Shepparton Irrigation Region Catchment Implementation Strategy

Sub-surface Drainage Program

Five Year Review

2006/2007

Volume 1 - Final Report

GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

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It should be noted that due to differences in the approach used to derive the figures presented in this report that some of the figures may differ from those presented in the 2005/06 SSDP Key Performance Indicator Annual Report (G-MW, 2007).

Abbreviations

BCR	- Benefit-Cost Ratio
BSMS	- Basin Salinity Management Strategy
CAS	- Catchment & Agriculture Services
CMA	- Catchment Management Authority
C806a	- Nutrient Impacts on River Murray Project
DPI	- Department of Primary Industries
DSE	- Department of Sustainability and Environment
DV705	- Irrigation Drain Management (Surface) Project
D484a	- Shepparton Sub-surface Drainage Project
D484b	- Shepparton Region Sub-surface Drainage Project
D800	- Shepparton Region Surface Drainage Project
D806	- Co-ordination and Support for Community Drains Project
D841	- Shepparton Region Drain and Salt Load Monitoring Project
EPBC Act	- Environment Protection and Biodiversity Conservation Act 1999
FEDS	- Farm Exploratory Drilling Scheme
F&EP	- Farm and Environment Program
F&EWG	- Farm and Environment Working Group
F814	- Salinity Advisory Service Shepparton Region
F818	- Groundwater Pump Grants and Incentives
GB CMA	- Goulburn Broken Catchment Management Authority
G-MW	- Goulburn-Murray Rural Water Authority
GMP	- Groundwater Management Plan
GSPSC	- Grouped Salt Project Steering Committee
G123	- Capital Grants for Groundwater Pumps Project
G700	- Implementation of SIR Groundwater Management Plan Project
G800	- Farm Exploratory Drilling Service Project
IPCC	- Intergovernmental Panel on Climate Change
M	- million
MDBC	- Murray Darling Basin Commission
PIRVic	- Primary Industries Research Victoria
RCS	- Regional Catchment Strategy
R499	- Effectiveness of Groundwater Pumping Project
SDE	- River Murray Salt Disposal Entitlement
SIA	- Social Impact Assessment
SIR	- Shepparton Irrigation Region
SIRCIS	- Shepparton Irrigation Region Catchment Implementation Strategy
SIRLWSMP	- Shepparton Irrigation Region Land and Water Salinity Management Plan
SIRTEC	- Shepparton Irrigation Region Technical Committee
SSDCG	- Sub-surface Drainage Coordinating Group
SSDP	- Sub-surface Drainage Program
SSDWG	- Sub-surface Drainage Working Group
S802	- Development of Shepparton Region Management Plan Project
S815	- Development of Sub-region Management Plans: Shepparton Project
TBL	- Triple Bottom Line
VSDIWG	- Victorian Salt Disposal and Investigations Working Group
WSC	- Water Services Committee

Executive Summary

Shepparton Irrigation Regional Catchment Strategy

The Sub-Surface Drainage Program (SSDP) is a key implementation Program of the Shepparton Irrigation Regional Catchment Implementation Strategy (SIRCIS). Its stakeholder engagement process, adaptive management, strategic focus and financial support provide significant benefits to the smooth implementation of the SIRCIS and the delivery of key catchment strategy outcomes.

Overall the SSDP has been shown to be delivering significant economic, environmental and social benefits at local, regional and State level. These benefits are expected to continue and strengthen as the Program delivers works that will serve some 185,000 ha of land, including 9,000 ha of key environmental features.

SSDP 5-Year Review

This is the third review that has been undertaken of the SSDP since the Plan was endorsed and the Program commenced in 1990. The review focuses on the achievements between 2000/01 and 2004/05 (i.e. 2000 and 2005), and identifies the challenges and targets for the next 6 years.

While considerable consultation has been undertaken in the preparation of the SSDP 5-Year review, it is expected that a wider community consultation Program will be embarked upon as part of the 2011 revision of the SSDP.

The focus of the SSDP 5-Year review is to present what is 'known' rather than to test the assumptions and principles which underpin the SSDP whilst enabling adaptive management type adoption of developments over the last 5 years. The review also identifies factors which have influenced and are likely to influence the future implementation of the SSDP. Although not a primary aim of the review, a number of the assumptions and principles of the SSDP have been clarified.

SSDP Achievements: 2000 to 2005

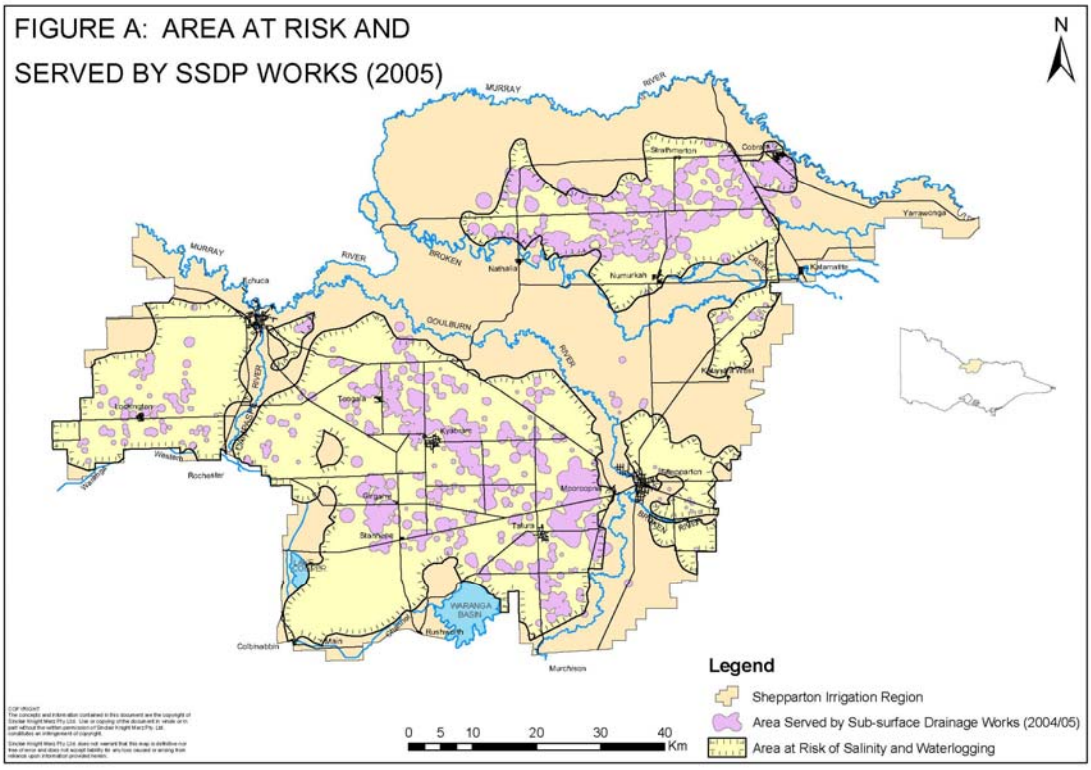
Key achievements of the SSDP between 2000 and 2005 include:

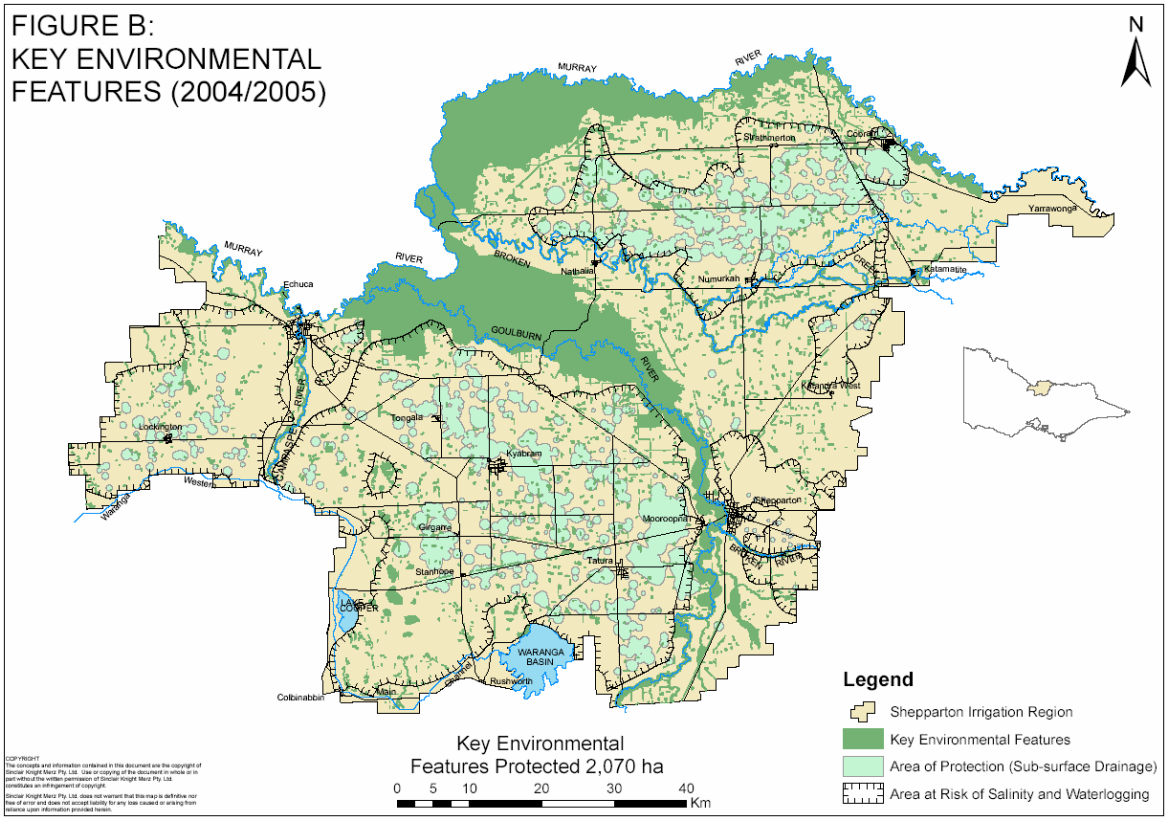
- An additional 15,500 ha of irrigated agricultural land at risk of land salinisation and waterlogging being served by the following works:
  - » installation of 22 new public pumps discharging to regional channels and drains
  - » installation of 116 new private pumps to serve areas of pasture
  - » upgrading of 13 existing private pumps to serve areas of pasture
  - » installation of 1 new private pump to serve an area of horticulture.

  This brings the total area served by SSDP works to 73,200 ha (refer to **Figure A**).
- Around 2,070 ha of key environmental features in the SIR have been served by the installation of private and public pumps since 1990 (refer to **Figure B**)
- Significant contributions to water savings by controlling the level of salt in the soil profile (improving water use efficiency) and harvesting additional water for reuse
- Further refinement of the adaptive management approach to the delivery of the SSDP outputs and outcomes
- Establishment of a strategic plan for the Research and Investigation component of the SSDP
- Formation of the agency based high level Sub-surface Drainage Coordinating Group to coordinate agency input to the SSDP

- Reinvigoration of the Sub-surface Drainage Working Group to undertake a more strategic role
- Establishment of a Grouped Salt Project Steering Committee to manage the SIRCIS salt related projects
- Strengthening of technical capacity in the areas of research and investigation, and on-ground works
- Strengthening of relationships between Goulburn-Murray Water, the Department of Primary Industries and PIRVic in particular, which has created a more united approach to the management of salt in the region (e.g. joint project submissions, targeted extension, etc.)
- Improved dissemination of information to the community
- Increased focus of salt management and reporting to meet MDBC requirements
- Greater focus on managing available groundwater resources in the SIR, including:
  - » implementation of an extensive metering Program (i.e. 523 meters fitted to private groundwater pumps
  - » aligning the groundwater entitlement limits under SIR WSPA Groundwater Management Plan with the SIRCIS.

The average annual expenditure of the SSDP over the reporting period was approximately $4.5M per year. The works delivered under the Program resulted in an estimated Salt Disposal Entitlement uptake of 0.92 EC (post SIR salt audit).





SSDP Achievements against Targets

Overall, the level of implementation between 2000 and 2005 was slightly lower than the targets set as part of the SSDP 2000 review. In terms of pumps installed, only 152 pumps were installed compared to the target of 216 pumps, and the actual area served was 15,490 ha compared to the target area served of 24,850 ha (after adding the Non-SSDP private pumps installed for the period).

This lower than projected delivery between 2000 and 2005 impacted on the achievement of the cumulative targets set for the SSDP at the commencement of the Program, with the total pumps being 18 less than the implementation target and the area served being 21,700 ha less than the target set as at June 2005.

The main reasons for the SSDP implementation targets not being achieved over the 5 year period are:

- Funding constraints, with the total funds requested to implement the required works not received by the SSDP
- Better monitoring of area served by adjusting for the impact of overlapping pumps (i.e. the 2000 implementation targets did double count the overlapping areas served whereas this review does not)
- The area served per private pump is assumed to be lower (average 90 ha) than that assumed as part of the 2000 SSDP review (average over 100 ha)
- Adapting the assumption that 1 ML of pump licence volume equates to 0.6 ha served instead of 1 ha as was the case in the past
- Drier than average climatic conditions over the period which meant that the need and drive for the implementation of sub-surface drainage works, particularly from a landowner perspective, was less than projected

- Recognition of the need for further 'Research and Investigation (R&I)' prior to the implementation of certain sub-surface drainage works (e.g. installation of pumps which discharge to evaporation basins).

One of the benefits of the lower than projected level of implementation is that the salt disposal impact of the SSDP was significantly less than its Salt Disposal Entitlement (SDE) allocation from the Victorian Government.

Looking Forward: Changes to the Underlying Philosophy of the SSDP

A key outcome of the SSDP 5-Year review has been a fundamental change in the delivery philosophy of the Program, with greater emphasis now being placed on the delivery of 'outcomes' (i.e. area served) as opposed to 'outputs' (i.e. the number of pumps installed), as has been the case in the past.

A further fundamental shift occurred in the determination of the area served. Prior to the SSDP 5-Year review the projected area served included the double counting of overlap between the area served by specific sub-surface drainage pumps. For the first time, this review excludes double counting of overlap in setting future targets and in determining achievement of historic targets. The previous approach adopted led to an over estimate of the area actually served by specific sub-surface drainage works.

Based on the knowledge gained since the 2000 SSDP review, there have been a number of changes to the assumptions underlying the calculation of the area served by SSD works. This includes a change to the area served per private pump installed. As part of the SSDP 5-Year review it was assumed that 1 ML of licence entitlement equates to 0.6 ha of area served. This compares to the previous assumption that 1 ML of licence entitlement equates to 1 ha. The change in assumption reflects that the average volumed pumped compared to licence entitlement between 2000 and 2005 (being 60%).

Looking Forward: Delivery Targets

The revised total area at risk of waterlogging and land salinisation is 350,350 ha. This area, which includes 165,350 ha of C Type land is outlined in **Figure A**. To date, cost efficient solutions for protecting the C Type areas have not been developed. This review and the implementation targets therefore focus on the 185,000 ha of land at risk which is underlaid by aquifers (B Type areas).

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The revised target area to be served by the SSDP of 185,000 ha is based on a revised delivery timeframe of 2030. This area served, which is 13,700 ha more than the area of 171,300 ha assumed in the 2000 SSDP review, includes 37,390 ha to be served by Non-SSDP private pumps.

Based on the target of 185,000 ha, and the SSDP achievement to 2005 of 73,200 ha served, there is 111,800 ha remaining to be served by future SSDP works.

As part of this 5-Year review the SSDP implementation date has been increased from 2023 to 2030. The planned implementation rate is shown in **Figure C** and requires an additional 1,650 ha/yr to be served over the next six years and then an additional 5,360 ha to be served in each year for the remaining 19 years of the SSDP.

Within the total area of 185,000 ha, it is expected that the sub-surface drainage works implemented under the SSDP will serve an estimated 9,000 ha of key environmental features in the SIR. This represents approximately 60% of the total area of key environmental features (estimated to be 15,090 ha) at risk due to land salinisation and waterlogging.

The total package of sub-surface drainage works to be implemented to serve the 185,000 ha includes:

- 1,571 pumps
- 50 evaporation basins
- 300 ha of tile drainage.

