage Network Management Strategy (Strategy)**, setting out the proposals and priorities for the management of:

- Upper South East Drainage Network infrastructure; and
- Key environmental features and significant agricultural issues in the Upper South East.

The Strategy outlines the core policy principles for the ongoing management of the Upper South East Drainage Network (USE Network) to meet the needs of key environmental features and habitats of biodiversity significance (mainly key wetland assets linked to the USE Network), and to address relevant significant agricultural issues (relating mainly to flood mitigation, groundwater and salinity management).

The Strategy includes four key themes, under which there are eight strategies and 27 core policy principles.

The key themes are:

- Theme 1 - Supporting sustainable agricultural business and the regional economy
- Theme 2 - Protecting and enhancing the region's biodiversity assets
- Theme 3 - Sustainable surface and groundwater management
- Theme 4 - Effective and efficient governance

The Strategy is also supported by a complementary Implementation Plan.

The strategies and core principles are outlined in the following pages.

**THEME 1:
Supporting
sustainable
agricultural
business and
the regional
economy**

Strategy 1 - Maintain effective regional arterial flood and salinity management services

Principle 1.1

To the extent possible, maintain an effective arterial flood management service to minimise the impact of flooding events on agricultural lands.

Principle 1.2

Harvest floodwaters as environmental flows to key wetland systems across the region (including the south lagoon of the Coorong) and act reasonably to minimise negative impacts of such flows on adjacent agricultural lands.

Principle 1.3

Maintain an effective arterial groundwater drainage service to those parts of the landscape identified as at risk to dryland salinity, to mitigate salinity and enable salt affected land to increase its productive potential through on-farm management measures.

Principle 1.4

Improve regional stakeholders' capacity to access relevant regional water resource information including real time flow, water quality and flow prediction information via the internet.

Principle 1.5

Provide flood and salinity management services that acknowledge both upstream and downstream landholders and aims to apportion the costs and benefits of water flow management equitably across the total catchment.

Strategy 2 – Strategically enhance and extend the capabilities of the USE Network

Principle 2.1

Progressively review the purpose, operation and functional design of drain infrastructure (including related 'private works' and infrastructure in the Lower South East) and where feasible reengineer infrastructure, to optimise its capability to manage water for agricultural production and environmental purposes.

Principle 2.2

Provide transparent and open assessment criteria for determining appropriate on-farm 'private works' developments, based on their consistency with, and capacity to augment the purposes and functions of the USE Network, subject to relevant legislation (and associated policies), technical, hydraulic and environmental assessment.

Strategy 3 – Ongoing development and application of the Adaptive Flows Management Framework

Principle 3.1

To the extent possible, manage the delivery of the maximum available volumes of suitable water to meet the environmental flow requirements of key wetland systems across the landscape (including the south lagoon of the Coorong) – recognising the need to reasonably manage such environmental flows to minimise negative impacts on agricultural land outside of targeted wetland assets.

Principle 3.2

Other than where specifically planned for a particular application, maintain (to the extent possible) a separation of saline groundwater and fresh surface water resources so as to optimise available water suitable for environmental purposes.

Principle 3.3

Direct available water along historic source water catchments from the Lower South East to the USE, via the REFLOWS floodways, to provide environmental flows to key wetland systems – including the south lagoon of the Coorong.

Principle 3.4

Further develop the USE Network in accordance with regional water management objectives, to harvest available surface water resources (and suitable groundwater resources) from the agricultural landscape and deliver these as environmental flows to environmental assets, including key wetlands across the region.

Principle 3.5

Where feasible, aim to improve the condition of environmental assets, including *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed endangered species by directing and managing available water of suitable quality to those areas, at appropriate times, frequency and duration.

Strategy 4 – Assist to maintain key biodiversity assets, particularly key wetland assets

Principle 4.1

Contribute to regional biodiversity planning and management outcomes which may include long term conservation of remnant biodiversity assets (particularly key wetland assets) through public and/or private land management practices and agreements, where feasible.

Strategy 5 – Ongoing generation of knowledge to underpin science based policy and operational management

Principle 5.1

Maintain and optimise a comprehensive hydrometric monitoring network to underpin the management of water resources through the USE Network.

Principle 5.2

Maintain and further develop an ecological response monitoring and evaluation program to underpin the refinement of ecological conceptual models, environmental flow prescriptions and other biodiversity conservation and enhancement measures.

Principle 5.3

Maintain an ongoing program of ecological, water resource and soils assessments and studies to continuously update and improve knowledge and understanding of their interrelationships with the functions of the USE Network, and ensure the management of the system is responsive to scientific information.

Principle 5.4

Continue to identify, promote and support new research initiatives to fill knowledge voids, strengthen science based policy development, and inform adaptive management process.

Principle 5.5

Facilitate access for regional agencies and stakeholders to relevant regional water resource information via the internet.

Strategy 6 – Ensure that regional water resource planning and management provides for the security of environmental water requirements

Principle 6.1

Maintain a central involvement with water allocation planning processes and provide key policy, scientific and operational knowledge to planning, and decision making to ensure consistency in approach, particularly in relation to environmental water requirements for environmental assets.

Principle 6.2

Apply scientific approaches and use data, information and knowledge outputs from the Adaptive Flows Management Framework to inform regional water resource management objectives.

Principle 6.3

Contribute to the ongoing development and refinement of knowledge and understanding to underpin water resource allocation and management processes, particularly regarding:

- regional hydrology and water quality;
- the functional nature of regional catchments and topography (as it relates to hydrology);
- the character, condition, threats to and environmental water requirements of water dependant ecosystems within the landscape; and
- the functionality and operability of the USE Network to manage water for agricultural production and environmental purposes.

Strategy 7 – Sustainable maintenance and strategic development of the USE Network

Principle 7.1

Establish an operations and maintenance program for all USE Network infrastructure that includes a life cycle assessment and annual work program based on risks and priorities.

Principle 7.2

Progressively review the purpose and functional design of drain infrastructure (including related 'private works' and infrastructure in the Lower South East), and where feasible reengineer infrastructure to optimise its operational capability and flexibility to apply water resources to the best purpose.

Strategy 8 – Review the legislative platforms and governance arrangements for the management of water resources in the South East

Principle 8.1

Review and redevelop legislation, as appropriate, to strengthen and integrate these legislative platforms (including the transition of responsibility for USE Program infrastructure and operating systems).

Principle 8.2

Review governance arrangements for regional decision making (including cross border agreements) in relation to water resource management to improve integration regarding water allocation, environmental water provision, and management of the drainage system, and ensure operational policies are complementary.

Principle 8.3

Review and where possible consolidate stakeholder engagement frameworks for water resource management and systems operations that include procedures for formal notification to landholders and a strategy for local landholder involvement in the management of the system.

Principle 8.4

Strengthen the capacity of the appropriate regional management body/ authority to maintain and operate the USE Network, by developing and resourcing a robust annual business planning process that identifies how the system will be managed and operated including resource requirements, work program and budget.

Principle 8.5

Develop the Adaptive Flows Management Framework and decision support system to include the entire drainage network of the South East and to incorporate increasing levels of system automation.

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INTRODUCTION

Purpose

The purpose of the Strategy is to outline the policy principles for the ongoing management of the USE Network to meet the needs of key environmental features and habitats of biodiversity significance (mainly key wetland assets linked to the network), and to address relevant significant agricultural issues (relating mainly to flood mitigation, groundwater and salinity management). This is in the context of:

- Managing water resources that are or may be manipulated by the USE Network, for purposes including environmental flows, flood mitigation and groundwater/salinity management;
- Supporting both environmental and agricultural production values that are affected by the manipulation of water resources within the USE Network;
- Managing discharges from the USE Network, including that to the south lagoon of the Coorong; and
- Further developing and managing infrastructure within and/or relating to the functions of the USE Network.

The policy principles outlined in the Strategy are expressed under four themes:

- **Theme 1 - Supporting sustainable agricultural business and the regional economy**
- **Theme 2 - Protecting and enhancing the region's biodiversity assets**
- **Theme 3 - Sustainable surface and groundwater management**
- **Theme 4 - Effective and efficient governance**

The current managing authority, the Upper South East Program Board (USE Program Board) ceases as at 30 June 2011, at which time the system will move from a construction program to ongoing operation, maintenance and management. The Strategy will provide a new managing authority with a high level policy document to guide the future management of the USE Network in a strategic manner. The Strategy is not an operational business plan but is supported by an Implementation Plan.

Background

The Upper South East (USE) region of South Australia covers an area of approximately 680,000 hectares. Over the past few decades the Upper South East Dryland Salinity and Flood Management Program (USE Program) has involved the construction of a network of approximately 714km of saline and freshwater drains, and floodways connected to natural watercourses and wetlands.

A map of the USE region and USE Network is provided in **Appendix 1**.

The USE Program has sought to satisfy multiple, and at times competing objectives, including:

- Protecting agricultural and environmental lands from dryland salinity;
- Mitigating widespread and prolonged flooding;
- Providing environmental flows to protect and enhance wetland and watercourse ecological values; and
- Protecting and enhancing ecological values of remnant natural areas (terrestrial and wetland) through management agreements with private landholders.

The USE Program was initiated largely in response to a history of flooding and salinity issues in the USE region. It has been estimated that at the time 250,000 hectares or 40% of productive agricultural land in the USE region was degraded by salinisation caused by high groundwater levels and flooding. A further 200,000 hectares, including approximately 40,000 hectares of high value wetlands and native vegetation were also at risk.

The USE Network is not simply a drainage scheme; water is managed at a landscape scale to achieve economic, social and environmental objectives. It is an integrated system of drains, floodways, natural watercourses and wetlands, through which saline and freshwater flows can be manipulated, by approximately 140 flow regulating structures including regulators and weirs. Management of water within the USE Network prioritises the redirection of water into environmental assets, including key wetlands. It also recognises that agricultural productivity is an important component of the region and that an effective arterial flood management service must be maintained that minimises negative impacts on agricultural lands. Additionally, harvesting and delivering of environmental flows must be done in a manner that minimises negative impacts of such flows on adjacent agricultural lands.

Legislative Framework

Since 2002, the USE Program has been delivered under the USE Act.

Section 43A of the USE Act requires the Minister to prepare the Strategy, setting out the proposals and priorities for the management of:

- USE Network infrastructure; and
- Key environmental features and significant agricultural issues in the USE.

The Strategy must be consistent with the State Natural Resources Management Plan [prepared under the *Natural Resources Management Act 2004* (NRM Act)] and give consideration to the provisions and administrative requirements of:

- NRM Act (including the South East Natural Resources Management (NRM) Plan and relevant Water Allocation Plans);
- Relevant Environment Protection Policies (EPPs) under the *Environment Protection Act 1993*;
- *South Eastern Water Conservation and Drainage Act 1992*; and
- Provisions of other relevant Acts – including for example; National Park Management Plans; cross border water resource agreements; and the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act).

Under the USE Act, the Minister is required to consult with other relevant Ministers in relation to proposals within the Strategy and to furnish a copy of the Strategy to the Natural Resources Committee of Parliament. The Strategy must be reviewed at least once every three years. An important distinction under Section 43A of the USE Act is the definition of 'Upper South East', which includes any other area of the State that is connected to the Project Area (ie the USE Network) by means of a watercourse, or by virtue of processes or activities that occur in that area and have a significant effect on the Project Area, and vice versa. This essentially expands the scope of the Strategy to consider upstream source water as far south as Kalangadoo and to the Victorian border, and downstream into the Coorong and Murray Mouth.

The Strategy outlines the historical, practical and legislative context in which the USE Network operates. The Strategy articulates the high level strategies and core principles under which the USE Network will be managed. It also provides information regarding the management of water through the USE Network (Chapter 3) and the management of key environmental features and significant agricultural issues at the regional level (Chapter 4) through the functions of the USE Network.

This Strategy should not be confused with the Adaptive Flows Management Framework and associated decision support system that has been developed to manage flows within the USE Network at the cyclic (annual) planning and operations levels. This more dynamic process of management will however be consistent with the general principles outlined in the Strategy.

An **Implementation Plan** has been developed to complement the Strategy. The Implementation Plan identifies how the Strategy will be applied to management priorities of

the USE Network, in a practical sense. The Implementation Plan provides additional information to assist the managing authority to manage the system and provide transparency to stakeholders regarding the management of the USE Network at both whole of region and sub-regional scales. This includes identifying areas for future investigations and works to improve or extend the capabilities and operations of the USE Network as an integrated system. This forms the basis for prioritising expenditure as part of the managing authorities business planning processes.

CHAPTER 1: UPPER SOUTH EAST PROGRAM

The South East region of South Australia is a large area, with a relatively small population based predominantly in the southern part of the region. The South East Regional NRM Plan (2010) contains a comprehensive profile of the South East region¹.

The total drainage system of the upper and lower South East is a critical part of the region's economic and social infrastructure which supports the region's capacity to undertake economic activity, maintain transport networks and protect highly valued natural environments. Stakeholders of the USE Network comprise persons and groups that have an interest in the management of water in the drainage system for economic, social and/or environmental purposes. This includes:

- South East community;
- Local and regional organisations and groups;
- State organisations and groups;
- Industries;
- Local Government;
- Non Government Organisations;
- State Government; and
- Australian Government.

Today, the South East region of South Australia is a highly modified landscape. Broad scale land clearing and an extensive drainage network have converted what was once a wetland dominated landscape into agricultural production on a vast scale. Land use is dominated by livestock production, dryland and irrigated crop production, and plantation forestry. This has generated wealth and prosperity for both the region and South Australia.

Historically, the South East featured a vast area of interconnected wetlands that covered some 40% of the landscape. In wet years, surface water that was trapped in the landscape by remnant sand dune ranges, flowed northwards and provided freshening flows to the southern lagoon of the Coorong via Salt Creek. It is estimated that today, less than 6% of the original wetlands in this landscape remain and those remaining are subject to a significantly altered hydrology.

As part of the region's development, extensive cross catchment drainage schemes were constructed in the South East to intercept surface water flows and remove them from the landscape. Since the early 1900s instead of surface waters from the Lower South East flooding the USE, water has been drained to the sea. This has resulted in altered water

¹The South East Regional NRM Plan (2010) is available at: <http://www.senrm.sa.gov.au>

flows into wetlands and watercourses. Subsequently, the region's environmental health has been severely compromised both in terms of quality and quantity.

Dryland salinity and periodic broad scale flooding are well recognised and documented problems affecting the USE region. Salinity is not a new feature in the USE, but it became an increasing problem with the demise of lucerne following aphid infestations in 1978, and subsequent widespread flooding during the 1980s and early 1990s.

The USE Dryland Salinity and Flood Management Environmental Impact Statement (EIS) and associated Plan sought to analyse the driving factors of the region's salinity problem and identify strategies to alleviate it. A multidimensional approach was necessary to address the existing salinity threat and the risk of its expansion; and that drainage was a fundamental component of the solution.

The Plan identified a multi-pronged approach to managing these problems, including major programs focussing on:

- Drainage of saline groundwater and mitigation of prolonged flooding;
- Management of environmental flows to key wetland systems;
- Conservation of remnant vegetation;
- Revegetation for biodiversity and recharge control; and
- Improving agronomy practices in a salt-land environment.

Subsequently, the South Australian and Australian Governments committed to the USE Program including the establishment of necessary legislative and policy provisions to support this initiative, including the USE Act.

Importantly, the USE Act provides for:

- The establishment of the USE Program;
- The acquisition by the Minister of a secure works corridor;
- The control by the Minister of private (drainage/water diversion) works;
- The provision to raise a regional contribution to the scheme; and
- The capacity to offset financial contributions for areas of land entered into management agreement.

Salinity and drainage in the USE has continuously attracted debate and exposed a range of perspectives and opinions. The implementation of the USE Program, particularly the engineering works - although supported by the majority of landholders in each catchment in which drainage development was proposed - has often been the subject of criticism by some stakeholders. Addressing community concerns has been a key aspect in the design and construction phases of the USE Program.

Overview of the USE Program

Under the USE Act, the Minister for Environment and Conservation has executive authority for the USE Program.

The Department for Water (formerly Department of Water, Land and Biodiversity Conservation) was charged with the responsibility to deliver the USE Program, in collaboration with other key State agencies and regional authorities. This included the South East Natural Resources Management Board (SENRM Board) and South Eastern Water Conservation and Drainage Board (SEWCD Board), in close consultation with landholders and peak industry bodies.

The USE Program Board was established to provide strategic policy and business direction to the USE Program. The USE Program Board considers and provides direction on all components of the USE Program at the strategic level and reports to the over viewing bodies (the Natural Resources Committee of the South Australian Parliament, and Australian Government).

The USE Program Board comprises representatives from key stakeholder institutions including; the Australian Government (Department of Sustainability, Environment, Water, Population and Communities, and the Department of Agriculture, Fisheries and Forestry); the South Australian Government [DFW, the Department of Environment and Natural Resources (DENR) and Primary Industries and Resources SA (PIRSA)]; regional authorities (SENRM Board and SEWCD Board); the Conservation Council of South Australia; and regional landholders. The USE Program Board will cease as at 30 June 2011.

The USE Program is an integrated drainage scheme incorporating environmental and engineering sub-programs. It is designed to address flooding and salinity problems in the at-risk parts of the landscape², while at the same time providing for the conservation and enhancement of biodiversity assets across the region, with a particular focus on the delivery of environmental flows to key wetlands.

The Engineering Program

Engineering works are designed and constructed to protect and enhance agricultural and biodiversity values.

The design of the USE Network is based upon the balance of three broad water resource objectives:

² National Land and Water Resources Audit (2000) estimated that 250,500 hectares of land in the Upper South East was affected by salinity ie land where salinity is a dominant issue.

The EIS Background Paper – USE Dryland Salinity and Flood Management Plan (1992) provides survey findings on the extent of Dryland Salinity in the Upper South East of South Australia.

- To drain saline groundwater from the upper soil profile in the ‘at risk’ parts of the landscape and thereby mitigate the effect of salinity in the root zone of pasture and native plant species (requiring deeper groundwater drainage);
- To remove floodwaters caused by significant periodic rainfall events and alleviate the impact of broad scale and prolonged inundation of production land and groundwater recharge (requiring usually shallower drainage); and
- To provide for appropriate environmental flows to key wetland systems of regional, national and international significance (requiring floodways and regulators for manipulation of fresh surface water resources).