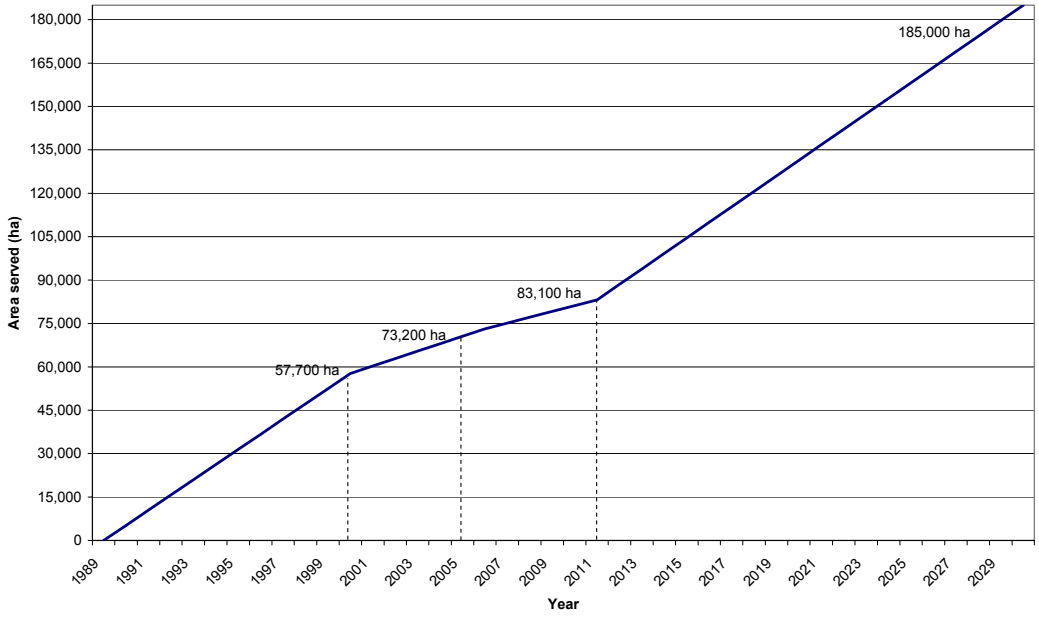


Figure C: Area Served at different Implementation Timeframe

Table A presents a summary of the SSD works delivered to 2005 and the works remaining to be delivered based on the 2030 delivery targets.

Table A: SSD Works Delivered and Still to be Delivered Under the SSDP

SSD Works	Works Delivered to 30 June 2005	Target Works to be Implemented to 30 June 2030	Works Still to be Delivered (2005/06 – 2029/30)
Public Pumps			
Public Pasture Pumps – channels or drains	43 pumps	375 pumps	**332 pumps**
Public Pasture Pumps – basins	0 pumps	50 pumps	**50 pumps**
Private Pumps			
Private Pasture Pumps Installed	254 pumps	541 pumps	**287 pumps**
Private Pasture Pumps Upgraded	59 pumps	112 pumps	**53 pumps**
Non SSDP Private Pasture Pumps	443 pumps	443 pumps	**0 pumps**
Private Horticulture Pumps Installed	20 pumps	50 pumps	**30 pumps**
Tile Drainage			
Tile Drainage	16 ha	300 ha	**284 ha**

The revised total cost to implement the SSDP, including capital cost of works and Program Support and Development, is estimated to be $225.5M (based on 2005 dollars and GST exclusive). In terms of 2005 dollars, of this $225.5M needed to fully implement the SSDP, $51M had been spent by 1 July 2005. This leaves $174.5M to be raised and spent between 2005 and 2030.

A breakdown of the total cost is as follows:

- Private Pasture Pump Program - $72.9M
- Private Horticulture Program - $11.1M
- Public Pump Program - $119.1M
- Program Support - $12.8M
- Program Development - $9.6M.

The revised salt disposal requirement of the SSDP is 12.4 EC without allowing for the undefined C Type area which, in the past has included an allowance of an additional 3.8 EC.

Based on the current uptake of 2.98 EC, a further Salt Disposal Entitlement of 9.42 EC will need to be allocated to the SSDP to enable full implementation. While the current uptake of SDE's is below the GB CMA allocation, further SDE's will need to be sought as implementation of the SSDP progresses.

Economic, Environmental and Social Benefits

Overall the SSDP has been shown to be delivering significant economic, environmental and social benefits at local, regional and state level. These benefits are expected to continue and strengthen as the Program is fully implemented.

As part of the SSDP 5-Year review, separate assessments have been undertaken on the economic, environmental and social components of the SSDP. Based on these assessments the SSDP has been shown to be:

- Economic (financially attractive) – with a Benefit Cost Ratio ranging between 1.4 and 1.9 over the different reporting timeframes assessed and a Total Economic Net Present Value of between $22.9M and $74.4M
- Environmentally Attractive – serving some 9,000 ha of key environmental features with a value of $17M
- Socially Beneficial – delivering a medium level social benefit to the regional community.

Table B presents a summary of the outcomes of the economic, environmental and social assessments undertaken as part of the SSDP 5-Year review.

Table B: Triple-bottom Line Assessment

Assessment	1990/91 to 2019/2020 (30 Years)	1990/91 to 2029/2030 (40 Years)	2005/06 to 2034/35 (30 Years)
Economic			
Benefit Cost Ratio (4% discount rate)	1.4	1.5	1.9
Total Economic Net Present Value ($M) (A) (4% discount rate)	$22.9M	$47.7M	$74.4M
Environment			
Total Environmental Net Present Value ($M) (B) (4% discount rate)	$16.4M	$17.0M	$44.9M
Total ($M) (A + B)	$39.3M	$64.7M	$119.3M
Social			
Expected Social Benefits	Medium Level Social Benefits		

On this basis, continued government investment in the SSDP should be attractive. The strong strategic and adaptive management approach adopted by the Program will ensure that there is little risk of the benefits detailed in the 5-Year SSDP review not being realised.

Risk Assessment

As part of the 5-Year SSDP review an assessment was undertaken of the risks posed to different stakeholder organisations as a result of their involvement in the implementation of the SSDP.

It was concluded from the risk assessment that the risk is far greater to the majority of stakeholders if the SSDP is not implemented than is posed by its implementation.

While the risk assessment did identify that the SSDP posed an element of risk to each stakeholder group, it also highlighted that strategies have already been developed, or are being developed, by most organisations to address these areas of risk. For example, the GB CMA has commenced the development of a 'Salt Register', to enable the transparent tracking and reporting of salt uptake across the region. The register will overcome a number of uncertainties which currently exist around the accuracy of the data, and will allow for easier integration of any future MDBC imposed rule changes.

Challenges to the Implementation of the Program

Climate change is having a significant impact on the management of land and water resources, as is evident in the implementation of the SSDP. These impacts include:

- A reduction in groundwater levels
- Reduced irrigation water allocations
- Strong fluctuations in demand for incentives based on reduced water allocations
- Reduced investment in low value agriculture.

As shown in **Figure D** and **Figure E**, the drier than average weather conditions have had a significant impact on groundwater levels across the SIR between 1996 and 2005. Based on current climatic forecasts this trend is expected to continue, at least in the immediate future. Predicting the extent and breadth of the impact on the SSDP will be a major challenge over the next 6 years.

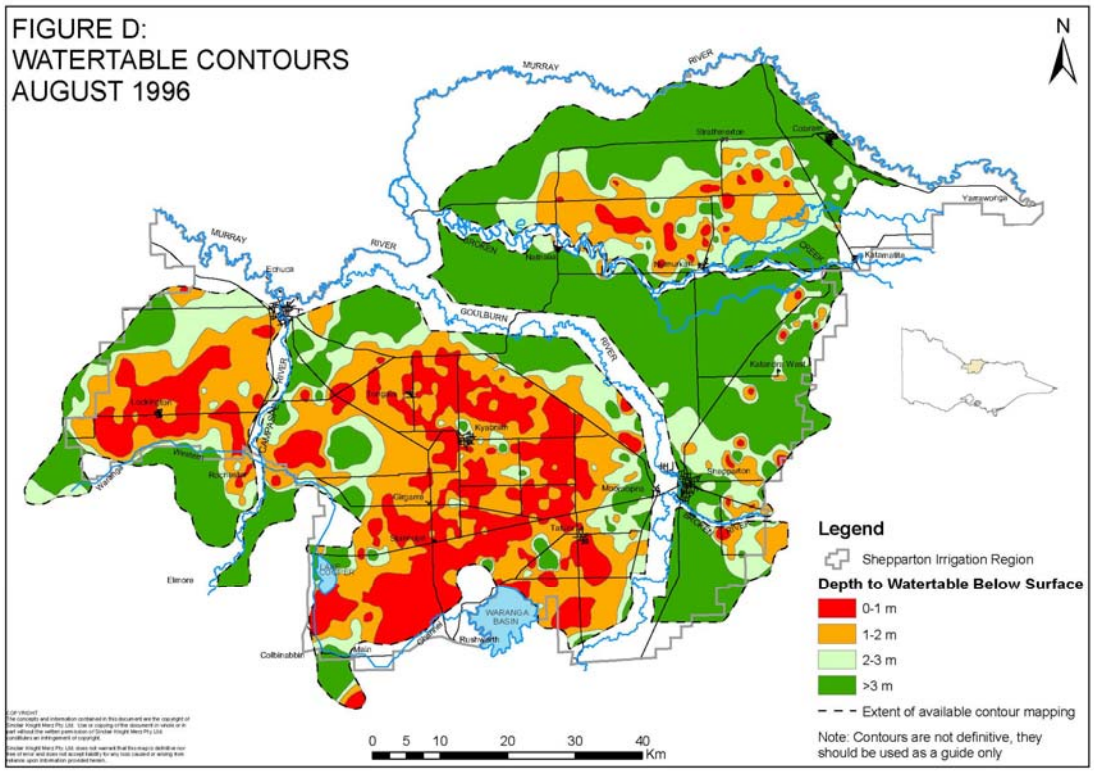
Water supply and drainage system reconfiguration, and improving the understanding of the impact of the presence of SSD works on water use efficiency are also two important issues which need to be addressed by the SSDP. The impact of current system reconfiguration planning could be significant in terms of the SSDP assets that are currently in the ground and proposed works. The SSDP needs to take a more proactive role in system rationalisation planning, and ensure that any impacts are taken into account in its future implementation.

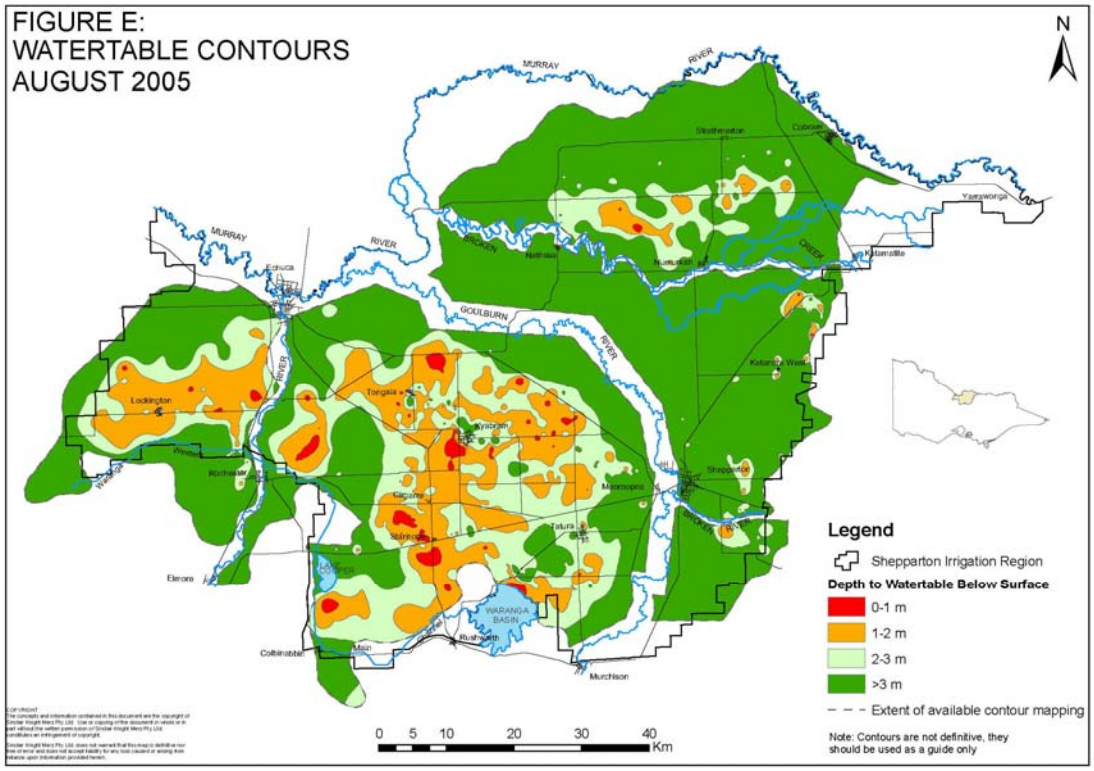
The benefits of the SSDP both in terms of additional water directly generated, and increased production efficiency due to reduced waterlogging and salinisation are yet to be fully explored and realised. Greater emphasis needs to be placed on these factors as they became future drivers to the success and implementation of the SSDP.

Other key challenges identified for the current and future successful achievement of the SSDP, include:

- Reduced water availability for irrigators
- Land use change resulting from water trading and industry changes
- Managing salt disposal at a local and regional scale
- Maintaining a strong relationship with other organisations with natural resource management responsibility, in particular G-MW
- Maintaining landowner support and participation in implementation
- Broadening the scope of the SSDWG to have a catchment wide responsibility
- Future use of different 'Market Based Instruments' to support implementation

- Future funding security
- Maintaining the strategic adaptive management approach to planning and implementation
- Advancing and using best available scientific and engineering knowledge.





2011 SSDP Major Revision

The 2011 SSDP review will involve a major revision of the Program, including its underlying philosophy and principles. In order for such a significant revision to take place, there are a number of key actions which need to undertaken prior to 2011. These include:

- Determining the applicability of the current underlying principles which govern the works required under the SSDP (e.g. area at risk, area to be served, standard of service to be provided, area served per pump, etc.)
- Improving the governance relating to current data management systems
- Determining the standard of service needs to serve environmental features
- More accurately determine proposed actions as well as salt disposal needs and credit generation under Schedule C
- Reviewing the SDE needs and sourcing SDE credits to support full Program implementation
- Quantifying the volume of water generated through the achievement of water use efficiency improvements and resource generation
- Determining the extent of the change in water use efficiency attributed to the SSDP works
- Confirmation of the area of watertable affected by SSDP works
- Ensuring that data generated as part of the SSDP 5-Year review is used and built upon over the next 6 years
- Assessing the required standards of service needs relative the current standards being delivered under the Program
- Site specific research into changes in rainfall totals, temporal patterns and intensities associated with storm events
- Quantification of the actual environmental benefits directly and indirectly delivered through the Program
- Improving the understanding of groundwater nutrients and trends in salinity groundwater salinity
- Determining the actual split in investment between the key stakeholders in the delivery of the Program
- Undertaking the necessary investigations to quantify the road benefits to be delivered through the Program. This information will be included as part of the economic assessment
- Understanding the impacts of water supply system rationalisation on existing and proposed SSDP works
- Establishment of a works program which requires completion of sub-regional planning, water supply system rationalisation arrangements to be known and resolving any issues with the redistribution of salts within the SIR via water supply channels and drains
- Further refinement of the SSDP and its deliver y to ensure outputs and outcomes meet the needs of the community and are delivered in the most cost effective way
- Ensuring that the key actions outlined above are addressed in the most cost effective way.

A number of the actions outlined above are included in the current SSDP R&I Program or in the new issues to be addressed by the R&I Program.

The delivery of these actions through the SSDP Strategic Investigation component of the Program will assist in ensuring that the 2011 review is carried out in an efficient and timely fashion, and is based on the best available information.

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PART A: INTRODUCTION

1. Sub-Surface Drainage Program Evolution

1.1. Move from Salinity to Catchment Management

The Sub-Surface Drainage Program (SSDP) is one of five Programs originally established under the Shepparton Irrigation Region Land and Water Salinity Management Plan (SIRLWSMP). The SIRLWSMP, which was approved by the Victorian Government in 1990, was developed as part of a statewide Program (known as 'Salt Action') to tackle the issue of salinity. The goal of the SIRLWSMP was:

> *"To manage the salinity of land and water resources in the Shepparton Irrigation Region (SIR) in order to maintain and, where feasible, to improve the social wellbeing, environmental quality and productive capacity of the Region."*

Over the past 15 years the SIRLWSMP has been through a number of reviews as its focus has moved from purely salinity management to total catchment management. In 2003, the Shepparton Irrigation Region Catchment Implementation Strategy (SIRCIS) was finalised. The SIRCIS provides the overarching framework and direction of natural resource management in the region, and addresses the goals and objectives of the Goulburn Broken Regional Catchment Strategy (GBRCS) from a SIR perspective.