All major engineering works under the USE Program (funded by the National Action Plan for Salinity and Water Quality (NAP), and National Water Initiative) have been completed. The final engineering components, including the establishment of the REFLOWS floodways to reconnect historical environmental flow paths from catchment in the Lower South East to the wetlands of the USE (an expansion of the original scope of the USE Program) were completed in May 2011.

The Environmental Program

The Salt-land Agronomy Sub-Program

This program increased the understanding and adoption of salt-land agronomy techniques across the region. This included promotion of clay-spreading, establishment of dryland lucerne and salt-tolerant perennial-pasture alternatives, salt-land soil nutrient management and gypsum spreading to address post drainage sodium in water and soil (sodicity). This program is completed.

Biodiversity Conservation Sub-Program

This program developed and implemented a range of stewardship incentives to promote biodiversity conservation on private land. It developed a sophisticated market based initiative, business and conservation covenant framework and secured some 18,000 hectares of valuable remnant biodiversity assets across the region, including a number of significant wetland areas.

Wetland Management Sub-Program (including the Coorong)

Early work of this program focused on the development of release protocols to manage water quality in the south lagoon of the Coorong and Morella Basin. The program later funded initiatives that increased understanding and knowledge of the region’s wetlands, including development of the regional SA Wetland Inventory Database (SAWID). It also provided funding for protection of key wetland systems under conservation covenants

(along side the Biodiversity Conservation Sub-Program). Information from this program has been incorporated into the Adaptive Flows Management System, which is a critical component of the decision support system.

Adaptive Flows Management Sub-Program

This program developed the knowledge base, operating principles and decision support system to underpin the adaptive management of flows within the USE Network into the future. Work included development of comprehensive micro-topographic digital elevation modelling, wetland and infrastructure inventories, environmental flows objectives, flow management structure operating guidelines and a geospatial database/ decision support system. Over time, this work will continue to evolve as an adaptive management system and continue to provide an important foundation for decision making in an accountable and transparent manner.

The interconnected network of surface water and groundwater drains, floodways, watercourses and wetlands have been designed specifically to optimise distribution of environmental flows throughout the region, as well as to manage the impacts of dryland salinity and flooding. As part of these improvements, the *Restoring Flows to the Upper South East* (REFLOWS) initiative provides the capacity to capture some of the surface water that is currently drained to sea and use it to supplement environmental flows.

The REFLOWS Project (an expansion of the original scope of the USE Program) seeks to partially restore historical surface water flows from key source water catchments in the Lower South East (via two large constructed floodways) to deliver more reliable and substantial environmental flow volumes to key wetland systems in the USE. Additionally, in periods of high rainfall/runoff it aims to deliver environmental flows to the south lagoon of the Coorong. The construction phase of REFLOWS was completed in May 2011.

Additionally, the **Coorong South Lagoon Flows Restoration Project** (CSLFRP) is an action proposed in the long-term plan for the Coorong, Lower Lakes, Murray Mouth (CLLMM) region. This project is very similar to the existing REFLOWS Project. Government is currently investigating the feasibility of using a combination of natural watercourses, newly constructed floodways and existing drains to divert freshwater from the South East towards the south lagoon of the Coorong. This freshwater currently discharges to the sea, and has been linked to degradation of sea grass beds. Diversion of this water into the Coorong will comprise a reinstatement of historical flow paths and will help maintain the salinity of the south lagoon of the Coorong within the target range for ecosystem health. The project will increase the resilience of the Coorong ecosystem by providing additional freshwater, independent of conditions in the Murray-Darling Basin.

As at 1 July 2011, the USE Program will principally move from a construction phase to an operational optimisation phase. This includes the assignment of infrastructure, operating

systems and management responsibilities to a regional management authority. Furthermore, new legislation (South East Drainage System Operation and Management Bill 2011) is being drafted to support and establish new governance arrangements for the management of water in the drainage system in the South East. The Department for Water will assume management responsibilities in the intervening period between the finalisation of the NAP funded USE Program and establishment of a new management authority.

CHAPTER 2: STRATEGIES AND CORE POLICY PRINCIPLES FOR MANAGEMENT OF THE USE NETWORK

This Chapter outlines eight key strategies and related core policy principles for the management of the USE Network. The core policy principles provide guidance for planning and implementing these strategies.

These strategies and principles are not static but identify and provide guidance for matters that are considered fundamental to the role of the USE Network in supporting both environmental and agricultural production values of the region. The three-yearly review of the Strategy provides an opportunity to assess, review and update the Strategies and Principles, as necessary.

The policy principles outlined in the Strategy are expressed under four themes:

- **Theme 1 - Supporting sustainable agricultural business and the regional economy**
- **Theme 2 - Protecting and enhancing the region's biodiversity assets**
- **Theme 3 - Sustainable surface and groundwater management**
- **Theme 4 - Effective and efficient governance**

Theme 1- Supporting sustainable agricultural business and the regional economy

Strategy 1: Maintain effective regional arterial flood and salinity management services

Maintain and operate the USE Network to provide flood and salinity management services to landholders in the at risk parts of the landscape, whilst recognising the necessity to balance the delivery of environmental water for wetland systems.

Strategy 2: Strategically enhance and extend the capabilities of the USE Network

Strategically develop the USE Network to augment and enhance the capability to manage water resources across the landscape for agricultural production and environmental purposes.

Theme 2- Protecting and enhancing the region's biodiversity assets

Strategy 3: Ongoing development and application of the Adaptive Flows Management Framework

Further develop and apply the Adaptive Flows Management Framework and decision support system, created under the USE Program, as the basis for the

ongoing planning, water resource monitoring, operational management, and environmental response evaluation across the USE Network (including its extension over time to the Lower South East).

Strategy 4: Assist to maintain key biodiversity assets, particularly key wetland assets

Contribute to the protection and enhancement of key biodiversity assets of the South East. This may include securing key remnant biodiversity assets under management agreements and providing protection and security to these assets from wider farming and property management hazards - particularly to complement the delivery of environmental water to key wetland assets.

Theme 3- Sustainable surface and groundwater management

Strategy 5: Ongoing generation of knowledge to underpin science based policy and operational management

Support an ongoing program of knowledge generation to underpin policy development, planning, operational decision making and evaluation of the performance of the USE Network through adaptive management.

Strategy 6: Ensure that regional water resource planning and management provides for the security of environmental water requirements

Establish a strong position of influence in water resource management planning processes to ensure that environmental water needs are at the centre of thinking and decision making, and that critical environmental water requirements for wetland assets across the landscape are secured.

Strategy 7: Sustainable maintenance and strategic development of the USE Network

Maintain and where appropriate enhance the capability of the USE Network to optimise operational capabilities and flexibility to apply water to the best purpose.

Theme 4 - Effective and efficient governance

Strategy 8: Review the legislative platforms and governance arrangements for the management of water resources in the South East

Review and redevelop the legislative platforms and governance arrangements relating to the management of water resources in the South East region to strengthen the capacity of regional bodies to coordinate and deliver integrated water resource management policy, business and operations.

Strategies and Principles under these themes are outlined in the following pages.

THEME 1: Supporting sustainable agricultural business and the regional economy

Strategy 1 - Maintain effective regional arterial flood and salinity management services

Principle 1.1

To the extent possible, maintain an effective arterial flood management service to minimise the impact of flooding events on agricultural lands.

Principle 1.2

Harvest floodwaters as environmental flows to key wetland systems across the region (including the south lagoon of the Coorong) and act reasonably to minimise negative impacts of such flows on adjacent agricultural lands.

Principle 1.3

Maintain an effective arterial groundwater drainage service to those parts of the landscape identified as at risk to dryland salinity, to mitigate salinity and enable salt affected land to increase its productive potential through on-farm management measures.

Principle 1.4

Improve regional stakeholders' capacity to access relevant regional water resource information including real time flow, water quality and flow prediction information via the internet.

Principle 1.5

Provide flood and salinity management services that acknowledge both upstream and downstream landholders and aims to apportion the costs and benefits of water flow management equitably across the total catchment.

Strategy 2 – Strategically enhance and extend the capabilities of the USE Network

Principle 2.1

Progressively review the purpose, operation and functional design of drain infrastructure (including related 'private works' and infrastructure in the Lower South East) and where feasible reengineer infrastructure, to optimise its capability to manage water for agricultural production and environmental purposes.

Principle 2.2

Provide transparent and open assessment criteria for determining appropriate on-farm 'private works' developments, based on their consistency with, and capacity to augment the purposes and functions of the USE Network, subject to relevant legislation (and associated policies), technical, hydraulic and environmental assessment.

THEME 2: Protecting and enhancing the region's biodiversity assets

Strategy 3 – Ongoing development and application of the Adaptive Flows Management Framework

Principle 3.1

To the extent possible, manage the delivery of the maximum available volumes of suitable water to meet the environmental flow requirements of key wetland systems across the landscape (including the south lagoon of the Coorong) – recognising the need to reasonably manage such environmental flows to minimise negative impacts on agricultural land outside of targeted wetland assets.