1.2. Review of Sub-Surface Drainage Program

The timeframe originally set for the delivery of the SSDP was 2020, with the Program to be reviewed on a 5 yearly cycle.

The first review of the SIRLWSMP, including the SSDP, was undertaken in 1995. The main drivers for this review were to assess achievement against implementation targets and initiate the preparation of a groundwater management plan for the SIR.

A second review of the SSDP was undertaken in 2000 by Sinclair Knight Merz. The 2000 review focused on the outcomes of the SSDP between 1995 and 2000, and set in place the implementation targets for the following 5 year period. As part of the 2000 review the completion date for implementation of the SSDP was extended by three years to 2023.

This document, which was prepared by Hydro Environmental, represents the **third review** of the SSDP (referred to as the 'SSDP 5-Year review' report). It focuses on the achievements between 2000/01 and 2004/05, and identifies the challenges and targets for the next 6 years. Where available, actual data for the 2005/06 financial year has been included in this review document.

While the SSDP 5-Year review report includes many of the components of a comprehensive revision, its primary purpose is as a 'status report' of the SSDP, with a full revision of the strategic direction, including the underlying philosophy and principles of the Program, to take place in 2011.

Through the work undertaken as part of the SSDP 5-Year review the implementation timeframe for the SSDP has been revised such that it will be fully implemented by 2030 rather than 2023 set in the 2000 5-Year review.

1.3. SSDP Vision, Mission and Objectives

The success of any organisation, strategy, program or project is primarily dependent on having agreed goals. These goals are usually expressed as the vision, mission, objectives (or outcomes) and desired outputs.

As part of the SSDP 5-Year review, agreement was sought from the Sub-surface Drainage Working Group (SSDWG) on the vision, mission and objectives of the SSDP. Prior to this review the SSDP did not have a recognised vision and mission.

In defining the SSDP vision and mission, consideration was given to the current vision of the two overarching catchment strategies, being the GBRCS and SIRCIS. While it was recognised that it was important for the SSDP to maintain its own identity, it is one of a number of programs which are being implemented to achieve the goals set out in the overarching regional catchment strategies (refer to **Figure 3**).

The vision, mission and objectives of the SSDP, as agreed by the SSDWG, are:

SSDP Vision

"Secure efficient, productive agriculture and enhanced environmental assets within the Shepparton Irrigation Region."

SSDP Mission

"To work with community to provide innovative groundwater and salt management services which support sustainable agricultural practices and protect environmental assets across targeted areas of the Shepparton Irrigation Region."

SSDP Objectives

"Within the Shepparton Irrigation Region, where economically, socially and environmentally feasible, to:

i. *Reduce the risk caused by soil and water salinisation by encouraging the conjunctive use of shallow groundwater in irrigated agriculture*

ii. *Foster opportunities to improve financial returns on investment in agriculture and improve community stability by increasing productivity and reducing risk*

iii. *Encourage innovation and continuous improvement in salt and groundwater management*

iv. *Minimise the mobilisation of salt and its impact on downstream users by being strategic and promoting solutions such as evaporation basins*

v. *Encourage high levels of community awareness, capacity and involvement in the implementation of the Shepparton Irrigation Region Sub-surface Drainage Program and its associated Catchment Programs and Strategies by all appropriate means*

vi. *Serve key land and water resources by providing effective salt management protection for 185,000 ha of agricultural land, by 2030*

vii. *Serve and enhance 22,000 ha of high value environmental assets, by 2030."*

1.4. Original Cost Share Arrangements

Prior to the commencement of the SSDP it was determined that 43% of the total costs to implement the Program would be invested by landowners in the SIR, with the remaining 57% invested by Government.

Table 1 presents an overview of the original cost share arrangements as outlined in the SIRLWSMP (now the SIRCIS), which was approved by the State Government in 1990.

Table 1: Original SSDP Cost Share Arrangements

	Capital Cost (%)	Annual Cost (%)	Overall Cost Share (%)
Private Investment	36%	52%	43%
Public Investment	64%	48%	57%
Total	**100%**	**100%**	**100%**

Source: Adapted from Shepparton Land and Water Salinity Management Plan (1990) (p.138).

The cost share arrangements take into account all costs relating to the following projects, as defined in the SIRLWSMP:

- Private Groundwater Pumps and Tile Drains
- Private Groundwater Pump Incentives
- Public Pumps
- Exploratory Drilling Service
- Priority Project Sub-surface Drainage Program
- Extension / Advisory Program
- Research / Investigation / Monitoring Program.

The cost for the economic evaluation assumed the SSDP will incur:

- 25% of the total costs of the Extension /Advisory Program
- 50% of the total costs of the Research / Investigation / Monitoring Program.

The remaining proportion of the costs (25%) would be incurred independent of the implementation of the SSDP.

2. Purpose and Scope of the SSDP Review

2.1. Purpose of Review

The primary purpose of the SSDP 5-Year review is to:

- Review the achievements of the SSDP between 2000 and 2005, relative to defined targets and stakeholder expectations
- Define the future direction of the Program in light of the known challenges facing the SSDP, with specific emphasis on the next six years.

While considerable consultation has been undertaken in the preparation of the SSDP 5-Year review, it is expected that a wider community consultation program will be embarked upon as part of the 2011 review.

The focus of the review is to present what is 'known' rather than to test the assumptions and principles which underpin the SSDP. The review does however, identify factors which have influenced and are likely to influence the future implementation of the SSDP. As part of the SSDP 5-Year review clarification of a number of the assumptions and principles of the SSDP has been achieved.

2.2. Scope of Review

The review includes the following components:

- An overview of the evolution of the SSDP
- Description of the factors that have influenced the implementation of the SSDP between 2000/01 and 2004/05
- Identification of key achievements in the implementation of the SSDP over the 5 year review period (where data is available achievements in 2005/06 are also reported)
- An assessment of delivery against defined targets
- Identification of implementation targets over the next 6-years and at the completion of the SSDP in 2030
- Description of the factors that are likely to influence the future implementation of the SSDP
- Possible strategies to manage future challenges in the implementation of the SSDP
- Establishment of 'Baseline Data'/Conditions against which to measure progress.

2.3. Structure of Review Documents

The review documentation comprises two separate volumes:

- Volume 1 – The main SSDP 5-Year Review Report (i.e. this document)
- Volume 2 – A compendium of supporting background reports and reference material.

It is also proposed that a catchment strategy level brochure will be prepared which will draw together the outcomes of the five SIRCIS Program reviews.

The compendium of background reports and reference material will include:

- General Background Information to the Characteristics of the SIR
- Original SSDP Objectives
- SSDP Research and Investigation Strategic Plan
- Environmental Impact Assessment
- Social Assessment
- Economic Assessment
- Risk Assessment
- Landuse Data
- SSDP Baseline Statistics Report
- Future Irrigation Scenarios
- Projected SSDP Salt Disposal Entitlements
- Overview of consultation undertaken in the preparation of the SSDP 5-Year review.

3. Regional Planning and Management Framework

3.1. Shepparton Irrigation Region (SIR)

The SIR is located in the Murray Darling Basin on the southern edge of the Riverine Plain in northern Victoria (SKM, 2002). The SIR is unique in that it covers an area under the jurisdiction of both the Goulburn Broken Catchment Management Authority (GB CMA) and the North Central Catchment Management Authority (North Central CMA). **Figure 1** presents a locality plan of the SIR showing the Catchment Management Authority boundary.

The region supports a population of approximately 110,000 people, and covers an area of some 500,000 hectares. Of this area, nearly 250,000 hectares (or 50%) was irrigated in 2004/05. The primary irrigated crops are dairy, cropping, livestock and horticulture with about 20% of the region being annual pasture and 30% being under permanent pasture and horticulture.

The SIR comprises four distinct G-MW serviced Irrigation Areas, being:

- Murray Valley Irrigation Area (River Murray primary source of water supply)
- Shepparton Irrigation Area (Goulburn River primary source of water supply)
- Central Goulburn Irrigation Area (Goulburn River primary source of water supply)
- Rochester Irrigation Area (Goulburn River primary source of water supply).

The boundaries of these irrigation areas are shown in **Figure 2**.

In the 2004/05 irrigation season approximately 1,000 GL of irrigation water was delivered to farms in the SIR, with 38% being delivered to the Central Goulburn irrigation area, 28% to the Murray Valley irrigation area, 19% to the Rochester irrigation area and 15% to the Shepparton irrigation area.

Volume 2 includes further details relating to the catchment characteristics of the SIR, such as the region's:

- Climate, soil and land use information
- Hydrology and hydrogeology information
- A description of waterlogging and land salinisation problems.

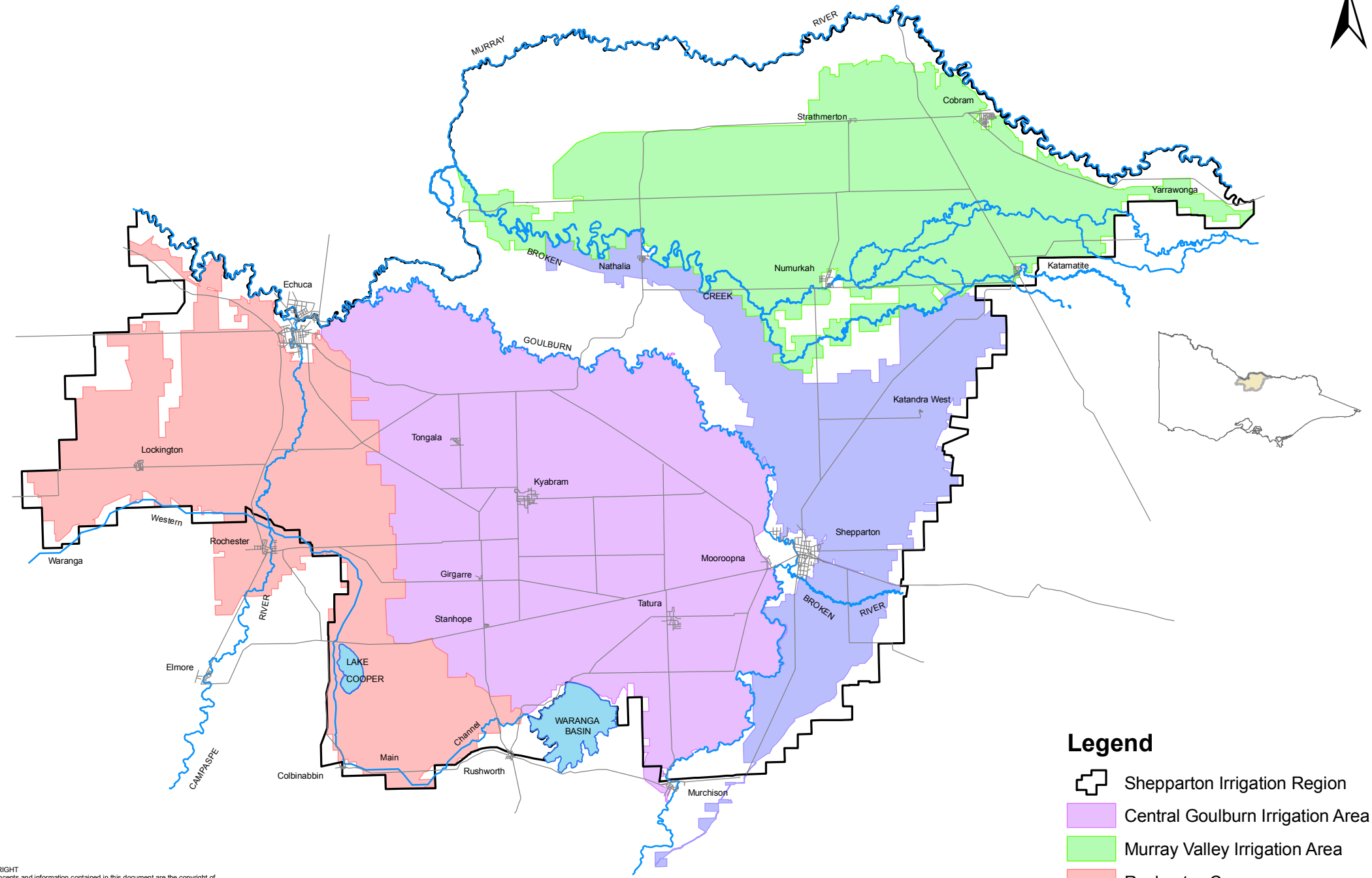
FIGURE 1: LOCALITY MAP OF THE SHEPPARTON IRRIGATION REGION

Legend

- Towns
- Shepparton Irrigation Region
- Goulburn Broken CMA
- North Central CMA
- Road
- Rivers
- Lakes

0 12.5 25 50 75 100 Km

FIGURE 2: IRRIGATION AREAS



3.2. Regional Planning Framework

As shown in **Figure 3**, the SSDP is one of the five Programs being used to deliver the SIRCIS. The other four Programs are:

1. Surface Water Management Program
3. Waterways Program
2. Farm Program
4. Environment Program.

To facilitate the management of the SSDP and to ensure accountability, the SSDP has been divided into four sub-programs which broadly address the following areas:

- Implementation
- Program Development
- Program Support
- Monitoring.

The **Implementation sub-Program** involves the investigation, feasibility analysis and implementation of on-ground works, such as groundwater pumps and tile drainage systems. Implementation is focused in three main areas (or 'Elements'), namely: (1) Farm Exploratory Drilling Scheme (FEDS); (2) Capital Grants and (3) Public Pumps.

The **Program Development sub-Program** relates to the ongoing improvement and development of the SSDP, and comprises two elements, being: (1) Strategic Plan Support and (2) Strategic Plan Implementation. The SSDP Research and Investigation (R&I) Strategic Plan is a key component of Program Development sub-Program, as it is where the strategic direction of the SSDP is established. The Strategic Plan is also integral to the SSDP's adaptive management approach to delivery. Further details relating to the SSDP R&I Strategic Plan are included in **Section 4.5**.

The **Program Support sub-Program** is the nucleus of the SSDP, as it is where the majority of consultation and coordination for all aspects of the SSDP's implementation takes place. This sub-Program encompasses a variety of elements, including:

- Salt disposal management and reporting – MDBC reporting requirements
- Committee support – key stakeholder meeting coordination and attendance
- Landowner and community engagement (extension)
- Administration / reporting / budgeting – key stakeholder and investor requirements
- Management and coordination of the SSDP
- Capacity building – staff development and training.

The **Monitoring sub-Program** captures both the implementation performance aspect of the SSDP, and the actual on-ground monitoring (or biophysical monitoring) performance (i.e. salt and nutrient loads discharged to receiving waters, etc.).

Key Performance Indicators (KPIs) have been developed to measure the success of the SSDP. Monitoring and annual reporting against these KPI's is a key component of the monitoring sub-Program. Further details relating to the KPIs are presented in **Section 4.9**.