Principle 3.2

Other than where specifically planned for a particular application, maintain (to the extent possible) a separation of saline groundwater and fresh surface water resources so as to optimise available water suitable for environmental purposes.

Principle 3.3

Direct available water along historic source water catchments from the Lower South East to the USE, via the REFLOWS floodways, to provide environmental flows to key wetland systems – including the south lagoon of the Coorong.

Principle 3.4

Further develop the USE Network in accordance with regional water management objectives, to harvest available surface water resources (and suitable groundwater resources) from the agricultural landscape and deliver these as environmental flows to environmental assets, including key wetlands across the region.

Principle 3.5

Where feasible, aim to improve the condition of environmental assets, including EPBC Act listed endangered species by directing and managing available water of suitable quality to those areas, at appropriate times, frequency and duration.

THEME 2: Protecting and enhancing the region's biodiversity assets

Strategy 4 – Assist to maintain key biodiversity assets, particularly key wetland assets

Principle 4.1

Contribute to regional biodiversity planning and management outcomes which may include long term conservation of remnant biodiversity assets (particularly key wetland assets) through public and/or private land management practices and agreements, where feasible.

THEME 3: Sustainable surface and groundwater management

Strategy 5 – Ongoing generation of knowledge to underpin science-based policy and operational management

Principle 5.1

Maintain and optimise a comprehensive hydrometric monitoring network to underpin the management of water resources through the USE Network.

Principle 5.2

Maintain and further develop an ecological response monitoring and evaluation program to underpin the refinement of ecological conceptual models, environmental flow prescriptions and other biodiversity conservation and enhancement measures.

Principle 5.3

Maintain an ongoing program of ecological, water resource and soils assessments and studies to continuously update and improve knowledge and understanding of their interrelationships with the functions of the USE Network, and ensure the management of the system is responsive to scientific information.

Principle 5.4

Continue to identify, promote and support new research initiatives to fill knowledge voids, strengthen science based policy development, and inform adaptive management process.

Principle 5.5

Facilitate access for regional agencies and stakeholders to relevant regional water resource information via the internet.

THEME 3: Sustainable surface and groundwater management

Strategy 6 – Ensure that regional water resource planning and management provides for the security of environmental water requirements

Principle 6.1

Maintain a central involvement with water allocation planning processes and provide key policy, scientific and operational knowledge to planning, and decision making to ensure consistency in approach, particularly in relation to environmental water requirements for environmental assets.

Principle 6.2

Apply scientific approaches and use data, information and knowledge outputs from the Adaptive Flows Management Framework to inform regional water resource management objectives.

Principle 6.3

Contribute to the ongoing development and refinement of knowledge and understanding to underpin water resource allocation and management processes, particularly regarding:

- regional hydrology and water quality;
- the functional nature of regional catchments and topography (as it relates to hydrology);
- the character, condition, threats to and environmental water requirements of water dependant ecosystems within the landscape; and
- the functionality and operability of the USE Network to manage water for agricultural production and environmental purposes.

Strategy 7 – Sustainable maintenance and strategic development of the USE Network

Principle 7.1

Establish an operations and maintenance program for all USE Network infrastructure that includes a life cycle assessment and annual work program based on risks and priorities.

Principle 7.2

Progressively review the purpose and functional design of drain infrastructure (including related 'private works' and infrastructure in the Lower South East), and where feasible reengineer infrastructure to optimise its operational capability and flexibility to apply water resources to the best purpose.

THEME 4: Effective and efficient governance

Strategy 8 – Review the legislative platforms and governance arrangements for the management of water resources in the South East

Principle 8.1

Review and redevelop legislation, as appropriate, to strengthen and integrate these legislative platforms (including the transition of responsibility for USE Program infrastructure and operating systems).

Principle 8.2

Review governance arrangements for regional decision making (including cross border agreements) in relation to water resource management to improve integration regarding water allocation, environmental water provision, and management of the drainage system, and ensure operational policies are complementary.

Principle 8.3

Review and where possible consolidate stakeholder engagement frameworks for water resource management and systems operations that include procedures for formal notification to landholders and a strategy for local landholder involvement in the management of the system.

Principle 8.4

Strengthen the capacity of the appropriate regional management body/ authority to maintain and operate the USE Network, by developing and resourcing a robust annual business planning process that identifies how the system will be managed and operated including resource requirements, work program and budget.

Principle 8.5

Develop the Adaptive Flows Management Framework and decision support system to include the entire drainage network of the South East and to incorporate increasing levels of system automation.

CHAPTER 3: MANAGEMENT OF WATER THROUGH THE USE NETWORK

The USE Network plays an important role in managing water to maintain and enhance economic, social and environmental values of the USE region. The USE Network has been designed and developed to provide for the drainage of saline groundwater and mitigation of salinity; alleviation of protracted inundation of agricultural lands; and to provide for the manipulation of freshwater for environmental flows to extensive remnant wetlands and habitats of biodiversity significance in the region.

This discussion explores the roles and functions of the USE Network at the regional scale in the following areas:

- Saline groundwater management;
- Flood mitigation;
- Environmental flows;
- Flow manipulation;
- Water quality management; and
- Protection of critical water resources.

3.1 Saline groundwater management

Groundwater drainage provides for drawdown of saline groundwater away from the surface root zone of plants. Most significantly this drawdown of the groundwater table during the summer months can impede the “wicking” of salts up into the root zone by lowering the water table beyond the effective zone of influence of evaporation. The subsequent leaching of salts from the upper soil profile (with winter rainfall) provides the opportunity for plants (both agricultural and native) to access freshwater in the profile during winter, which can dramatically improve their health.

Benefits: The most significantly salt affected areas in the landscape are characterised by sapphire and salt scalds. These areas essentially have no sustainable production value for grazing. Slightly less saline areas can be sown with salt tolerant *Puccinellia* pasture. *Puccinellia* is the last pasture option available before an area is essentially lost to production.

Recent field trials in the USE have shown that drainage and the resultant change in soil salinity/ water quality enable a range of far more productive pastures to be established. These include biannual fescues and in some cases legumes, which offer a two to four times increase in potential carrying capacity.

For much of the year groundwater drains carry a small 'base-flow' of typically quite saline water that has been drawn from the soil profile, within the zone of influence of the drain. The salinity of this flow can vary across the landscape from about 5000mg/L to more than 30,000 mg/L. Approximately 15,000 - 20,000 megalitres of base flow are discharged via the USE Network each year, removing some 250,000 tonnes of salt from the landscape.

Following periods of significant rainfall, the drain base flow is added to by 'event flows'. These event flows are produced by either:

- Rainfall percolating through the soil profile into the drain, which leaches salt out of the soil profile and creates an increase in the salinity of the drain water; or
- In significant wet periods, by fresh over surface flows, which serve to dilute the salinity of the drain flow – often to a point where the resultant 'shandy' of water can be used for diversion into more characteristically brackish or saline wetlands that are often found in the downstream parts of the landscape.

The management of saline groundwater directly links with Principles 1.3 and 2.1.

3.2 Flood mitigation

Drainage of floodwaters serves to alleviate broad scale and prolonged inundation of the landscape, associated with significant seasonal rainfall events. Such inundation has been known to put large production areas under water for many months. This can impede access to stock (and landholders) and can destroy large areas of improved pasture. It also contributes to recharge of the groundwater table and can exacerbate the subsequent salt expression process.

Surface water drainage serves to mitigate flood damage, loss to production area and carrying capacity, and pasture or stock replacement costs. Importantly, regional landholders have expressed the view that such surface water drainage can give them the confidence to invest in, and establish, deep rooted perennial pastures (without the risk of loss due to flooding).

Through flows of fresh surface water (particularly in significant volumes) also serve to flush salts from the landscape surface and upper soil profile. This freshens the plant root zone - a process that some landholders have described as 'healthy-wet'.

Floodwaters can be carried through the landscape via catch-drains and floodways into natural watercourses, where they can be delivered as environmental flows to key wetlands.

Flood mitigation directly links with Principles 1.1, 1.5, 2.1 and 3.1.

3.3 Environmental flows

Environmental flows are an essential component of catchment health. Many wetland systems are suffering from extreme dehydration as a result of previous regional drainage schemes, and local modification of flow paths and wetland sills by individual landholders. This has been further exacerbated by significantly lower than normal rainfall over the past decade. Subsequently, all fresh surface water drained from production areas of the landscape (see 3.2) must be managed appropriately to optimise environmental flows.

In the USE, the redirection of water resources into regional wetland system offers significant public and private benefit. The manipulation of environmental flows through the USE Network (including the capacity for inter catchment transfers) supports the maintenance of a 'healthy-wet' landscape, by harvesting surplus fresh surface water from production areas and moving this to and through wetland systems. These environmental flows rehydrate water dependant ecosystems (including floodplain vegetation), freshen the soil profile, and flush and transport salts from the landscape.

In addition to providing for environmental water needs of key wetland systems and habitats of significant biodiversity, well managed environmental flows can ensure:

- Accessible production areas and secure improved pastures;
- Well hydrated floodplain areas supporting production and biodiversity values;
- A well managed watercourse system that provides for the flushing and transportation of salts from the landscape; and
- Broader ecosystem services.