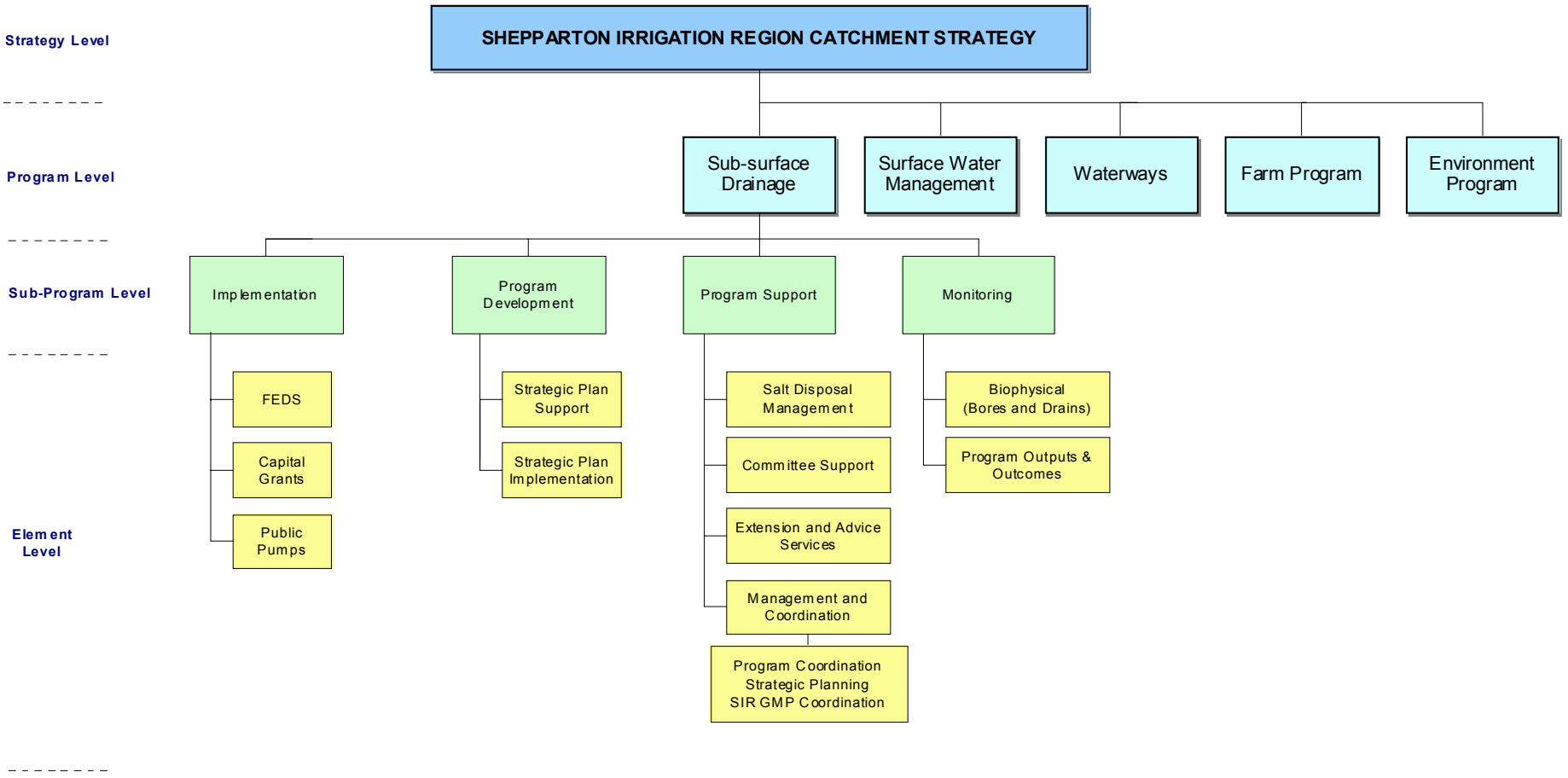


Figure 3: SIR Planning and Delivery Framework

3.3. SIRCIS - SSDP Management Structure

The SIRCIS - SSDP management structure is diagrammatically presented in **Figure 4**. The SIR Implementation Committee (SIRIC) is the peak management body of the SIRCIS. As the SIR is spread across parts of both the GB CMA and North Central CMA (refer to **Figure 1**), SIRIC must make referrals to the particular CMA Board that is responsible for the area to which their deliberations apply.

Each SIRCIS Program is guided by a working group, comprising both landowner and agency members. The SSDP is the responsibility of the Sub-Surface Drainage Working Group (SSDWG).

The Shepparton Irrigation Region Technical Committee (SIRTEC) is in place to provide guidance and advice to SIRIC on technical matters. SIRTEC comprises two community representatives, and agency representatives who are generally technicians and project officers.

The Sub-Surface Drainage Coordinating Group (SSDCG) is an initiative implemented out of the SSDP 2000 review, and is unique to the SSDP. The SSDCG was established in recognition of the need for greater coordination between the natural resource management agencies given their charter for delivering the outcomes of the SSDP. The SSDCG is responsible to the SSDWG for ensuring that the SSDP continues to be efficiently and effectively delivered. Most issues are passed through the SSDCG prior to seeking SSDWG input. This process enables the SSDWG to operate at a more strategic level.

G-MW's involvement in the implementation of the SSDP is as a service provider and the lead agency for the SSDP, as well as being the custodian of regional public water supply and drainage assets.

DPI has a responsibility for research, landowner engagement and fostering private asset creation associated with the SSDP. Although Government policy related to the SSDP is provided through the CMAs, PIRVic must also ensure that its work on the SSDP aligns with the policy directives of its primary funding body, being the State Government.

Salt disposal activities relating to the SSDP are addressed between GB CMA Board and DSE, with DSE being the conduit for discussions with the MDBC and the Victorian Salt Disposal Investigations Working Group (VSDIWG). The GB CMA is also represented on the VSDIWG.

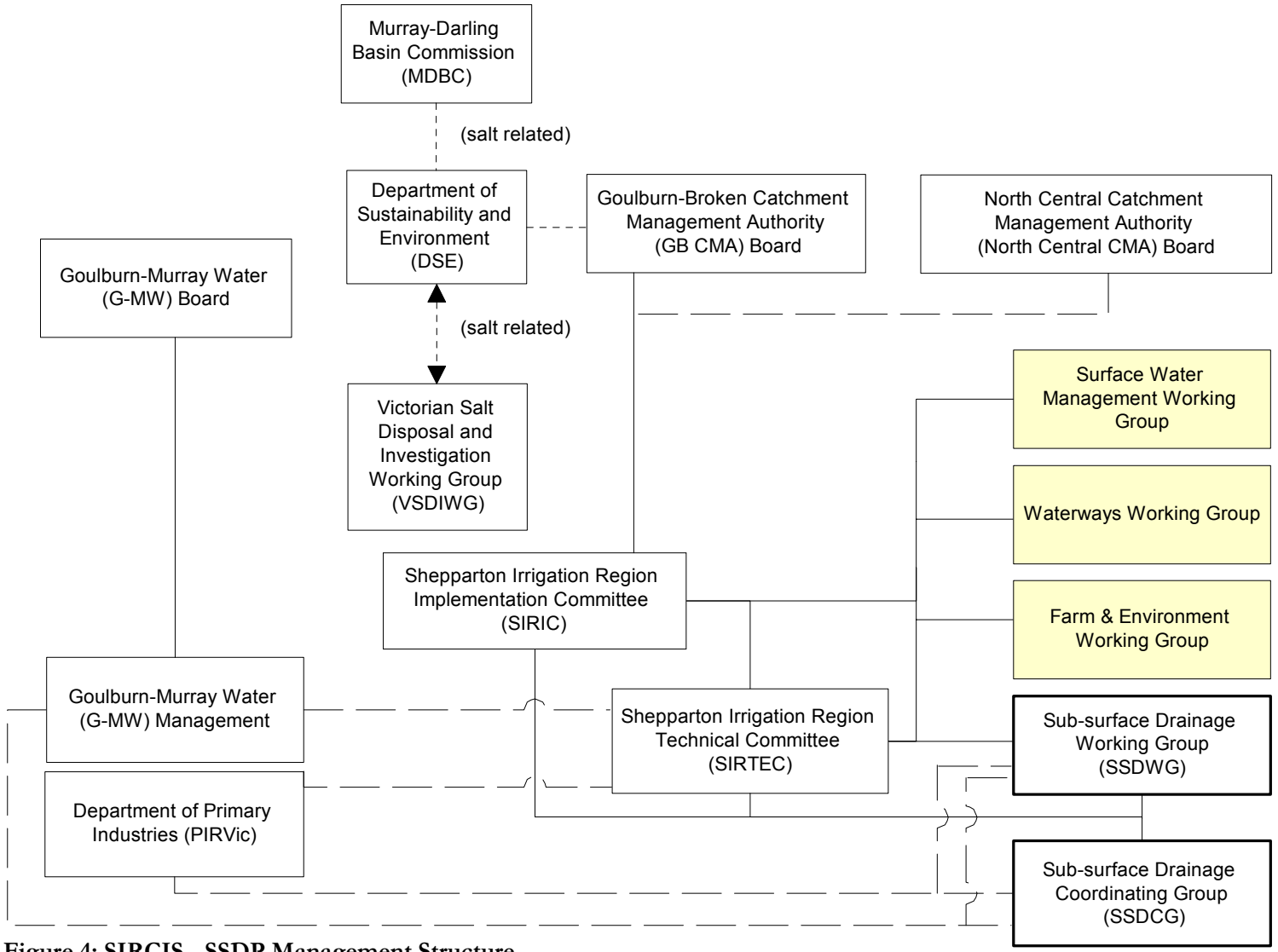


Figure 4: SIRCIS - SSDP Management Structure

3.4. Groundwater Management Plans

The SIR comprises three Water Supply Protection Areas (WSPAs) and two Groundwater Management Areas (GMAs), namely:

- Shepparton Irrigation Region Water Supply Protection Area (focused on the shallow aquifer (i.e. <25m below the surface))
- Campaspe Deep Lead Water Supply Protection Area (focused on the deep aquifer (i.e. >25m below the surface))
- Katunga Water Supply Protection Area (focused on the deep aquifer)
- Mid-Goulburn GMA (focused on the deep aquifer)
- Kialla GMA (focused on the deep aquifer).

Figure 5 shows the boundaries of the WSPAs and GMAs within the SIR.

GMAs are discrete areas in which the groundwater resources have been sufficiently developed to warrant specific management to ensure that the resource usage is sustainable and equitably shared.

WSPAs are established in areas where the groundwater resource requires a greater level of management and protection than can be provided under a GMA. WSPAs are declared by the Minister for Water.

Once a WSPA has been established Groundwater Management Plans (GMPs) are developed as part of the framework for managing groundwater resources in the Region. In the SIR, GMPs have been established for SIR (1995), Campaspe Deep Lead (August 2003) and Katunga WSPAs (initially August 2003 and revised July 2006). As a result of increasing stress on groundwater resources in the Kialla GMA (Zone 2) and Mid-Goulburn GMA, a proposal has been put forward to declare these GMAs as a WSPA. If this proposal is successful a GMP will also be prepared for these areas.

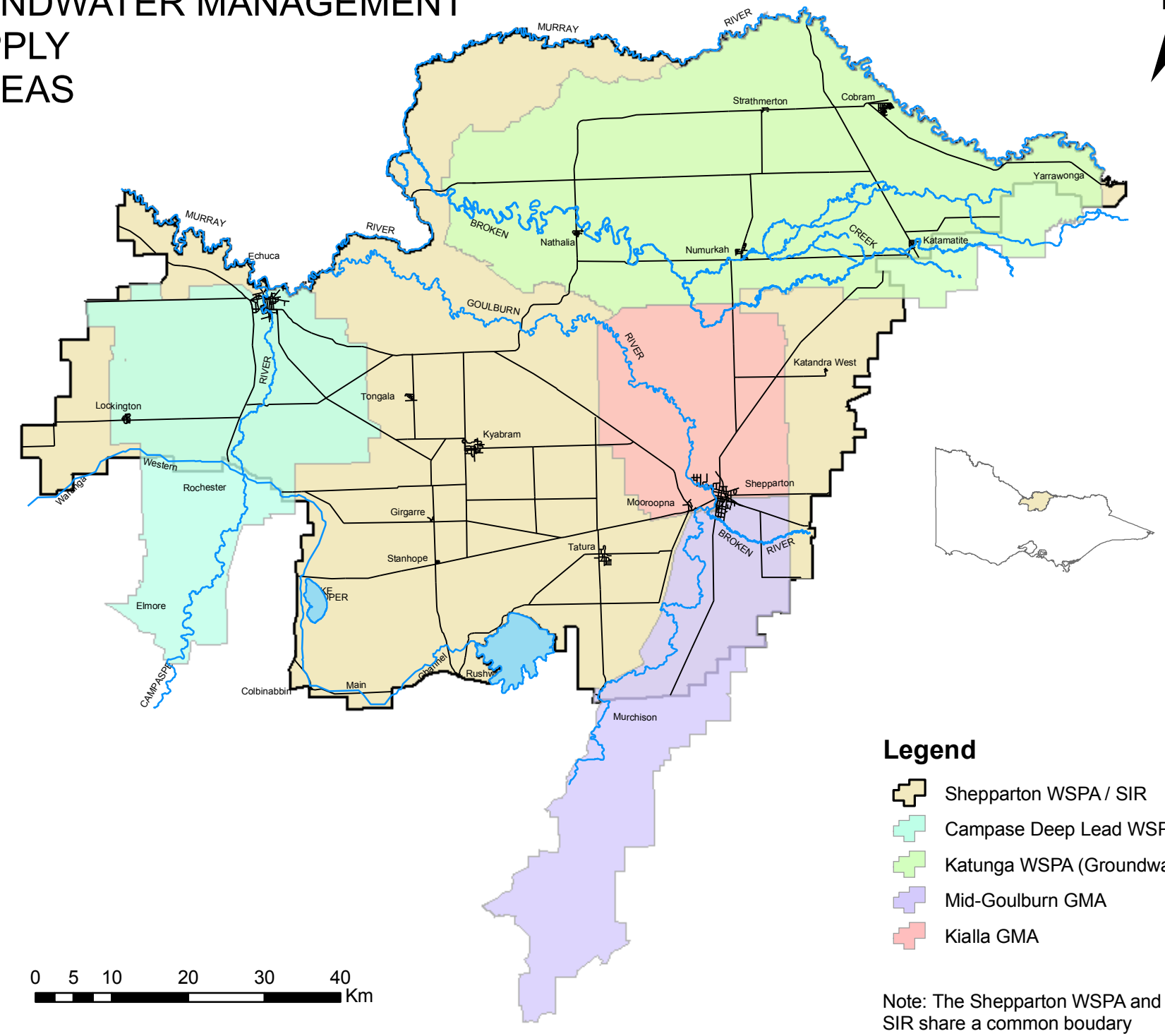
Of the three WSPAs in the SIR, the SIR WSPA has the greatest interaction and influence on the SSDP. While the SIR GMP is principally aimed at managing the use of shallow groundwater for sustaining catchment health, it has a secondary goal of managing the shallow groundwater resource. The Plan is not a direct sub-Program of the SSDP however, it is an important and integral part of the SIRCIS.

The Campaspe Deep Lead and Katunga WSPAs are reported as part of the SSDP 5-Year review for completeness. It is not believed that the management of these areas will have a significant impact on the delivery and management of the SSDP, however it may in some areas.

Key elements of the GMPs include:

- Bore metering and monitoring to obtain more reliable data on groundwater usage and pumped groundwater salinities
- Generally establishing a sustainable yield for the groundwater system
- Encouraging regular responsible use of groundwater, particularly in relation to the SIR WSPA (via licence conditions).

FIGURE 5: GROUNDWATER MANAGEMENT AND WATER SUPPLY PROTECTION AREAS



PART B:
SSDP Review 2000 to 2005 Achievements

4. SSDP 5-Year review

4.1. SSDP Planning and Delivery

The SSDP is a key Program for the SIRCIS. Its stakeholder engagement process, strategic focus and financial support provide significant secondary benefits to the smooth implementation of the SIRCIS programs and the delivery of key catchment strategy outcomes. The SSDP has also shown to be the most cost effective Program currently being implemented under the SIRCIS.

In spite of drought and funding restrictions over the past 5 years, the SSDP has continued to deliver tangible positive outcomes for the region. Key achievements include:

- Installation of some 22 public and 62 private groundwater pumps with the assistance of the Program
- Further refinement of the adaptive management approach to the deliver y of the SSDP outputs and outcomes
- Establishment of a strategic plan for the Research and Investigation (R&I) component of the SSDP
- Formation of the agency based high level SSDCG to coordinate agency input to the SSDP
- Reinvigoration of the SSDWG to undertake a more strategic role
- Establishment of the Grouped Salt Project Steering Committee (GSPSC)
- Strengthening of technical capacity in the areas of research and investigation, and on-ground works
- Strengthening of relationships between G-MW, the Department of Primary Industries (DPI) and PIRVic in particular, which has created a more united approach to the management of salt in the region (e.g. joint project submissions, targeted extension, etc.)
- Improved dissemination of information to the community (e.g. Community Reference Kit)
- Increased focus of salt management and reporting to meet MDBC requirements
- Greater focus on managing available groundwater resources in the SIR, including:
  - » implementation of an extensive metering program (i.e. 523 meters fitted to private groundwater pumps (refer to **Section 4.9**)
  - » aligning the groundwater entitlement limits under SIR WSPA Groundwater Management Plan with the SIRCIS.

The last five years have provided an opportunity to consolidate past achievements and set in place a firm platform from which the SSDPs objectives can be realised. The adaptiveness of the Program's management has also come to the fore over the last 5 years with:

- An increased focus on group rather than single landowner investigations
- A continued focus on the Private Pump Program (or FEDS Program).

4.2. Key Assets of the SIR

A strong and prosperous SIR community depends on the security and efficiency of the irrigation industry, which in turn relies on healthy rivers and land, as well as a secure water supply.

Assets can be defined at a variety of scales and include both natural and man-made features. At its broadest scale the SIR's natural assets are its soil, water and biodiversity. These assets are interconnected and collectively support the region's social and economic assets. For example, in the SIR, the combined presence of fertile soil and a secure supply of good quality water have lead to a vibrant agricultural industry, creating significant employment, a strong sense of community and a healthy economy. Each of these outcomes is considered an asset in their own right.

The key assets of the SIR, grouped under the themes of soil, water, biodiversity, social and economic are presented in **Table 2**.