Environmental Flows directly link with Principles 1.2, 3.1, 3.2, 3.3, 3.4, 3.5

3.4 Flow manipulation

The USE Network is an integrated system of drains, floodways, natural watercourses and wetlands, through which flows of different natures can be manipulated to achieve a variety of objectives. This is done via a sophisticated arrangement of approximately 140 flow regulating structures including regulators and weirs.

To provide guidance for wetland management the Adaptive Flows Management team (located within the SEWCD Board), in collaboration with the Department of Environment and Natural Resources, has developed a framework, which identifies 14 Regional Wetland Landscape Unit types.

Conceptual models for each wetland unit type describe key environmental values and functional hydrological requirements. These wetland profiles are used to define management prescriptions and environmental flow objectives for wetlands across the region.

Flow manipulation directly links with Principles 3.1, 3.2, 3.3, 3.4, 3.5

The **Adaptive Flows Management Framework** draws upon these environmental flow objectives to plan and manage flows within the USE Network.

The manipulation of environmental flows within a complex set of catchments (as those of the USE) requires a comprehensive understanding of the system and its processes. It also requires the capacity to make informed decisions within the limits of existing knowledge. The principle of adaptive management is to continuously improve management knowledge through structured experimentation ('learning-by-doing'), modelling and ongoing monitoring and evaluation. The growing knowledge and experience base is captured within a decision support system, and drawn upon to inform future planning and operational decision making.

Considerable work has been done to develop the knowledge base, operating principles and decision support system to underpin the adaptive management of the USE Network into the future. This work has included the development of:

- Natural asset (wetland) and built infrastructure inventories;
- Comprehensive micro-topographic digital elevation modelling;
- Wetland 'characteristic type' model and environmental flows objectives;
- Flow management structure operating guidelines; and
- Geospatial database as the platform for the decision support system.

This work has resulted in the development of an interactive database that:

- Holds the collective body of knowledge relating to the USE Network - landscape features, ecological assets (wetlands), operating infrastructure and water resources;

- Captures relevant meteorological, hydrological, ecological and operational data about how the landscape and the USE Network are functioning;
- Defines the current flow management prescriptions for catchment management units and in some cases individual wetlands or wetland complexes;
- Identifies the current operating principles and 'rules' for the USE Network (condition-based diversion triggers for example) - from the catchment level down to individual regulators; and
- Makes this information available to decision makers when planning the management of the USE Network and/or considering specific management decision options.

This work is well advanced and will continue to evolve as an adaptive management system.

Adaptive Flows Management directly links with Principles 5.2, 5.3, 5.4, 6.2

A comprehensive regional hydrological monitoring network has been established, including approximately 71 surface water and 82 groundwater monitoring stations. Many of these are linked by telemetry to provide real time information to a centralised planning and operations centre, established within the SEWCD Board offices.

This hydrological monitoring network enables managers to monitor rainfall in the upper portions of catchments and to estimate flows from key source water areas in the Lower South East and western Victoria. This capability provides managers with the necessary data and information to model, plan for, predict and manipulate flows throughout the USE Network.

Over the past seven years, an annual regional water quality monitoring program has been implemented. This program has established a comprehensive picture of the condition of flows through the USE Network, to assess salinity levels in flows and to monitor for the occurrence of a range of other potential contaminants such as nutrients, pesticides, heavy metals and petrochemicals.

Catchments of the USE are comparatively low risk by nature as water quality within the USE Network is generally very good. Of notable exception is the presence of salt within the landscape, which can influence the quality of groundwater base flows and (under certain circumstances) surface water quality.

A regional wetland monitoring program has enabled managers to monitor the condition of key wetland systems throughout the region and evaluate environmental health in response to environmental flows. This program provides real time data on wetland hydration, salinity and other water quality attributes and has been complemented by a seasonal program of

aquatic vegetation and fauna monitoring. Targeted sampling is also conducted for other potential contaminants where a risk has been identified.

The optimisation of environmental flows to targeted wetland assets is a dynamic process, influenced by such factors as:

- Individual wetland landscape characteristic and associated environmental flow needs;
- Historical pattern of environmental watering;
- Annual rainfall/runoff profile and source water availability; and
- Operational capability.

It is not beneficial to attempt to define specific flow priorities to individual wetland assets in a 'static' sense. However, the **Implementation Plan** aims to provide sufficient information to enable stakeholders to understand potential implications of the management of the USE Network to their general sub-regional area. This is achieved by means of a set of '*Management Principles*' statements for major source water catchments and network components across the region.

For this purpose, catchments, drains, floodways, watercourse and wetland systems of the region have been notionally divided into a number of logical 'management units'. The description of each of these management units and their related principles for future network management are presented in the **Implementation Plan**.

3.5 Water quality management

The Environment Protection (Water Quality) Policy 2003 establishes water quality criteria and provides that a person must not, by discharging a pollutant into any waters, cause any water quality criteria to be exceeded or, if already exceeded, to be further exceeded.

Since 2003 a comprehensive water quality monitoring program has been conducted across the USE Network. Although there is no specific discharge of waste into or from the USE Network, the monitoring program indicates that from time to time at points around the Network a small number of water quality criteria exceedances occur.

These are generally 'spot' exceedances of contaminants that are naturally present in the landscape. These are principally metals, most commonly; aluminium, iron, silver, copper, nickel, chromium and cadmium. There are also less frequent exceedances of selenium, zinc and (inorganic) arsenic - and other contaminants in far less frequent occurrences.

Monitoring data suggests that ‘spot’ exceedances do not move any distance downstream or accumulate throughout the system, but rather that they are very rapidly diluted (to below the relevant water quality criteria) by the volume of flow.

In the past the USE Program has prepared a *Water Quality Monitoring Plan and Procedures* document. This plan detailed the conduct of a systemic water quality monitoring program, within:

- The USE Network;
- Key wetland systems;
- Morella Basin (as the key control structure at the end of the system); and
- The discharge mixing zone in the south lagoon of the Coorong.

The monitoring program has become progressively more streamlined as knowledge about the system has grown and water quality risks have been evaluated and qualified.

Water quality monitoring directly links with Principle 5.2 and 6.3

Hydrological monitoring directly links with Principle 5.1

3.6 Protection of critical water resources

3.6.1 Water resource availability under changing climatic conditions and altered landscape hydrology

Climate change is recognised as a potential threat to water resources across much of Australia. Recent drought conditions in South Australia and an increased understanding of the future impacts of climate change have highlighted that changes to the water cycle can be expected, both in terms of supply (availability) and demand (how much water is needed).

Many locations in SA show a drying trend over the last decade or more. Although this is consistent with the projections of climate change it is hard to attribute this specifically to climate change or to cyclic climate variability. In examining the trend over the last century, there have been dry phases (and droughts) in the first half of the 1900s that are similar to the dry period experienced over the past few years.

The dry phase of the past ten years dramatically skews the rainfall trend downwards for this short period of analysis. However, the long term rainfall pattern suggests that the trend is only marginally below level. A detailed look at the data shows that the region has experienced such dry phases throughout recorded history.

Whereas temperature change is easier to detect and project, and there is confidence in the future climate change scenario projections, there is less confidence in the accuracy of future rainfall projections. However, there is a high degree of consistency between models on a dryer outlook for Southern Australia.

In 2006 DWLBC produced the report; “A Review of Hydrological Monitoring and Operational Information for the Drains, Watercourses, Wetlands and Regulators of the Upper South East: Climatological Information”. This report provides an analysis of the climatological patterns across the USE. The assessment of rainfall data patterns is similar to that of the Bureau of Meteorology, characterised by:

- A distinct lower than average period of rainfall over the past 10-12 years;
- The recent dry period is still within the normal cyclic nature of the long term record; and
- A long term rainfall trend for stations across the USE varying from marginally negative to marginally positive.

Modelled projections in global warming scenarios indicate decreasing rainfall and increasing temperature; this will likely result in increased evaporation and reduced runoff, which will further affect water resources. Although there is clear evidence that such changes will occur, there remains significant uncertainty about the rate and extent of change, and the pattern that it will follow.

The Fourth Assessment Report of the United Nations International Panel on Climate Change (2007) is based upon global scale modeling. The report reiterates the broad global features of climate change including the risk of:

<i>Warmer and more frequent hot days.....</i>	<i>Virtually certain</i>
<i>Warm spells / heat waves.....</i>	<i>Very likely</i>
<i>Increased areas affected by drought.....</i>	<i>Likely</i>
<i>More frequent heavy precipitation events.....</i>	<i>Very likely</i>

The report, ‘Climate Change Under Enhanced Greenhouse Conditions in SA’ (CSIRO) 2006, suggests that;

‘For the South East region projected annual and seasonal changes in temperature and rainfall for 2030 and 2070 point to annual rainfall decreases of 1-10% by 2030 and of 2 - 30% by 2070.’

However, the report also makes the qualifying observation;

‘However, given the large variability in rainfall and the differences between model simulations, it will be difficult to detect an enhanced greenhouse signal in annual rainfall in South Australia before 2050’.

Recent water resource modelling that underpins the planning for the USE Network factors in decreasing rainfall/runoff as a consequence of climate change. This work, undertaken for the purposes of the REFLOWS project feasibility assessment, evaluates future surface water resource availability based upon 10%, 20% and 30% yield reductions (the latter of which is regarded as a reasonable ‘worst case’ scenario).