Table 2: Summary of the Key Assets of the SIR

Asset	Asset Description
Soil	• One of Australia's major irrigated agriculture regions
Water	• Contains over 645 km of streams, with the Goulburn River (below Eildon) being declared as a Heritage River • Some 1,000 GL of water is delivered annually to farms for irrigation purposes • Over 70 GL of groundwater is pumped from licensed private pumps annually (based on measured volume)
Biodiversity	• Contains 73,250 ha of remnant native vegetation cover • Contains flora and fauna species listed under the Environment Protection and Biodiversity Conservation Act 1999 • Contains one wetland of international significance (i.e. Barmah) and 56 400 ha of wetlands of national significance
Social	• Growing and culturally diverse community • Contains the single largest indigenous community in both rural and urban areas of Victoria. In 2002 there were 4,000 indigenous people living in the SIR
Economic	• Agriculture and horticulture are the most important farm labour employers • Produces agriculture products worth an estimated $1 billion per year and, in turn, supports a food processing sector generating approximately $1.7 billion per year in outputs

Figure 6 diagrammatically shows the interdependencies between the natural, social and economic assets of the SIR.

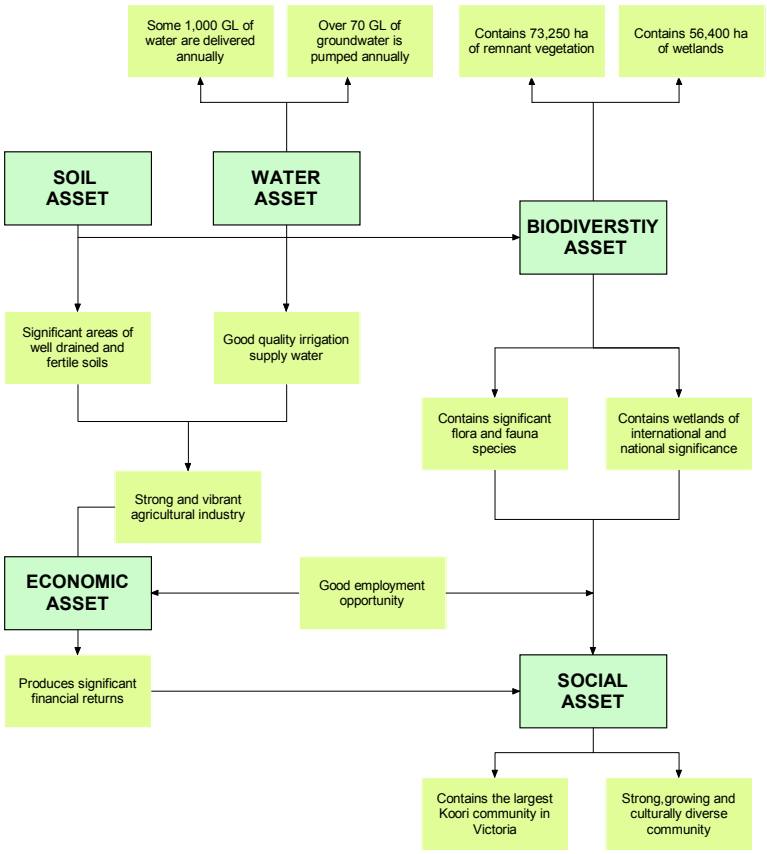


Figure 6: Relationship between the SIR Assets

4.3. Influences on Program Achievements

4.3.1. Climatic Conditions

The world's climate is changing. The 20th century was the warmest century on record. Snow cover in the Northern Hemisphere and floating ice in the Artic Ocean is diminishing rapidly. Globally, sea level has risen 100-200 mm over the past century and precipitation has increased by about one percent (EPA, 2000). The Intergovernmental Panel on Climate Change (IPCC) has concluded that human activities are interfering with the climate and that human-induced climate change will continue for many centuries.

Greenhouse gases in the atmosphere are the single largest contributing factor to climate change. These changes invite fluctuations in precipitation, wind patterns and alter the frequency and severity of extreme weather events (DSE, 2004). Results of which will have wide-ranging effects on natural ecosystems and the economy.

Australia's average temperature has increased 0.8°C since 1900, with the 1990's being the warmest decade on record (DSE, 2004). The Goulburn Broken Region is one region which has experienced a warming trend. Since 1950, the region has experienced a 0.1°C increase in average temperature per decade (DSE, 2004).

Figure 7 shows the past 16 years of rainfall data for the regional centre of Kyabram, located in the SIR (refer to **Figure 1**). Average annual rainfall for Kyabram since 1990 is 424 mm, with the average annual rainfall between 2001 and 2006 being 355 mm (almost 70 mm less than the long term average) (DPI, 2007). The lowest annual rainfall was recorded in 2002 of 198 mm.

Climate change is having a significant impact on the management of land and water resources, as is evident in the implementation of the SSDP. These impacts include:

- A reduction in groundwater levels
- Reduced water allocations
- Strong fluctuations in demand for incentives due to reduced water allocations
- Reduced investment in low value agriculture.

In recognition of these influences, the SSDP has had to be adaptive in its implementation.

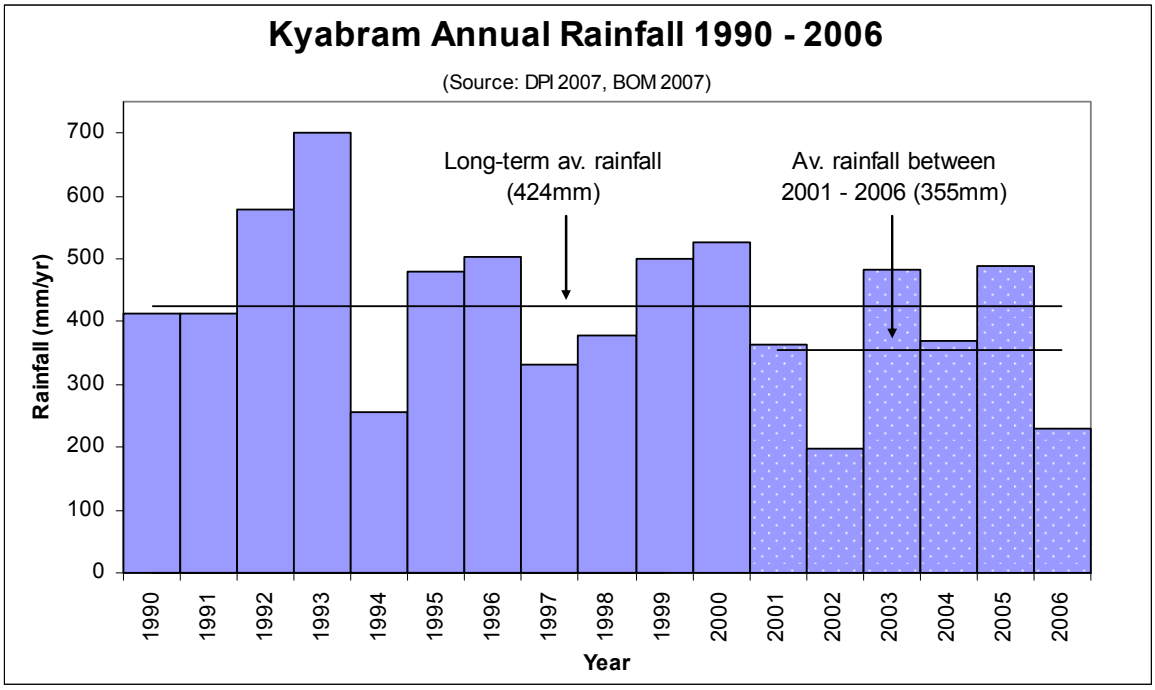


Figure 7: Kyabram Annual Rainfall 1990 – 2006

4.3.2. Surface Water Use and Allocations

Table 3 presents a breakdown of the surface water use and water allocations across the SIR from 2000/01 to 2004/05. Despite a reduction in average allocations over the period, surface water use figures have remained relatively constant at around 1,000 GL. The figures suggest that irrigators have been relying on the water trading market to buy water from 'sleeper' allocations within the SIR and from other areas outside the SIR to maintain production.

There is some question as to the sustainability of this practice over the longer term, particularly with increased need to make additional water available for environmental purposes, and with many of the new permanent plantings in the Sunraysia Region maturing and requiring more water.

Table 3: Surface Water Use in SIR between 2000/01 and 2004/05

Irrigation Areas	Financial Year (ML)					Average (ML)
	2000/01	2001/02	2002/03	2003/04	2004/05	
Shepparton	159,600	177,200	113,300	155,400	156,800	152,460
Central Goulburn	402,300	439,200	270,000	406,700	381,900	380,020
Rochester	225,300	230,100	120,300	196,600	196,700	193,800
Murray Valley	345,600	400,900	350,100	206,700	281,800	317,020
Total Annual Use	**1,132,800**	**1,247,400**	**853,700**	**965,400**	**1,017,200**	**1,043,300**

Source: (G-MW, D. McKenzie).

As part of the Victorian Government's commitment to the Living Murray Initiative (refer to **Section 4.3.7**), 20% of G-MW's sales water pool will be set aside for the Environmental Water Reserve. This allocation known as the '80:20 sales water deal', will deliver on average, 120,000 ML of water annually back to the environment from the Goulburn, Loddon and River Murray systems.

As part of the water deal, sales water will be replaced with lower-reliability water shares. This will create greater certainty over sales water ownership, and will provide landowners with more legal protection than currently exists with sales water.

4.3.3. Land Use Changes

Changes in the composition of different enterprises have been obtained for the periods 1996/97 and 2003/04 (refer to **Table 4**). The key trends evident from these figures are a reduction in the areas of grazing and horticulture, and an increase in the area of mixed farming. There has also been the introduction of a new land use category referred to a 'Lifestyle Faming' (i.e. farms which are generally not financially viable in their own right with the owner having a supplementary off-farm income).

Table 4: Change in Enterprise Area between 1996/97 to 2003/04

Land Use	Area (Ha)		
	1996/97	2003/04	Change (%)
Dairying	198,817 ha	189,866 ha	5% reduction
Grazing	100,741 ha	60,793 ha	40% reduction
Horticulture	20,127 ha	15,464 ha	23% reduction
Mixed Farming	89,547 ha	121,448 ha	36% increase
Lifestyle	N/A	22,255 ha	N/A
Total Area	**409,232 ha**	**409,826 ha**	

Source: (DPI, Andrew Macalister).

Landuse changes have a considerable impact on the implementation of the SSDP, with different landuses requiring different levels of SSD protection. In addition, the ability of landowners to use groundwater varies between different land use types (refer to **Section 4.3.5**).

Table 5 shows the distribution of land use within the area served by SSDP works and within the area at risk of waterlogging and salinisation in 2003/04.

Table 5: Distribution of Area Served and at Risk in 2003/04

Land Use	Area at Risk of Salinisation and Waterlogging (%)	*Area Served by existing SSDP Works (%)
Horticulture	2%	3%
Perennial Pasture	23%	42%
Annual Pasture and Cropping	30%	30%
Other (Non-irrigated)	45%	25%
Total	**100%**	**100%**

Source: (DPI, Andrew Macalister)
Note: *Percentages include non-SSDP private pumps.

SSDP works will target areas of highest production hence highest irrigation intensity. The land use figures in **Table 5** are based on 2003/04 which was a year of 100% water allocation and dryer than average.

For the SSDP economic evaluation a 60:20:20 ratio was adopted for perennial pasture, annual pasture and cropping, and dryland respectively which is close to the 75% irrigated and 25% dryland shown for the area served in **Table 5**.

Further details relating to the distribution of land use within the area served by SSDP works and within the area at risk of waterlogging and salinisation are presented in **Volume 2** of the SSDP 5-Year review report.

4.3.4. Water Trading

Over the last 10 years, a significant amount of water entitlement has been permanently and temporarily traded in Northern Victoria, both within supply systems and between supply systems. One of the reasons for introducing water trading was to increase the economic output from water used for irrigation. This is achieved by allowing water to trade between different water users, with water generally moving to users best able to maximise the financial return from the water.

A vibrant water trade market exists across the SIR with some 433,400 ML of water being permanently and temporarily traded within the SIR between 2000/01 and 2004/05 (refer to **Table 6**). The major challenge facing the SIR is to manage and minimise the trade of water, particularly permanent water, out of the region. In 2003/04 alone, over 14,400 ML was reported to be permanently transferred out of the SIR. **Table 6** presents a breakdown of the temporary and permanent water trade relating to the SIR over the period of the review.

Table 6: Net Volume of Water Traded Within and Outside of the SIR

Temporary / Permanent Trade	Net Volume of Water Traded				
	2000/01	2001/02	2002/03	2003/04	2004/05
Within the SIR					
- Permanent	1,783 ML	2,340 ML	6,493 ML	6,594 ML	5,754 ML
- Temporary	62,145 ML	77,948 ML	72,480 ML	89,308 ML	108,578 ML
Outside of the SIR					
- Permanent*	-2,169 ML	-2,829 ML	1,367 ML	-14,492 ML	-14,573 ML
- Temporary*	54,149 ML	59,948 ML	-8,841 ML	30,633 ML	25,407 ML

Source: ANCID Annual Benchmarking Reports / G-MW Paul Kerrins and Rod Killmartin
*Negative figures indicate water trade out of the SIR is greater than water trade into the SIR
Positive figures indicate water trade into the SIR is greater than water trade out of the SIR.

To assist in managing the implications of water trade a cap has been placed on the maximum net volume of water that can be permanently traded between irrigation areas each year. Between 2000/01 and 2004/05 this cap was set at 2% (i.e. the net allowable permanent trade from an irrigation area was 2% of the area's water entitlement).

4.3.5. Shandying Rules

Reuse of groundwater water is considered a key strategy in sustainable management of water resources. Its importance in the rural sector has become more apparent in recent years with the prolonged drought and continued pressure to improve water use efficiency. The challenge faced by all those that reuse water is ensuring that the quality of the water applied does not adversely impact on the crop or soil health.

Reuse of pumped groundwater for agricultural production is key implementation activity of the SSDP. Due to the generally higher salinity concentrations of some groundwater, it is a requirement that any highly saline groundwater is mixed with fresher channel water (i.e. 'shandied') prior to being applied for agricultural production.

Given that pasture is the dominant agricultural crop in the SIR, a "best practice" salinity concentration limit of 800 EC (assuming a zero productivity loss) was established for application of shandied water on pasture where government funds are used to support bore installation. Where government funding is not sought by the landowner, groundwater extraction licence entitlements are based on a "minimum standard" salinity concentration limit of 1700 EC.

In the case where the construction of a private bore is fully funded by the irrigator, an 85% productivity limit has been set by SIRIC. This means that while a decline in productivity is allowed, this decline must not exceed 15% of the expected productivity under normal conditions.

These conditions are consistent with the 800 EC ('best practice') and 1700 EC ('minimum standard') limits set for pasture where the minimum standard allows for up to 15% loss in productivity.

4.3.6. Salt Disposal Entitlement (SDE) Accounting

Management of salt disposal is a key component of the SIRCIS. In 2004/05 the SIR had a Salt Disposal Entitlement (SDE) of 4.9 EC, 3.4 EC of which was allocated by Government at the commencement of the SIRLWSMP in July 1990, and a further 1.5 EC being allocated on 13 August 2001. There is also a commitment for a further 2.0 EC to be allocated to the SIR in 2005/06 (which was officially allocated on 11 July 2006), bringing the total SDE across the SIR to 6.9 EC.

It is projected that with full implementation of the SSDP that a revised SDE allocation of 12.4 EC will be required. As part of the 2000 SSDP review (SKM, 2002), the SDE requirement was 11.9 EC compared with an uptake of the SSDP of 2.22 EC based on works that were in place as at 30 June 2000.

These salt disposal needs with full implementation of the SSDP exclude the 3.8 EC that may be required from some of the C Type area works which are as yet undefined.

Details relating to the uptake of SDEs by the SSDP between 2000 and 2005 are presented in **Section 4.4.7**.

4.3.7. The 'Living Murray Initiative'

Community perception of the extent and resources to be applied to the conservation of the environmental and social factors of the Murray-Darling Basin has dramatically changed over the past decade. Irrigators across the Basin have become leaders in improving farm water use efficiency, and environmental awareness is beginning to make significant inroads with terms such as 'environmental flows' and other environmental water allocations becoming widely acknowledged amongst the general community as being a good thing.

One of the factors that has led to this change in community perception and growing concern for the environment, particularly over the last 5 years, is the Murray-Darling Basin Commission's (MDBC) 'Living Murray Initiative' (referred to as the 'Living Murray').

The Living Murray was established by the Murray Darling Basin Ministerial Council in mid-2002 to address the declining health of the River Murray system. It focuses on three key areas of the River Murray system:

- Water recovery
- Environmental delivery
- Environmental works and measures.