Under the ‘worst case’ projection future rainfall/runoff cycles will continue to yield significant volumes of surface water at regular intervals (4 to 5 years in 10) and periodic extreme flow/flood events (perhaps 1 year in 10) - not inconsistent with historic patterns.

The significantly dryer than normal weather pattern experienced in the USE over the past 15 years, and corresponding decrease in the volume and frequency of surface water flow events has placed all wetlands in the region under stress. However, even during this period, the experience of seasons with moderate rainfall (e.g. 2004, 2009) demonstrates that the catchment area of the USE is capable of yielding substantial volumes of water to supply wetlands across the landscape, although certainly not often enough to provide optimum flows to all wetlands.

The water resource assessments identified that (even when making reasonable allowance for the effects of climate change and land use change in key catchment areas) the key source water catchments of the USE will yield significant flows of fresh surface water (10-50GL) with regular frequency.

Under conditions of reduced and uncertain rainfall/run-off, the capacity to manage significant flow events for environmental and other purposes is a critical goal. Through the development of the REFLOWS floodways, which is reconnecting historical source water catchments in the Lower South East, valuable additional flows can be delivered to key wetland systems in the USE, and in some years to the Coorong.

Additionally, the Coorong South Lagoon Flows Restoration Project (CSLFRP) is an action proposed in the long term plan for the Coorong, Lower Lakes, Murray Mouth (CLLMM) region. The project will increase the resilience of the Coorong ecosystem by providing additional freshwater, independent of conditions in the Murray-Darling Basin. The CSLFRP is the only project proposed under the long term plan for the CLLMM region that will increase freshwater inflows to the site. Modelling by CSIRO indicates that the CSLFRP, in combination with current existing inflows from the South East to the Coorong, has the potential to maintain the salinity of the south lagoon of the Coorong within the target range for ecosystem health, potentially even in the absence of barrage flows.

Protection of critical water resources directly links with Principles 1.2, 3.1, 3.2, 3.3 and 3.4

The vulnerability of regional water resources to land use change

The capacity to manage and deliver critical water resources depends not only on the development and operation of infrastructure, but on complementary water policy. This includes development and land use change, and water resource allocation, including cross border arrangements.

Historically, there has been very limited development of storage capacities and consumptive use of surface water resources in the South East. This is due primarily to the nature of the landscape (being very flat and porous and largely unsuitable for surface water storage), the comparatively good seasonal rainfall experienced across much of this landscape, and readily available groundwater of suitable quality.

Generally, agricultural businesses in the region have been based on low intensity broad acre farming. Several pockets of more intensive horticulture (generally vineyards, but also lucerne production) have been developed based upon irrigation using groundwater resources. In 2006-07 the USE and Lower South East had 87,000 ha of irrigated crops (ABS cat no. 4618.0)³. This increased to 89,268 ha in 2008-09, with 1215 agricultural business irrigating (or 46 percent of agricultural businesses) (ABS cat no.4618.0).

Groundwater resources of the region are highly valued and used primarily for irrigation of horticultural crops and some pastures. Water from unconfined (or water table) aquifers is easily accessible (less than 10 m in most low lying areas) and used extensively. These aquifers are recharged by local rainfall. Water from the confined aquifer originates in Victoria and is deeper (greater than 50 m) but generally of low salinity (600 - 3000 mg/L). In most areas it is subartesian but between Lucindale and the coast it is artesian and thus easily accessible and used to irrigate pastures. Water from the confined aquifer is not recharged by rainfall but in part from the water table and mainly through specific recharge areas. In the USE the water used for irrigation comes from unconfined aquifers which tend to be more saline. Irrigation inevitably increases the salinity of the groundwater and in some areas increased use has led to significant increases in salinity⁴.

Several factors have unfolded over the past few decade that stand to significantly change the historical profile of water resource use and management within the region.

1. The experience across the region of extended dry climatic conditions over the past 15 years, combined with an increase in general awareness of future climatic predictions under climate change scenarios, has heightened stakeholders' sense of

³ http://www.pir.sa.gov.au/wid/regions/south_east

⁴ Dairy SA Regional Action Plan 2000, http://www.pir.sa.gov.au/wid/regions/south_east/industries

the critical nature of water resources and focussed interest in securing water resources.

2. Dramatically declining water tables within the region, in particular the decline of key aquifers relied upon for irrigation activities, has led to a realisation by stakeholders that groundwater resources are not infinite and are directly linked to climatic and land use influences.
3. A general trend across agricultural industries to more intensive production practices (driven by contemporary economics), most of which call for access to secure water resources (and often greater volumes of water).
4. On a much broader scale, the development of intensive commercial plantation forestry has a significant capacity to affect both surface water yields and groundwater recharge. The region has a long history of pine plantation forestry. In contrast, the rate of expansion of hardwood plantation forestry has increased considerably (13% growth across the region) predominantly located in the Hundreds of Coles and Short and to a lesser extent in the adjoining Hundreds of Joyce, Spence, Killanoola and Monbulla⁵. As at December 2009, 42,154 ha of hardwood blue gum had been planted, representing a significant regional scale land use change factor⁶.

The full impact of this latter development, in terms of long term water resource availability is yet to be fully realised. The possibility of further large scale development of plantation forestry (particularly in key source water catchments, such as the Southern Bakers Range and Mosquito Creek) is a matter of concern for many stakeholders.

A regulation to declare commercial forestry a water affecting activity came into effect in June 2004, applying to groundwater resources within an area south of a line approximately from Naracoorte to Kingston. New plantations are required to account for their impact on groundwater resources through an offsetting water allocation, or where available, through the setting aside within the groundwater budget of forest threshold expansion opportunity (available in some groundwater management areas for plantation expansion). The draft Lower Limestone Coast Water Allocation Plan proposes a water licensing regime for plantation forest impacts on groundwater resources, subject to enabling legislation.

Subsequently, a heightened sense of competition for water resources across the region is likely be a feature in future water allocation planning processes. Such competition for

⁵ <http://www.waterforgood.sa.gov.au/wp-content/uploads/2011/03/south-east-regional-profile.pdf>

⁶ <http://www.gtplantations.org/>

available water resources will likely include consideration of water resources relevant to and/or contained within the USE Network.

It will be crucial in regional surface water planning and management to maintain a focus on and achieve adequate provision of environmental water. Environmental watering considerations need to take into account the function of the USE Network to deliver environmental flows from very large historical source water catchments to often quite distant downstream environmental assets (including the Coorong).

Impact of land use changes on regional water resources directly links with Principles 6.1, 6.2, 6.3

Cross border arrangements

Victoria and South Australia share ephemeral surface water resources in the border region. The management of these catchments links a number of agencies on each side of the State border.

At present there are no formal cross border surface water sharing arrangements in place between the South Australian and Victorian Governments. However, a cross jurisdictional pilot project (using the Mosquito Creek Catchment as a study area) has sought to identify and address issues brought about by fragmented management, and develop transferable catchment management protocols for the integrated and sustainable management of shared catchments. This project has worked to fill critical knowledge gaps and support the protection of key environmental assets in the Mosquito Creek Catchment, including Bool and Hacks Lagoons Ramsar Wetlands.

In 2009 the ***Connecting the Catchments*** Memorandum of Understanding (MoU) was established between nine South Australian and Victorian organisations to proactively manage the issues that affect cross border surface water catchment areas.

The goal of ***Connecting the Catchments*** is to collaborate in good faith to protect and enhance the environmental values linked to or within water catchment areas shared between Victoria and South Australia - balancing social, cultural and economic demands. This initiative reflects a clear commitment to collaboration in cross border catchment management.

The establishment of such arrangements to ensure whole of catchment approach to cross border catchment management is a fundamental requirement to securing future environmental flows from this key source water area.

Cross border arrangements directly links with Principle 6.1, 6.2 and 6.3

CHAPTER 4: MANAGEMENT OF KEY ENVIRONMENTAL FEATURES AND SIGNIFICANT AGRICULTURAL ISSUES

This Chapter examines the broad principles of managing key environmental features, habitats of biodiversity significance, and significant agricultural issues at a regional scale via the USE Network. This is in the context of:

- Key environmental features and habitats of biodiversity significance under the USE Act;
- Management agreements under the USE Act;
- Related management of ‘protected areas’;
- Implications for the management of native vegetation; and
- Significant agricultural issues.

4.1 Key environmental features and habitats of biodiversity significance under the USE Act

For the purposes of the USE Act, ‘key environmental feature’ means any of the following aspects of the environment: wetlands; water resources; native vegetation; natural habitats; environmental biodiversity; and other aspects of the environment that the Project is intended to protect or enhance, that are identified as key environmental features by the Minister by notice in the Gazette.

A number of references to key environmental features occur in the USE Act.

- The Minister in implementing the USE Program is to undertake initiatives to protect enhance or re-establish key environmental features in connection with the implementation of the USE Network;
- The Minister may enter into management agreements relating to the preservation, conservation, management or re-establishment of any key environmental feature;
- A person must not construct, remove, close off, obstruct or in any other way interfere with any works, or undertake any other activity that would be likely to adversely affect any key environmental feature; and
- The Minister may issue a *project order* for the purpose of protecting or enhancing any key environmental feature.