Significant research and consultation effort was initially undertaken to define the scope and direction of the Living Murray Initiative. This included an intensive community consultation process whereby input was provided through both community meetings and direct submissions.

The 'First Step' for the Living Murray was announced in November 2003. This involves the recovery of an estimated 500 GL/yr of water over a 5 year period to be used to assist in the protection and enhancement of six significant ecological assets.

As outlined in **Section 4.3.2**, as part of the Victorian Government's commitment to the Living Murray Initiative, 20% of G-MW's sales water pool will be set aside for the Environmental Water Reserve. This allocation known as the '80:20 sales water deal', will deliver on average, refer to **Section 4.3.2**.

4.3.8. Funding

The average annual expenditure of the SSDP between 2000/01 and 2004/05 across its four sub-Programs (refer to
Figure 3) was approximately $4.5M. **Table 7** presents details of the funds sought based on the works program presented in the 2000 SSDP review, funds allocated by Government and the total expenditure under the SSDP over the period of the SSDP 5-Year review.

Table 7: SSDP Funding and Expenditure between 2000/01 and 2004/05

SSDP Funding	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Total Funds Sought ($)	$4,708,900	$4,799,900	$5,506,200	$5,962,500	$5,592,400	$26,569,900
Total Funding Allocation ($)	$4,007,800	$3,709,600	$4,848,500	$4,889,900	$4,396,400	$21,852,200
Allocation versus Funds Sought (%)	85%	77%	88%	82%	79%	82%
Total Expenditure ($)	$3,955,500	$4,055,900	$4,645,200	$5,008,500	$4,725,600	$22,390,700
Expenditure versus Allocation (%)	99%	109%	96%	102%	107%	102%

Source: (G-MW, J. Burkitt and P. Dickinson)
Note: 1. The above figures include the following projects C806a, D484A, D484b, D841, F814, F818, G700, G800, R499, S802, S815 and G123.

Over each of the 5 years reported the SSDP spent all of its allocated funding (102%) but failed to receive the funds sought in any year. As discussed in the latter sections of the report this has been a major factor in the Program not being able to achieve its targets.

Table 8 includes a breakdown of expenditure in 2004/05 between the four sub-Programs of the SSDP. Program Support and Implementation are the two sub-programs where the majority of the funds were expended. As shown in **Section 8.2**, in the future it is projected that there will be a decrease in Program Support expenditure over the next 6 years.

In 2004/05, there was no investment in the installation of private pumps or tile drains to serve horticultural areas in the SIR.

Table 8: Breakdown of 2004/05 SSDP Expenditure

Funding Area	Expenditure ($'000)
Program Support	$1,900
Implementation	
- Public	$479
- Private	$1,374
- Horticulture	$0
Program Development	$492
Monitoring	$479
Total ('$000)	**$4,726**

Source: (G-MW, J. Burkitt and P. Dickinson)

4.4. On-ground Achievements

4.4.1. Overview

Between 2000/01 and 2004/05 an additional 11,000 ha were served by works implemented as part of the SSDP. These works included:

- Installation of 22 new public pumps discharging to regional channels and drains
- Installation of 62 new private pumps to serve areas of pasture
- Upgrading of 13 existing private pumps to serve areas of pasture
- Installation of one (1) new private pump to serve an area of horticulture.

A further 4,500 ha was served by private pumps installed without SSDP assistance ('Non-SSDP private pumps').

The area served is considered to be the area over which there is some drawdown in groundwater pressures/water level in response to groundwater pump operation, or some watertable drawdown due to the operation of tile drains.

To June 2005, the total area served by SSD works, including Non-SSDP private pumps, was 73,200 ha.

4.4.2. Relationship between Outputs and Outcomes

The SSDP has a number of clearly defined implementation targets which have been categorised as Program 'Outputs' and 'Outcomes'. These targets are interrelated, with the achievement of one being dependent on the delivery of the other.

Broadly a Program 'Output' is defined as a management action that has been implemented as part of the SSDP, such as the installation of a private or public pump, and the installation of a tile drainage system.

A Program 'Outcome' is the resultant impact of a Program output. For example, the outcome of installing a Public Pump (an output) will be the protection of a certain area of productive agricultural land. As part of the SSDP 5-Year review this area is referred to as 'area served'.

4.4.3. SSDP Implementation Targets

Table 9 presents a summary of the SSDP implementation targets for the following periods:

- 2000/01 to 2004/05 (i.e. period of the SSDP 5-Year Review)
- 1990/01 to 2004/05 (i.e. targets from the commencement of the SSDP to June 2005).

It is important to note that these historic implementation targets include the overlapping benefits of specific SSD works (i.e. the area served was double counted).

Table 10 presents a summary of the achievements of the SSDP against the five year (2000/01 to 2004/05) and 15 year (1990/91 to 2004/05) implementation targets.

Unlike the implementation targets, the achievements reported in **Table 10** do not double count the overlapping benefits of specific SSD works. For example, if a public and private pump are installed such that there was an overlap between their respective area served, this overlapping area is included for only one pump instead of two which was the practice in the past.

4.4.4. Delivery Against SSDP Targets

Overall, the level of implementation between 2000 and 2005 was slightly lower than the targets set as part of the SSDP 2000 review. In terms of pumps installed, only 152 pumps were installed compared to the target of 216 pumps, and the actual area served was 15,490 ha compared to the target area served of 24,850 ha (after adding the Non-SSDP private pumps installed for the period).

This lower than projected delivery between 2000 and 2005 impacted on the achievement of the cumulative targets set for the SSDP at the commencement of the Program, with the total pumps being 18 less than the implementation target and the area served being 21,700 ha less than the target set as at June 2005.

The main reasons for the SSDP implementation targets not being achieved over the 5 year period are as follows:

- Funding constraints, with the total funds requested to implement the required works not received by the SSDP (refer to **Section 4.3.8**)
- Better monitoring of area served by adjusting the impact of overlapping pumps (refer to **Section 5**)
- The area served per private pump is assumed to be lower (average 90 ha) than that assumed as part of the 2000 SSDP review (average over 100 ha) (refer to **Section 5**)
- Drier than average climatic conditions over the period which meant that the need and drive for the implementation of SSD works, particularly from a landowner perspective, was less than projected
- Recognition of the need for further 'Research and Investigation (R&I)' prior to the implementation of certain SSD works (e.g. installation of pumps which discharge to evaporation basins).

One of the benefits of the lower than projected level of implementation is that the salt disposal impact of the SSDP was significantly less that than its SDE allocation from the Victorian Government.

A breakdown of the 'Outputs' and 'Outcomes' of the SSDP between 2000/01 and 2004/05 and since the commencement of the Plan is presented in the following sections of the SSDP 5-Year review.

Table 9: SSDP Implementation Targets to 2005 and with full Implementation of the Program

Activity	Five Year Target to 2005 (2000/01 to 2004/05)	2005 Cumulative Target (1990/91 to 2004/05)
Public Pumps		
1 Continue operation of Phase A pumps where technically appropriate	Ongoing operation – review performance of scheme	Ongoing operation – review performance of scheme
2 Install new public pumps discharging to regional channels or drains	• 40 pumps installed • 8,000 ha being served	• 61 pumps installed • 12,200 ha being served
3 Install new public pumps discharging to evaporation basins	Develop criteria and guidelines and install 1 basin	• 1 pump and basin • 200 ha being served
4 Installation of Public Pumps to serve environmental features (such as remnant vegetation, wetlands and streams)	Develop criteria and guidelines and install 1 pump	• 1 pump installed • One environmental feature served
5 Provide salinity and waterlogging control for new high value crops in the region	Develop and adopt a cost effective strategy	Develop and adopt a cost effective strategy
Private Pumps		
6 Consistent pumping and reuse by existing private pumps (Non-SSDP Private Pumps within Area of Risk) [3]	• 54 pumps • 4,560 ML/yr being reused • 4,560 ha being served	• 395 pumps • 45,000 ML/yr being reused • 45,000 ha being served
6a Existing private pumps upgraded with Capital Grant assistance [3]	• 13 pumps • 1,100 ML/yr being reused • 1,100 ha being served	• 59 pumps • 4,980 ML/yr being reused • 4,980 ha being served
7 Installation of new SSDP private pumps	• 95 pumps installed • 10,820 ML/yr being reused • 10,820 ha being served	• 289 pumps installed • 31,670 ML/yr being reused • 31,670 ha being served
8 Installation of private pumps to serve existing horticulture areas	• 12 pumps installed • 300 ha being served	• 31 pumps installed • 775 ha being served
Tile Drains		
9 Installation of tile drains to serve existing horticulture areas (mainly at Shepparton East)	69.1 ha	85 ha
10 Installation of tile drains/low capacity pumps to serve non-horticultural areas	Develop and adopt a cost effective strategy	(same as 5-Year Target to 2005)
Pump Discharge		
11 Regulated discharge of pumped groundwater to regional channels, drains and streams within agreed guidelines	(As needed)	(As needed)
12 Regulated discharge of pumped groundwater to River Murray to minimise salt accumulation within the Region's soils and aquifers	2.87 EC	5.09 EC

Source: Sinclair Knight Merz, 2002.

Table 10: Achievement of SSDP 5-Year and Cumulative Targets

Activity	Five Year Target to 2005 (2000/01 to 2004/05)	Delivery against 2005 year Target (2000/01 to 2004/05)	2005 Cumulative Target (1990/91 to 2004/05)	Delivery Against 2005 Cumulative Target (1990/91 to 2004/05)
OVERALL	• 24,849 ha served • 216 pumps installed • 69.1 ha tile drainage	• 15,496 ha served • 152 pumps installed • 0 ha tile drainage	• 94,910 ha served • 837 pumps installed • 85 ha tile drainage	• 73,181 ha served • 819 pumps installed • 16 ha tile drainage
Public Pumps				
1. Continue operation of Phase A pumps where technically appropriate	Ongoing operation – review performance of scheme	Ongoing operation – review performance of scheme	Ongoing operation – review performance of scheme	Ongoing operation – review performance of scheme
2. Install new public pumps discharging to regional channels or drains	• 40 pumps installed • 8,000 ha served	• 22 pumps installed • 4,587 ha being served	• 61 pumps installed • 12,200 ha being served	• 43 pumps installed • 8,966 ha being served
3. Install new public pumps discharging to evaporation basins	Develop criteria and guidelines and install pump to 1 basin	R&I project to be developed	• 1 pump and basin • 200 ha being served	• 0 pump and basin • 0 ha being served
4. Installation of Public Pumps to serve environmental features (such as remnant vegetation, wetlands and streams)	Develop criteria and guidelines and install 1 pump	R&I project to be developed	• 1 pump installed • One environmental feature served	• 0 pumps installed • No features served
5. Provide salinity and waterlogging control for new high value crops in the region	Develop and adopt a cost effective strategy	No action	• Develop and adopt a cost effective strategy	No action
Private Pumps				
6. Consistent pumping and reuse by existing private pumps (Non-SSDP Private Pumps within Area of Risk) [1.]	• 54 pumps • 4,560 ML/yr being reused • 4,560 ha served	• 54 pumps • 4,560 ML/yr being reused • 4,560 ha being served	• 395 pumps • 45,000 ML/yr being reused • 45,000 ha being served	• 443 pumps • 37,390 ML/yr being reused • 37,390 ha being served
6a Existing private pumps upgraded with Capital Grant assistance [1.]	• 13 pumps • 1,100 ML/yr being reused • 1,100 ha served	• 13 pumps • 1,100 ML/yr being reused • 1,100 ha being served	• 59 pumps • 4,980 ML/yr being reused • 4,980 ha being served	• 59 pumps • 4,980 ML/yr being reused • 4,980 ha being served
7. Installation of new SSDP private pumps	• 95 pumps installed • 10,820 ML/yr being reused • 10,820 ha served	• 62 pumps installed • 5,230 ML/yr being reused • 5,230 ha being served	• 289 pumps installed • 31,670 ML/yr being reused • 31,670 ha being served	• 254 pumps installed • 21,440 ML/yr being reused • 21,440 ha being served
8. Installation of private pumps to serve existing horticulture areas	• 12 pumps installed • 300 ha served	• 1 pump installed • 19 ha being served	• 31 pumps installed • 775 ha being served	• 20 pumps installed • 389 ha being served
Tile Drains				
9. Installation of tile drains to serve existing horticulture areas (mainly at Shepparton East)	69.1 ha	0 ha	85 ha	16 ha
10. Installation of tile drains/low capacity pumps to serve non-horticultural areas	Develop and adopt a cost effective strategy	R&I Project commenced (GG03020) Define 'C Type' areas	(same as 5-Year Target to 2005)	(same as 5-Year Delivery 2005)
Pump Discharge				
11. Regulated discharge of pumped groundwater to regional channels, drains and streams within agreed guidelines	(As needed)	(As needed)	(As needed)	(As needed)
12. Regulated discharge of pumped groundwater to River Murray minimise salt accumulation within the Region's soils and aquifers	2.87 EC	0.92 EC	5.09 EC	2.98 EC
13. Environmental features served by Public and Private Pumps	-	740 ha served	-	2070 ha served

Source: (Hydro Environmental, 2006)

Note:

1. A different methodology was used to determine delivery against the implementation targets. The areas served through works delivered do not double count the overlapping benefits of specific SSD works. In order to determine the actual area served compared to the target area to be served, the area served based on works delivered will need to be factored up by 1.25 for all private works. There is no factor required to be applied to public pumps or tile drainage.

4.4.5. Outputs (On-Ground Works)

4.4.5.1. Works Delivered to Serve Pasture Areas

The following tables are presented in relation to activities undertaken between 2000/01 and 2004/05 to serve pasture areas:

- **Table 11**: Public pumps installed to serve pasture areas
- **Table 12**: Private Pumps installed and upgraded to serve pasture areas (Capital Grant Assistance)
- **Table 13**: Non-SSDP Private Pumps installed to serve pasture areas
- **Table 14**: Volume pumped from public pumps to serve pasture areas
- **Table 15**: Volume pumped from public pumps to serve pasture areas.

Between 2000/01 and 2004/05 there were 22 public pumps installed, and 62 private pumps installed and 13 private pumps upgrades with Capital Grant Assistance. In addition there were 54 private pumps installed, without funding assistance, which will also result in pasture benefits. This brings the total number of pumps installed to serve pasture areas in the SIR to 799 pumps.

Table 11: Public pumps installed to serve pasture areas

Public Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
No. Public Pumps installed	5	6	5	3	3	**22**
Cumulative No. Public Pumps installed since 1990	26	32	37	40	43	**43**

Source: (Hydro Environmental, 2006).

Figure 8 shows the location of the private pumps that have been installed and upgraded to serve pasture areas in the SIR.

Table 12: Private pumps installed and upgraded to serve pasture areas (New Pumps and Existing Pumps – Capital Grant Assistance)

Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
No. private pumps installed	4	5	32	13	8	**62**
Cumulative No. Private Pumps installed since 1990	196	201	233	246	254	**254**
No of Private Pumps upgraded [1]	4	6	2	0	1	**13**
Cumulative No. Private Pumps upgraded since 1990	50	56	58	58	59	**59**

Source: (Hydro Environmental, 2006).

[1] The figure presented does not include where multiple Capital Grant have been given to a single pump (i.e. a pump that was initially installed with Capital Grant assistance and subsequently upgraded with Capital Grant assistance, or multiple upgrades to a single pump with Capital Grant assistance. The total number of Capital Grants that have been allocated to private pump upgrades to 2004/05 is 70.

FIGURE 8:
PRIVATE PUMPS
2000/01 to 2004/05

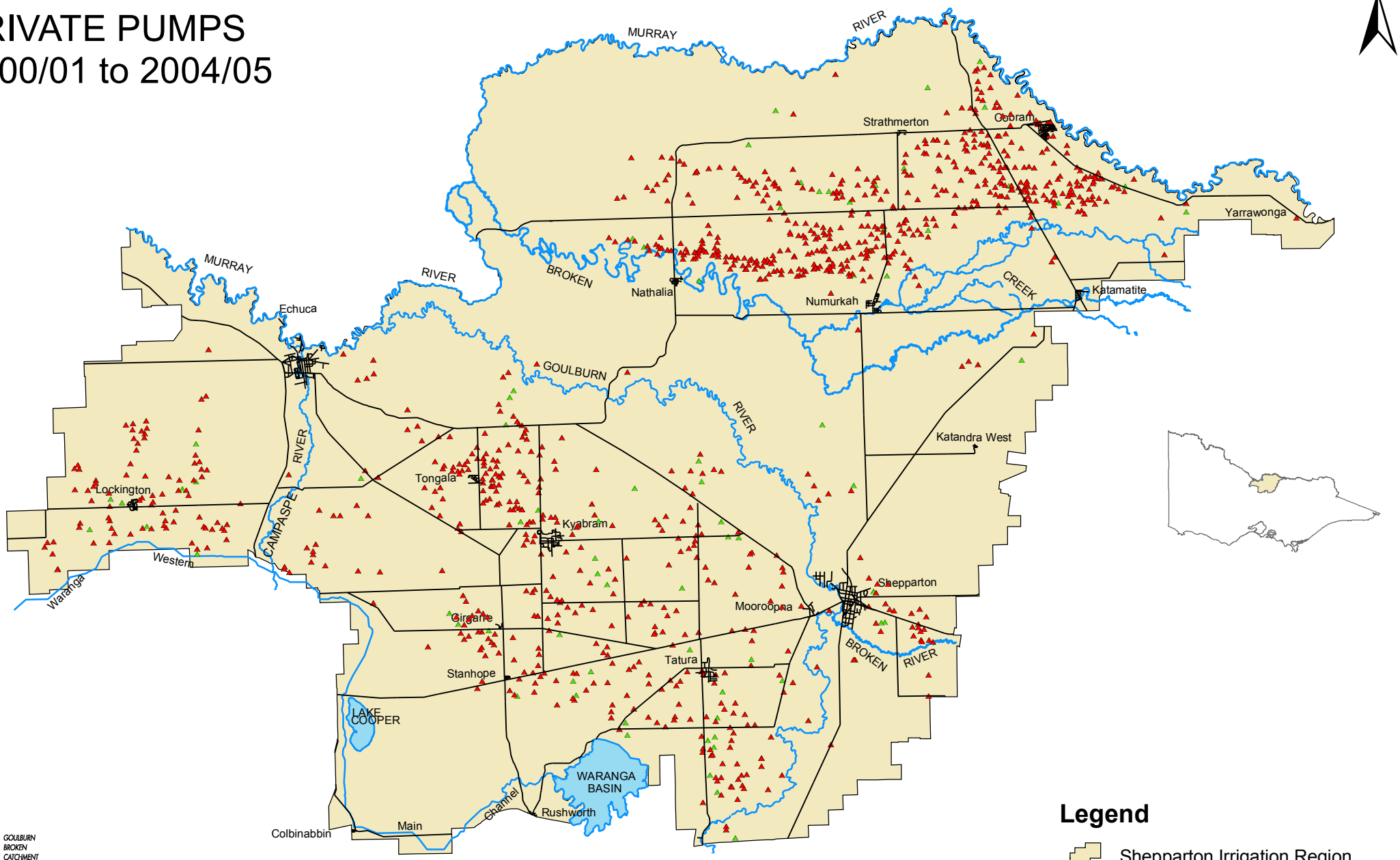


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Table 13: Non-SSDP Private Pumps installed to serve pasture areas

Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
No. private pumps installed	11	11	11	11	10	**54**
Cumulative No. Private Pumps installed since 1990	400	411	422	433	443	**443**

Table 14 shows the cumulative number of public pumps installed to serve pasture areas, the opportunity for pumping and the actual volume of water extracted by public pumps between 2000/01 and 2004/05.

Table 14: Volume pumped from Public pumps to serve pasture areas

Public Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Cumulative No. Public Pumps installed	26	32	37	40	43	**43**
Opportunity for pumping of public pumps (ML)	2,748 ML	1,530 ML	1,894 ML	1,975 ML	2,139 ML	**8,912 ML**
Actual volume pumped for pasture protection (ML)	2,002 ML	1,580 ML	1,375 ML	1,956 ML	2,043 ML	**7,955 ML**
Extent of pumping opportunity captured (%)	73%	103%	73%	99%	96%	**89%**

Source: (SIRWSPA Ann Report).

As indicated in **Table 15**, between 2000/01 and 2004/05 approximately 366,000 ML of groundwater was pumped from private bores (both SSDP and non-SSDP) to serve pasture areas. This represents just over 60% of the licensed entitlement of the metered private pumps. As private pump licences expire, the conditions placed on the licences are being reviewed particularly from an extraction entitlement perspective. It is expected that the current gap between water entitlement and water use will gradually decline over time, with a move towards higher standard of pump management/performance.

Table 15: Volume pumped Private pumps to serve pasture areas

Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
No. of metered private pump licences	687	719	604	622	702	
Irrigation Entitlement metered bores (ML)	86,410 ML	121,432 ML	121,757 ML	118,132 ML	138,669 ML	**586,400 ML**
Actual volume pumped (ML)	71,750 ML	63,295 ML	101,823 ML	64,288 ML	64,820 ML	**365,976 ML**
Comparison of Metered and Licensed Volumes (%)	83%	52%	84%	54%	47%	**62%**

Source: (Hydro Environmental, 2006).

To 2004/05 there have been no public pumps specifically installed to discharge to evaporation basins.

4.4.5.2. Works Delivered to Serve Horticulture Areas

Table 16 presents the number of private pumps that have been installed to serve horticultural areas in the SIR. Between 2000/01 and 2004/05 only one private pump has been installed for this purpose, bringing the total number of private pumps installed to serve horticulture areas since the commencement of the SSDP to 20 pumps.

Table 16: Private pumps installed to serve horticultural areas

Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
No. private pumps installed / upgraded	0	0	1	0	0	**1**
Cumulative No. Private Pumps installed / upgraded since Plan inception	19	19	20	20	20	**20**

Source: (Hydro Environmental, 2006).

4.4.5.3. Works Delivered to Served Environmental Features

A SSDP R&I project has been undertaken identifying high value environmental features within the SIR (Project GI03 036). This work included an assessment of the sites of high environmental value at risk from high watertables and salinisation.

In addition to serving pasture and horticultural areas a number of SSD works implemented as part of the SSDP (as detailed in the preceding tables) also serve key environmental features in the SIR.

4.4.6. Outcomes (Area Served)

4.4.6.1. Area of Pastured Served

Table 17, **Table 18** and **Table 19** present the area of pasture served by public and private pumps in the SIR. The figures presented take into account the overlapping benefits being delivered between the different SSD works (i.e. the overlapping areas are not double counted).

Between 2000/01 and 2004/05 an additional 15,500 ha of pasture was served through the installation of private and public pumps. As at 30 June 2005, the total area of pasture being served by private and public pumps in the SIR is 72,780 ha.

The location of the pasture areas being served by private and public pumps in 2004/05 is presented in **Figure 9**.

Table 17: Annual Change in Area of Pasture Served by Public Pumps

Public Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Area Served (ha)	1,043 ha	1,251 ha	1,043 ha	626 ha	626 ha	**4,589 ha**
Cumulative Area Served (ha)	5,421 ha	6,672 ha	7,715 ha	8,340 ha	8,966 ha	**8,966 ha**

Source: (Hydro Environmental, 2006).

Table 18: Annual Change in Area of Pasture Served by Private Pumps (New Pumps and Existing Pumps - Capital Grant Assistance)

Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Area Served (ha)	675 ha	929 ha	2,701 ha	1,266 ha	760 ha	**6,331 ha**
Cumulative Area Served (ha)	20,765 ha	21,695 ha	24,394 ha	25,661 ha	26,421 ha	**26,421 ha**

Source: (Hydro Environmental, 2006).

Table 19: Annual Change in Area of Pasture Served by Non-SSDP Private Pumps

Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Area Served (ha)	929 ha	929 ha	929 ha	929 ha	840 ha	**4,566 ha**
Cumulative Area Served (ha)	33,765 ha	34,693 ha	35,622 ha	36,550 ha	37,394 ha	**37,394 ha**

Source: (Hydro Environmental, 2006).

4.4.6.2. Area of Horticulture Served

Table 20 presents the area of horticulture being served by private pumps in the SIR. The area of horticulture being served by tile drainage is presented in **Table 21**.

Table 20: Annual Change in Area of Horticulture Served by Private Pumps

Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Area Served (ha)	0	0	19 ha	0	0	**19 ha**
Cumulative Area Served (ha)	370 ha	370 ha	389 ha	389 ha	389 ha	**389 ha**

Source: (Hydro Environmental, 2006).

Table 21: Annual Change in Area of Horticulture Served by Tile Drainage

Tile Drainage	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Area Served (ha)	0	0	0	0	0	**0**
Cumulative Area Served (ha)	16 ha	16 ha	16 ha	16 ha	16 ha	**16 ha**

Source: (Hydro Environmental, 2006).

Between 2000/01 and 2004/05 only an additional 19 ha of horticultural area was served by SSDP works. There were no additional tile drains installed to serve horticultural areas.

4.4.6.3. Area of Environmental Features Served

To June 2005, 2,070 ha of key environmental features were served by existing private and public pumps in the SIR.

Table 22 presents the area of environmental features served by the implementation of SSDP works between 2000/01 and 2004/05. The figures presented do not include 210 ha of key environmental features estimated to have been served prior to the commencement of the SSDP in 1990.

Table 22: Annual Change in Area of Environmental Features Served by the SSDP

Public and Private Pumps	Financial Year					Total
	2000/01	2001/02	2002/03	2003/04	2004/05	
Area Served (ha)	148 ha	148 ha	148 ha	148 ha	148 ha	**740 ha**
Cumulative Area Served (ha)	1,482 ha	1,626 ha	1,744 ha	1,922 ha	2,070 ha	**2,070 ha**

Source: (Hydro Environmental, 2006).

The key environmental features in the SIR as at 2004/05 are presented in **Figure 10**, along with the areas currently being served by existing SSDP works.

FIGURE 9:
PRIVATE and PUBLIC PUMPS AREA SERVED (2004/05)

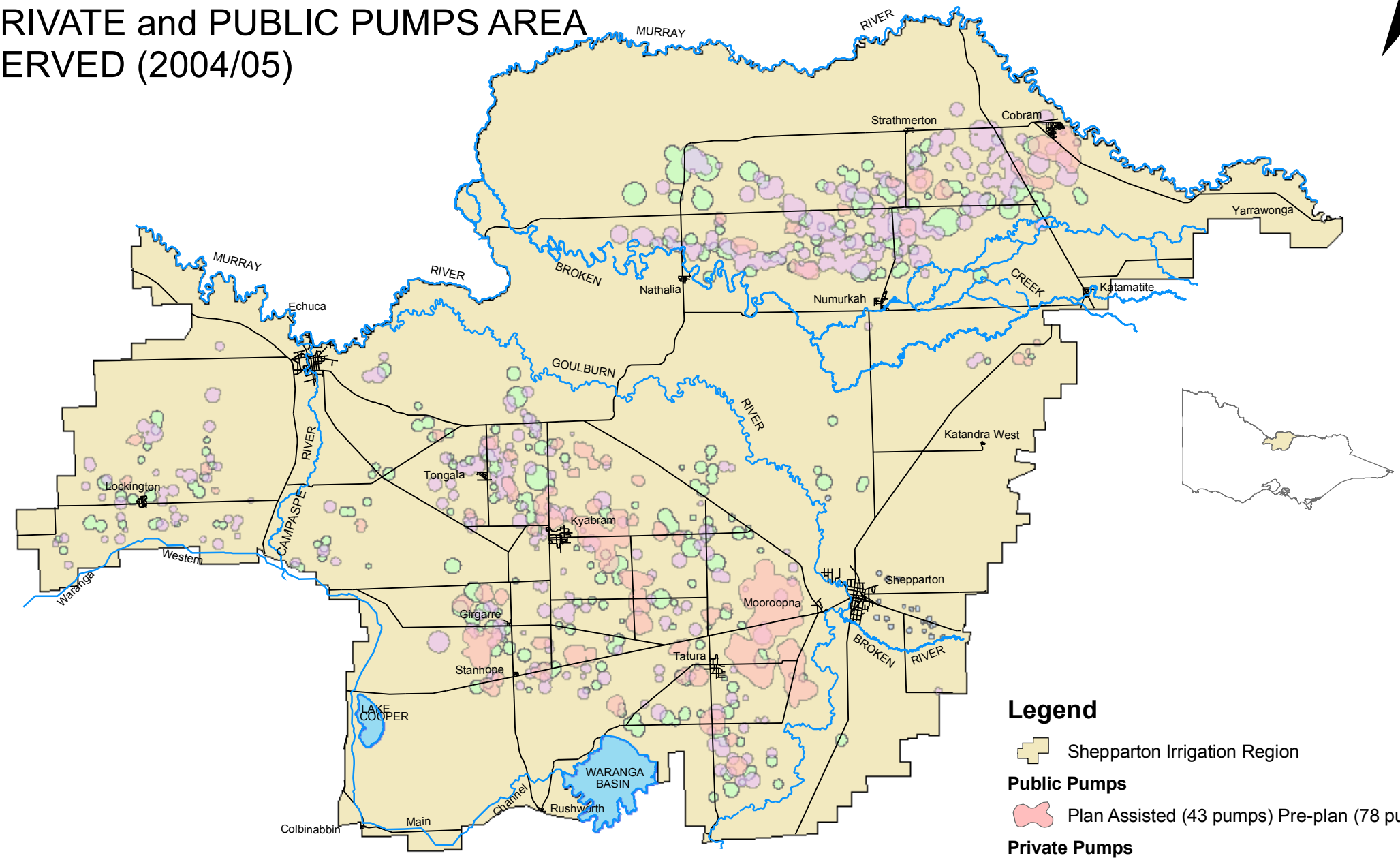
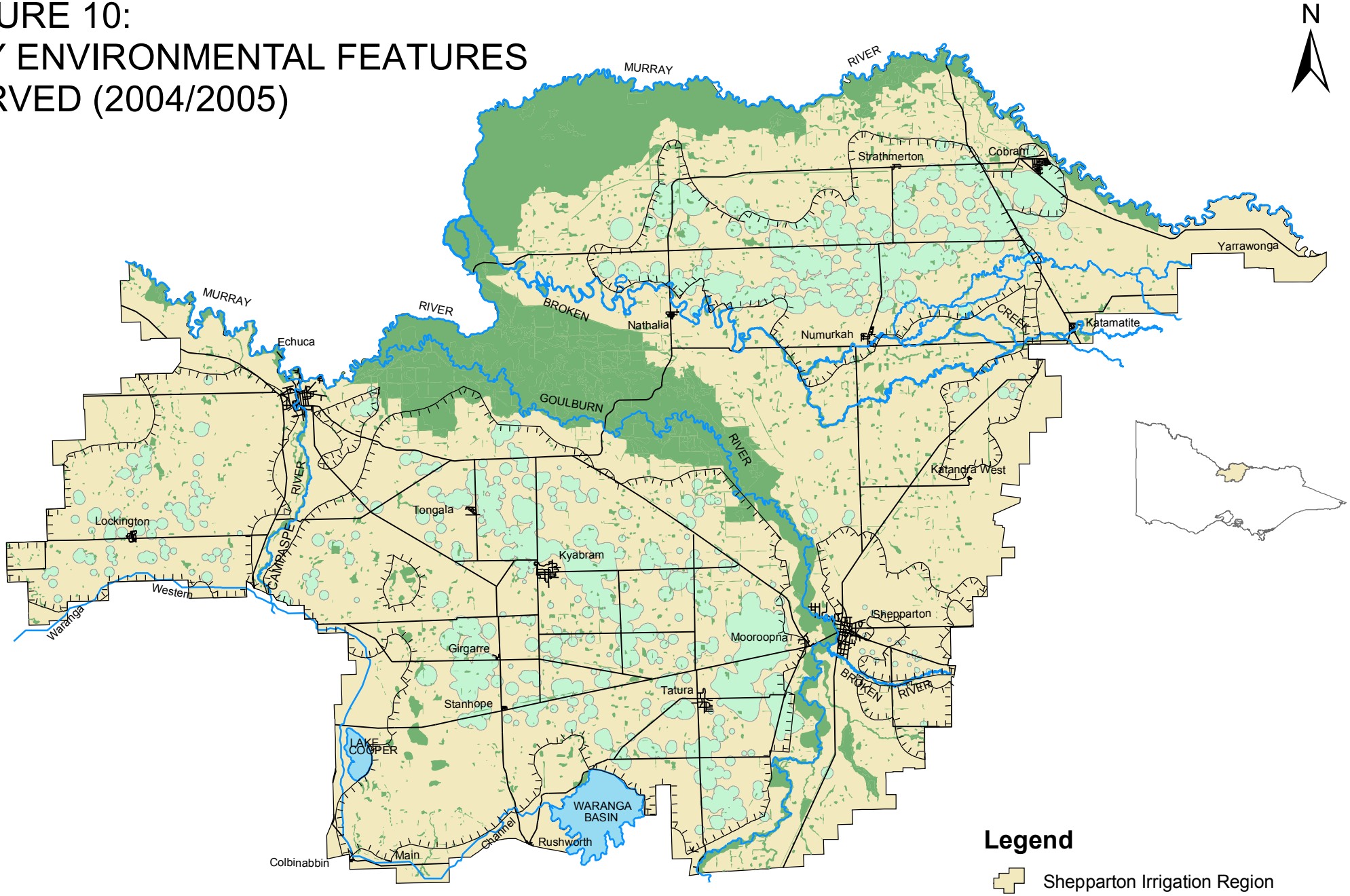


FIGURE 10:
KEY ENVIRONMENTAL FEATURES SERVED (2004/2005)



4.4.7. Salt Disposal

4.4.7.1. Expected Requirements

Of the 4.9 EC Salt Disposal Entitlement (SDE) available to the SIR in 2004/05, 2.98 EC was committed to works being delivered under the SSDP. **Table 23** presents a breakdown of the commitment of SDEs under the SSDP together with the projected SDE requirement with full implementation of the SSDP.