An important application of such ‘key environmental feature’ status is in a circumstance where an individual is determined to undertake a course of action (clearance, grazing practice, water management etc) which will adversely affect significant remnant biodiversity assets on their property or elsewhere.

In such circumstances the specification of these assets as key environmental features clearly identifies them for special consideration under the USE Act.

The management of key environmental features

Wetlands of the USE are being stressed by a decline in environmental flows. Arguably this pertains more to landscape modification over the past 50 years (with significant physical reductions to catchment areas and watercourse drainage) than to climate change or variability over the past 10 - 15 years. The latter has certainly highlighted this problem.

In recent years many wetlands along major watercourses of the USE have received reasonable environmental flows (in 2004, and to lesser degree in 2005). However, these flows did not fill the large wetland areas of the Northern Bakers Range, Gum Lagoon/Duck Island Complex, or Tilley Swamp. This was followed by almost no catchment runoff across the region in 2006 - 2008.

In the winter of 2009 many wetlands along the Marcollat, Bakers Range, West Avenue and Taratap watercourses again received a refreshing hydration, however flows were insufficient to fill or flush through to the large northern wetlands, which are the furthest down the catchment.

Wet winter conditions in 2010 provided significant system flows throughout the USE allowing multiple opportunities for the diversion of water into wetlands. This included sustained release from the Morella Basin into the Coorong (15GL), inundation of Lochaber Swamp from Drain E, inundation of the Taratap Swamps from the Taratap Drain, delivery of environmental flows to the West Avenue Watercourse, and filling of Willalooka Wetlands and Mandina Marshes.

An unseasonal rainfall event in December 2010 also enabled water to be diverted to the West Avenue watercourse.

The cumulative effect of a general decline in environmental flows has resulted in wide spread and significant change to wetland and floodplain ecosystem composition. This has seen:

- A general decline in emergent vegetation and sedgelands and the corresponding in-growth of woody species (*Melaleuca* and *Acacia*);

- A dominance to drier and salt tolerant species;
- The localised loss of species; and
- In some cases the opportunistic development or use of wetland areas for agricultural production.

In some circumstances, wetlands have been hydrated with suboptimal (saline) water, which has impacted upon the freshwater ecology that previously characterised these areas.

Climate change is recognised as an important factor for consideration in future management planning. However, it is also recognised that there will be wet years, wet decadal phases and extreme rainfall and runoff events in the future. These occurrences must be regarded as flooding and salinity driving risks as well as providing important opportunities to harvest critical freshwater resources for environmental flows.

Under any future scenario, environmental flows to the wetlands of the USE will be limited by modified catchments, changed and changing land use and reduced rainfall/runoff events (for shorter or longer periods of time). Under these circumstances it becomes crucial to actively harvest and manage available environmental flows from local catchments and remote source water areas, and to strategically direct suitable flows to key wetland assets.

The definition of the character and environmental flow requirements of key wetland assets across the landscape; the design of the USE Network; the development Adaptive Flows Management Framework and decision support system; and ultimately the planning, operation, monitoring and adaptive management of the Network provides the best opportunity to sustain these assets in the long term.

The interconnection of the USE Network with the region's natural watercourses and wetlands has been designed to manage flooding risks and the impacts of dryland salinity, and very specifically to optimise the distribution of environmental flows throughout the region.

As part of the USE Network there is an aim to capture some of the surface water from the Lower South East that is currently drained to sea and, through the REFLOWS floodways, to use it to supplement environmental flows to key wetland systems in the USE.

The ***Management Principles for Source Water Catchments*** and ***Management Principles for Drainage Network Management Units*** contained in the **Implementation Plan** identify future network management principles and priorities for each of these areas, including provision of environmental water to relevant key environmental features within each management unit.

At this time the identified list of wetland assets proposed as key environmental features represents the most important environmental assets, with respect to the functions of USE Network. Future inclusions may be identified from time to time on the basis of the ongoing learning that is inherent in the adaptive management process, and through the acquisition of a growing body of data and knowledge within the decision support system.

Where they have been established, individual management agreements (see 4.2) support the management of the USE Network by securing the status of wetland assets for biodiversity conservation purposes and by securing the right to apply environmental flows to these areas (in accordance with the defined prescription).

Generally, key environmental feature areas will have appropriate environmental flows delivered to them as part of the management of flows within the USE Network. Some wetland areas however are either naturally 'off stream' from the USE Network or have been isolated by some historic engineering works. In situations where such a wetland is nominated as a key environmental feature, the Minister has the capacity (under the USE Act) to:

- undertake works to protect, enhance or re-establish any key environmental feature;
- enter into a management agreement relating to the conservation, management or re-establishment of any key environmental feature; and
- issue a project (or reparation) order—for the purpose of protecting or enhancing any key environmental feature.

Most wetlands covered under a management agreement form a component area of an identified regional key environmental feature. Other portions fall within the protected area system (Parks and Heritage Agreements). Such work also benefits habitats of biodiversity significance.

4.2 Management agreements under the USE Act

Section 16 of the USE Act provides that the Minister may enter into a management agreement with landholder for the purpose of conserving and managing the environmental values of biodiversity assets on private lands.

The Minister has entered into a number of such agreements relating to biodiversity assets of a variety of types across the region, including a number of key wetland assets.

These management agreements are perpetual contracts, which are registered on the Certificate of Title for the relevant property and binds both current and futures owners of the land. These management agreements also incorporate a 15 year initial management

plan, which provides quite specific guidelines for the future management of these areas including where relevant the delivery of environmental flows to wetlands.

These management agreements ensure the appropriate management of wetland areas (in the context of wider property management) to which environmental flows will be provided via the USE Network, when available.

These management agreements do not generally address significant agricultural issues directly, as their focus is on environmental assets. However, the management of these areas in association with the wider USE Network does contribute to flood mitigation objectives, groundwater recharge and amelioration of salinity.

Management agreements over wetlands

Management plans (associated with each management agreement) for wetland assets are uniquely different from the wider number of agreements. They include specific objectives, strategies, requirements and conditions for environmental flows to these wetlands. These flow prescriptions are essentially 'targets' for level of inundation (Australian Height Datum [AHD]), hydration period, timing and return frequency, and (maximum) salinity level of environmental water.

These prescriptions are developed in the context of the Adaptive Flows Management Framework and are consistent with current knowledge and principles for environmental flows management identified for relevant wetland and 'network' components.

Individual management agreements create a contractual obligation for landholders (and future landholders) to cooperate with the management of environmental flows within the USE Network, as they relate to a particular wetland/s on their property. This is in accordance with the objectives and guidelines for environmental flows outlined in the respective management plan.

The delivery of environmental flows to wetlands covered by a management agreement may happen either passively (natural flow from a local catchment, requiring no manipulation), or actively (generally flows managed through the USE Network).

In establishing these prescriptions it is recognised that no individual can be held responsible for the availability of the desired environmental water, as climatic conditions are not within the control of either landholders or USE Network managers. It is also recognised that flow prescriptions may evolve in the future, based upon improved knowledge and/or climatic and landscape conditions.

Management plans include a provision specifying that environmental flow prescriptions are subject to the availability of source water of suitable quality and quantity. This provides practical protection for the landholder in the event that water is not consistently available. Other than an implied 'statement of intent' by virtue of the prescription there is no obligation upon the USE Network manager to deliver particular flows to any point in the landscape at any point in time, although this is clearly the objective when conditions allow.

Management plans provide very useful guidelines for future environmental flow planning and delivery to key wetland assets. They support the management of the USE Network under the Adaptive Flows Management Framework, by securing the status of wetland assets for biodiversity conservation purposes (excluding stock, managing vermin and pest plants, in some cases revegetation) and by securing the right to apply environmental flows to these areas in accordance with the prescription defined in the management plan.

4.3 Related management of 'protected areas'

A number of protected areas (eg Conservation Parks, Conservation Reserves, National Parks) in the USE feature wetland assets that have been affected by modified catchment hydrology. The management plans for these protected areas vary based upon their size, but more importantly based upon when these plans were developed and (as it relates to environmental flows) the level of knowledge regarding hydrology and environmental water requirements at that time.

All plans recognise that modified regional and local hydrology over many decades has and continues to impact upon environmental flows to wetland assets. Although most of the existing plans identify the objective of improving environmental flows to wetland assets, none provide detailed descriptions of the functional requirements of these wetland assets or prescriptions for the management of environmental flows. Generally, all plans identify the need to promote a surface water regime to reinstate periodic inundation of wetlands with acceptable quality water in a manner that (to the extent possible) reflects historical natural flow patterns.

The USE Program, DFW, DENR and SEWCD Board have collaborated to define the functional requirements of many of these wetland assets and establish targets for the management of environmental flows through the USE Network.

A discussion of the management of environmental flows to key protected areas is featured in the **Implementation Plan** - Management Principles for Source Water Catchments and Network Management Units.

4.4 Implications for the management of native vegetation

It is very likely that from time to time in the future, managed environmental flows will result in the inundation of wetland systems that will in the natural course of events affect native vegetation. Such inundation may disadvantage (kill) some vegetation associations (particularly invading terrestrial species, *e.g. Melaleuca*) and advantage other associations/habitats (*e.g. Gahnia* sedgelands, emergent macrophytes, *etc.* – generally the open water habitats) - which may well be part of the deliberate purpose of the inundation.

Wetlands of the USE (particularly the large wetland complexes) are not homogeneous in nature and are usually composed of a number of components:

- Geomorphological –sumps, floodplains, wet sedgeland ‘meadows’ etc;
- Hydrological – permanent and semi permanent ‘lakes’, seasonally inundated zones, episodically inundated zones etc; and
- Ecological – open water habitats, woodland communities, shrubland communities, sedgelands, emergent aquatic communities.

Although the arrangements of these components in wetland systems follow general patterns, there is variation based upon the randomness of historical events (hydration/inundation cycles) and equally dehydration and other propagation influences (fire events or wind patterns). A significant environmental event or sequence of events can and usually will change the arrangement of these components within a wetland or regional wetland complex.

Managed environmental flows, although they may be part of a longer term plan, will be executed as essentially ‘unique’ events, in essence, one annual (or even multi-annual) cycle in a longer series of management cycles. Each of these cycles have the capacity to advantage certain wetland components and disadvantage others.

The clearance of *Melaleuca* (an endemic native species) by fire or flooding is regarded as native vegetation clearance, under the provisions of the *Native Vegetation Act 1991*. This requires close consultation with and approval of the Native Vegetation Council. It may be appropriate to submit a general wetland inundation vegetation management plan to obtain formal endorsement from the Native Vegetation Council for such courses of action under the umbrella of the Adaptive Flows Management Framework and decision support system.

A case example: Tilley Swamp watercourse

Tilley Swamp watercourse was once a large, wide, open wetland complex, featuring: semi-permanent open water areas with emergent macrophyte assemblages; extensive *Gahnia* sedgeland; fringing *Melaleuca* shrub-lands; and terrestrial vegetation on elevated topography.

Tilley Swamp has not received substantial freshwater environmental flows or experienced regular prolonged inundation for several decades, largely as a result of catchment modification.

Putting aside the extensive clearance of native vegetation within this watercourse for agricultural production, the effect of this extended dehydration has been to diminish the existence of open water habitat with emergent macrophytic vegetation and *Gahnia* sedgeland in favour of tea-tree (*Melaleuca ssp.*). Such vegetation prefers dryer conditions and has now expanded across the watercourse area in the form of a closed canopy of tall shrubs (almost trees).

To re-establish the structure and ecological value of this wetland requires far more regular, large scale environmental flows and correspondingly longer periods of inundation – probably with an associated program of fire treatments to kill the large tree-form *Melaleuca* (which cannot be readily drowned by such inundation).

This management regime will advantage emergent macrophytic vegetation and *Gahnia* sedgeland (in slightly different topographic parts of the wetland landscape) and counter the current in-growth of tea-tree, killing the larger shrubs (with fire) and periodically ‘drowning’ small regenerating plants.

A detailed examination of this case, as an environmental benefit: risk assessment, can be found in the Tilley Swamp Risk Assessment, Stage 3 Report (USE Program, 2007).

4.4 Significant agricultural issues

The USE Network consists of a vast interconnected network of groundwater drains, surface drains and floodways, that are integrated with natural wetlands & watercourses to address the impact of salinity on regional agriculture and natural resources. Additionally, the USE Network aims to mitigate the impact of flood events across the USE region. Agricultural issues directly relating to USE Network function and management include;

- Cyclic water table rise and salinity, which impacts on the pasture production and carrying capacity of affected land areas (saline groundwater management); and
- Flooding and prolonged broad acre inundation, which may cause subsequent loss of pasture cover, and escalated groundwater recharge (flood mitigation).

This Strategy focuses on the primary functions and capabilities of the USE Network, including:

- Drainage of saline groundwater from the upper soil profile in the at risk parts of the landscape;
- Management of floodwaters to mitigate the impact of broad scale and prolonged inundation of agricultural land; and
- The provision of environmental flows to key wetland systems.

Saline groundwater management

Groundwater drainage provides for drawdown of saline groundwater away from the surface root zone of plants. This drawdown of the groundwater table during summer months can impede the “wicking” of salts up into the root zone by lowering the water table beyond the effective zone of influence of evaporation. The subsequent leaching of salts from the upper soil profile (with winter rainfall) provides the opportunity for plants (both agricultural and native) to access freshwater in the profile during winter, which can dramatically improve their health.

Flood mitigation

Floodwater drainage serves to alleviate broad scale and prolonged inundation of the landscape, associated with significant seasonal rainfall events. Such inundation has been known to put large production areas under water for many months. This can impede access to stock (and landholders) and can destroy large areas of improved pasture. It also contributes to the recharge of the groundwater table and can exacerbate the subsequent salt expression process.

Related or secondary issues requiring adaptation of on-farm management practices include:

- Clay spreading and delving to retain upper soil profile moisture and reduce groundwater recharge;
- The establishment of alternative perennial and salt land specialist pastures;

- Salt-land soil nutrient management; and
- Gypsum application to address sodicity (where it occurs).

During the USE Program a beneficial range of management options associated with agricultural and pastoral practices have been developed and adopted, which has enhanced on-farm viability in the USE. In conjunction with landowners, various primary production research agencies have developed improved agriculture production in parallel with the USE Program. Dryland salinity research has exhibited enhanced varietal fodder production, resulting in increased stocking rates. Several field days have demonstrated the success of this program from an agronomy perspective. Verification surveys have aggregated that over 200,000ha of improved pastures have been establishment in the region since inception of the USE Program and USE Network.

Flood and salinity risk management

Since the late 1800's, the landscape of the South East region has been extensively developed for primary production. The periodic broad inundation of the landscape was regarded as a limitation to development and a threat to the livelihoods of farming families.

As part of the region's development, extensive cross catchment drainage schemes have been progressively constructed throughout the South East since the mid 1900s, including extensive drainage schemes in the Lower South East and the USE. These arterial drainage services have been provided to areas across the region, which have previously been identified as having a significant flooding and/or salinity risk. These risks have been largely mitigated by the extensive drainage system and this service will be maintained and improved in the future as needs determine.

However, even under the changed climatic scenarios projected for the region, it is recognised there will still be episodes of extreme rainfall and associated runoff that will put large areas of low lying parts of the region under water. This will at times temporarily overwhelm the established water management engineering infrastructure. The USE Network provides for floodwaters to be harvested as environmental flows to key wetlands across the region (including the south lagoon of the Coorong). In doing so, the managing authority will act reasonably to minimise negative impacts of such flows on adjacent agricultural lands. Flood and salinity management services will acknowledge both upstream and downstream landholders and aim to apportion the costs of benefits of water flow management equitably across the total catchment.

Arterial engineering infrastructure is largely fit for purpose and will be maintained and managed by a regional authority. Strategic direction regarding the management of

environmental flows will be provided by the SENRM Board and scientific support from DFW and DENR.

Additionally, there is a need to review the functionality and design of infrastructure in the region. This includes some of the earlier components of the USE Network (such as the Fairview drain, the Bakers Range catch-drain and the Water Valley drain) and the Lower South East drainage systems to incorporate improved capability to manage environmental flows to wetlands. The REFLAWS Project is one example of a major rethinking and redesign of older infrastructure (in this case Drain M and Drain E) to improve its environmental flows management functionality.

Landholders will continue to be able to connect into the USE Network with on-farm 'private works' subject to the approval of the managing authority (currently the SEWCD Board), based upon case by case assessments.

Future arterial and private works developments will be assessed and designed upon the general principles developed for the USE Network. The focus will be to keep saline groundwater and fresh surface water separate, and to harvest excess surface water from the agricultural landscape and direct it into watercourses and floodways to provide for environmental flows to key wetland assets (as per the design principles of the Didicoolum Drain, the Taratap Drain and Bald Hill Drain for example).

Support to landholders in addressing the related secondary issues has and will continue to be coordinated through Primary Industries and Resources SA, SENRM Board and other agencies.

CONCLUSION

The Strategy outlines the core policy principles for the ongoing management of the USE Network to meet the needs of key environmental features and habitats of biodiversity significance (mainly key wetland assets linked to the USE Network), and to address relevant significant agricultural issues (relating mainly to flood mitigation, groundwater and salinity management). The Strategy is not an operational business plan but is supported by an Implementation Plan.

The current managing authority, the USE Program Board, ceases as at 30 June 2011. At this time, the system will move from a construction program to ongoing operation, maintenance and management. Governance of this phase is planned to occur under proposed legislation, the South East Drainage System Operation and Management Bill 2011.

The Strategy and Implementation Plan will provide a new managing authority with a high level policy document and guide for the strategic management of the USE Network into the future.

APPENDIX 1: REGIONAL WATERCOURSE AND DRAINAGE INFRASTRUCTURE

SOUTH EAST SOUTH AUSTRALIA
Regional Watercourse and Drainage Infrastructure



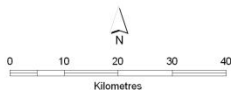
Upper SE Program drains, including Reflows

- Constructed Alignment
- Proposed Alignment

Drains

- SE Water Conservation and Drainage Board drain
- Private drain

- Main road
- Watercourse
- Water body or land subject to inundation



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