The financial impacts included in **Table 23** are the annual downstream impacts resulting from salt disposal from the SSDP assuming 1 EC leads to an annual impact of $230,000.

As the nature and location of the works to serve the C Type areas is unknown, the 3.8 EC of salt disposal entitlement included in the 2000 SSDP review for these areas, has not been included in the SSDP 5-Year review.

Table 23: Breakdown of Current SSDP SDE Commitments and Projected SDE Requirements

SIRCIS Activity	SDE Uptake between 2000 and 2005	Committed SDE (1990 to 2005) (post audit[3])	Required SDE (Full Implementation of SSDP)
SSDP Public Pumps	0.74 EC	1.52 EC	8.9 EC
SSDP Private Pumps	0.18 EC	1.30 EC	3.3 EC
SSDP Horticulture Works (Low Yield)	0 EC	0.16 EC	0.2 EC
Total	**0.92 EC**	**2.98 EC**	**12.4 EC**
Total Financial Impact	$211,600	$685,400	$2,852,000

Source: Hydro Environmental, 2006

Note: 1. The sum of the above numbers may not equal the total presented due to rounding errors
2. The figures above do not include the additional 3.8 EC requirement for undefined C-Type areas
3. For audit details refer to Section 4.4.7.2.

Between 2000 and 2005 there was an estimated uptake of 0.92 EC through works delivered under the SSDP. The majority of this uptake related to the installation of new Public Pumps.

It is projected that a further 9.42 EC (12.4 EC in total) will need to be allocated to the SSDP to achieve full implementation as planned. While the current uptake of SDEs is below the region's allocation, further SDEs will need to be sought as implementation of the SSDP proceeds.

The figures presented in **Table 23** relating to full implementation of the SSDP, are based on a paper prepared by Hydro Environmental (2006), titled 'Projected Sub-surface Drainage Program Salt Disposal Entitlements to 2030'. **Table 24** presents an extract from the paper showing the total salt load and approximate salinity impact across the different management area types.

Table 24: Projected SSDP Salt Disposal Entitlements in 2030 (Paper Extract)

Ownership	Private Pumps			Public Pumps			Total
Management Area Type	C	Low B3	High B3 Private	High B3 Public	B2	B1	
Total Area	1,300 ha	98,700 ha		85,000 ha			185,000 ha
Total Salt Load (t)	1,300 t	18,100 t	4,200 t	39,900 t	21,000 t	0	84,400 t
Approx. EC Impact	0.2 EC	2.7 EC	0.6 EC	5.8 EC	3.1 EC	0	12.4 EC

Source: Hydro Environmental, 2006

Note:
1. New salt loads are assumed to be proportional to the change in area to be served in each management type area
2. Average overall relationship between salt generated and EC impact at Morgan is 6,800 t/EC
3. The above numbers may not equal the total presented in the Hydro Environmental report due to rounding errors
4. The figures above do not include the additional 3.8 EC requirement for undefined C-Type areas.

4.4.7.2. SIR Salt Export Modelling

In 2005 a detailed analytical model of the water and salt inflow and outflow was developed to enable the change in the export of salt and water from the SIR to be generated in daily time steps.

This model output is then able to be run through the MDBC's DTSM and BIGMOD models to determine changes in EC and Economic Impact at Morgan due to actions taken in the SIR. The modelling enables the impact of the SSDP, the Surface Water Management Program and the Farm Program to be separately identified. The modelling also shows;

- the increase in water reuse/recycling at both a farm and a regional level is having a significant adverse impact on downstream River Murray salinities due to a reduction in dilution flows in the mid to lower Murray
- there are beneficial interdependencies between SIRCIS management action with the total requirements of each of the actions in each of the programs measured in isolation would be less than if they were all modelled together
- the impact of each action and the cumulative actions is likely to be less than has been found by past modelling.

4.4.8. Improved Water Use Efficiency and Water Generation

The SSDP makes a significant contribution to water savings by controlling the level of salt in the soil profile of the 76,200 ha served by works under the Program. Controlling the level of salt reduces plant stress and increases production efficiency as measured by production of dry matter per megalitre of water applied.

In addition to improving production efficiency of a significant part of the SIR, between 2000/01 and 2004/05, the SSDP annually generated some 75,600 ML/yr of additional water by extracting groundwater which could otherwise cause waterlogging and salinisation or serve no useful purpose if it was not extracted. Of this volume, 73,200 ML/yr was produced by private pumps and 2,400 ML/yr was produced by public pumps.

4.5. Research and Investigation (R&I) Achievements

4.5.1. Development of the SSDP R&I Strategic Plan

Between 2000/01 and 2004/05 the key achievement under SSDP Research and Investigation (R&I) sub-Program was the development of the SSDP R&I Strategic Plan. The Plan, which was completed in 2003, was developed in recognition that there were a number of issues affecting the SSDP which were not captured or addressed under the R&I framework that existed at the time.

Prior to the development of Strategic Plan, the R&I aspect of the SSDP was managed in a relatively ad hoc manner. This made it difficult to determine whether funds were being targeted at addressing the highest priority issues and that outputs were being delivered in the most desirable order. It was also impossible to ensure that SSDP R&I outputs were appropriately timed and led to the best possible outcomes whilst making best use of available skills and resources (e.g. avoiding duplications of work).

The preparation of the SSDP R&I Strategic Plan broadly involved the:

- Identification and prioritisation of key issues
- Grouping the prioritised issues
- Identification of tasks to address the prioritised issues, and
- Development and prioritisation of projects which captured the tasks and objectives.

A total of 42 project outlines were initially developed as part of the SSDP R&I Strategic Plan in 2003. These projects addressed 51 of what were considered to be the highest priority issues for the SSDP at the time.

Key components of the SSDP R&I Strategic Plan (2003) included a:

- Detailed and costed one year work program
- Costed 5 year costed work program
- SSDP R&I Work Program Management and Reporting Framework.

The SSDP R&I Work Program Management and Reporting framework sets out a process by which new and emerging issues are incorporated into the SSDP R&I work program.

4.5.2. Outputs of R&I Strategic Planning Process

Key outputs relating to the SSDP R&I strategic planning process between 2000/01 and 2004/05 were:

- Development of a SSDP R&I Strategic Plan
- Implementation of a management and reporting process for the SSDP R&I Annual Work Program and rolling 5 Year Work Program
- Commencement of a review of the SSDP R&I Strategic Plan (2007)
- Identification and prioritisation of 265 issues to 91 key issues through workshops, meetings, interviews and a prioritisation process associated with the SSDP R&I Strategic Plan (2007)
- Development of project briefs for some 52 projects of which 36 projects have commenced and six have been completed.

Table 25 lists the six SSDP R&I projects which have been completed between 2000/01 and 2004/05.
Table 26 lists the R&I projects that have commenced that are yet to be completed.

Table 25: SSDP R&I Strategic Plan Projects Completed between 2000/01 and 2004/05

No.	Project ID	Project Title
1.	GG02 008	Development of the transparent framework for prioritising works and measures under the SSDP
2.	GG03 012	Development of SSDP Performance Indicators
3.	GI02 019	Relationship between on-farm management practices and groundwater accessions
4.	GG03 045	New Technologies - OhmMapper
5.	GG03 045	New Technologies - Evaluating High Resolution Electrical Resistivity
6.	GG04 049	Watertable Behavior Analysis - Dhurringile LAP Area Groundwater Analysis

Table 26: SSDP R&I Strategic Plan Projects Commenced

No.	Project ID	Project Title
1.	GG02 000	Preparation of an investigation and work Program
2.	GG02 002&10	Review SSDP management structure AND Improvement in communication between SSDP mgt. stakeholders (& funding bodies)
3.	GG02 003	Drainage Catchment Scale Planning
4.	GC04 005	Review Cost Shares
5.	GG03 006	Review compatibility of SSDP and G-MW policies and procedures
6.	GG06 007	Review Impact of Projected Changes in Groundwater Levels and Salinity
7.	GG03 009	Development of Technical Guidelines for implementation of works & measures under the SSDP
8.	GG02 013	Review of SSDP monitoring needs
9.	GI03 014	Determine the presence and extent of potentially harmful substances in groundwater
10.	GG03 020	Define "C Type" areas and develop management options
11.	GG06 022	Review Groundwater Discharge Op. Guidelines for Drains and Channels
12.	GG06 031	Assessment of Groundwater Pump Performance
13.	GG02 033	Review of groundwater disposal and operation practices
14.	GG06 034	Review of Phase A Operational Rules (optimise)
15.	GG03 044	Horticultural incentives for new development
16.	GG03 045	Investigation of New Technologies
17.	GG03 046	Water Reform Implications
18.	GG03 046a	Water Reform Implications – IDG
19.	GG04 049	Watertable behavior analysis
20.	GG04 050	SSDP 5 Year Review
21.	GG05 051	Review of SSDP R&I Strategic Plan
22.	GI02 011	Improving Local Community Awareness and Involvement in the Implementation of the SSDP
23.	GI02 015	Review of the G-MW and NRE-ISIA data management systems
24.	GI03 016	Land Use Change Opportunities
25.	GI03 036	Assessment of High Value Environmental Features within SIR
26.	GG02 025	Review of the SSDP/SIR Salt Disposal Budget
27.	GG05 026	Review of Salt Conveyance Practices (Part of Grouped Salt Project)
28.	GG02 028	Develop options to maximise salt credits to the region
29.	GG02 028a	Salt Inflows to Goulburn River - Wahring Investigation
30.	GI03 029	Map the proposed location for evaporation basins in the SIR
31.	GG03 030	Evaporation basin design, ownership and promotion (Water for Growth)
32.	GG03 043	Salt disposal administration and reporting
33.	GG03 047	Deep Lead Impacts
34.	GG03 048	Salt Audit Model
35.	GI05 052	Knowledge Integration Framework
36.	GG04 049	Watertable Behavior Analysis - Dhurringile LAP Area Groundwater Analysis

4.5.3. SSDP R&I Achievements

Key achievements of the SSDP R&I Strategic Plan between 2000/01 and 2004/05 include:

- An improved understanding of the achievements of the SSDP through the adoption of and use of Performance Indicators
- An improved understanding of the relationships between farm management practices and groundwater accessions
- Identification of new technologies to assess and identify aquifers to be targeted for groundwater pumping for salinity and groundwater management
- A greater understanding of watertable behaviour in the Dhurringile Land Action Plan (LAP) Area
- An improved understanding of the SSDP prioritisation processes and delivery tools
- A greater understanding the MDBC salt administration process
- Commencement of process of developing surface drainage catchment based sub-regional SSD plans.

4.5.4. Other R&I Projects

In addition to projects being delivered under the SSDP R&I Strategic Plan, Primary Industries Research Victoria (PIRVic), which is part of the Department of Primary Industries Victoria (DPI), has undertaken a number of projects which broadly align with, and assist in, the achievement of the objectives of the SSDP.

These projects are not captured under the SSDP R&I Strategic Plan because they are funded through sources external to the GB CMA and the SIRCIS.

The PIRVic project achievements broadly include the following, which can benefit the SSDP:

- Better information decision making
- Better understanding of catchment planning needs
- Changing irrigation and land management practices
- Improving resource use efficiency
- Minimising impacts of irrigation.

Of these 39 projects undertaken by PIRVic, 24 were completed between 2000/01 and 2004/05.

Table 27 presents a list of the completed projects. The remaining 15 projects are expected to be completed by June 2007.

Table 27: SSDP related PIRVic projects completed between 2000/01 and 2004/05

No.	Project Title
1.	Use of Remotely Sensed Data to Estimate Actual Evapotranspiration and Assess Water Use Efficiency in an Irrigated Landscape
2.	Irrigation in a Variable Landscape: Matching Irrigation Systems and Enterprises to Soil Hydraulic Characteristics
3.	Mapping of Native Pasture using Satellite Imagery in the Goulburn Broken Catchment
4.	Linking Farms, Catchments and Channel Automation: Farm Benefits Module
5.	Farm Salinity Management
6.	Catchment Scale Land Use Mapping for NAP Regional Catchments
7.	Regional Irrigation Information Systems
8.	Bayesian Networks for Water Resources Management Decision Analysis
9.	Technical Support for Local Area Plans
10.	Policy Instruments to Improve Water Use Efficiency – Market Mechanisms
11.	Collaboration with NGOs to achieve NRM outcomes
12.	Consistency of On-Farm Environmental Management Systems for Victoria
13.	Irrigation Benchmarking and Improvement System (IBIS – Pasture)
14.	Increasing Water Use Efficiency Through Improved Irrigation System Design
15.	Improved Water Use Efficiency through better Farm Groundwater Management Practices
16.	Increasing the impact of research and extension in irrigated agriculture
17.	Implications of Water Policy Options for Irrigation Regions (formerly Planning & Economics)
18.	Module 5: Recharge Quantification Experiment
19.	Module 6: Sprinkler, Subsurface Drip and Surge Irrigation Experiment
20.	Module 7: Decision Support Timer Development
21.	Interaction of Saline Water and Soil Sodicity
22.	Effect of Salinity and Waterlogging on the Productivity of Irrigated Forage Species
23.	Planning and Economics
24.	Management of Saline Groundwater; Field Testing of 3 Systems

4.6. Other Program Achievements

4.6.1. Drainage Catchment Scale Planning

Over the past five years there has been a gradual move from whole of region planning for SSD towards drainage catchment scale planning. This change recognises the differences in catchment characteristics and community needs across the SIR, from a surface and subsurface drainage perspective. Twenty-four drainage catchments have been defined within the SIR. The location of these drainage catchments is presented in **Figure 11**. It is expected that the boundaries of these catchments will broadly be used as the basis for the development of future 'Drainage Catchment Sub-surface Drainage Plans'.

Within the period of the SSDP 5-Year review, no SSDP drainage catchment plans were developed, however, a SSDP R&I project was commenced to define the framework by which these plans will be produced. Once developed, the planning framework will be initially trialled on Wyuna drainage catchment. Following the completion of this drainage catchment plan, drainage catchment plans will be produced for the Nanneella and Dhurringile Local Action Plan (LAP) areas. **Figure 12** shows the location of these two LAP areas, along with the other LAP areas in the SIR.

Drainage catchment scale planning is expected to facilitate more regional implementation and greater adaptive management by changing the way that:

- SSDP works are planned, prioritised and implemented
- SSDP works are tracked and evaluated
- Stakeholders are engaged.

The drainage catchment plans will specifically address local scale issues and be more consistent with the requirements of the local conditions, especially local salt distribution and management. They will also facilitate broader engagement and adoption of other aspects of the SIRCIS.

4.6.2. SSD Extension and Education

There have been a number of surveys conducted of groundwater users in the SIR. These surveys have generally focused on the level of groundwater knowledge and perceptions of groundwater issues.

Although these surveys may not technically be unbiased and statistically correct, they do provide an indication of the level of knowledge held by groundwater users. Analyses of these surveys has revealed that among private groundwater irrigators, there is a general level of understanding of:

- Groundwater best management practices
- The rationale behind groundwater pumping and localised changes in watertable depth (watertable and salinity control)
- The need for shandying of groundwater in the SIR (salinity reduction of irrigation water) and associated technical support.

The surveys also revealed that the key driver for landowners to install and pump groundwater was the desire to secure additional water, or at least the rights to additional water. Between 2000/01 and 2004/05 only 62% of licensed extraction volumes were used for irrigation purposes (refer to **Table 15**).

On the basis of the survey results, it was concluded that the effectiveness of SSD extension and engagement efforts should be improved to ensure that landowners can be better informed in the following three key areas:

1. Land salinisation and waterlogging across the SIR
2. The importance of groundwater pumping as a salinity control measure
3. The importance of maintaining good water quality and shandying to the recommended salinity concentrations if productivity is not to be impacted to the extent that groundwater reuse is not cost effective.

FIGURE 11: DRAINAGE CATCHMENTS

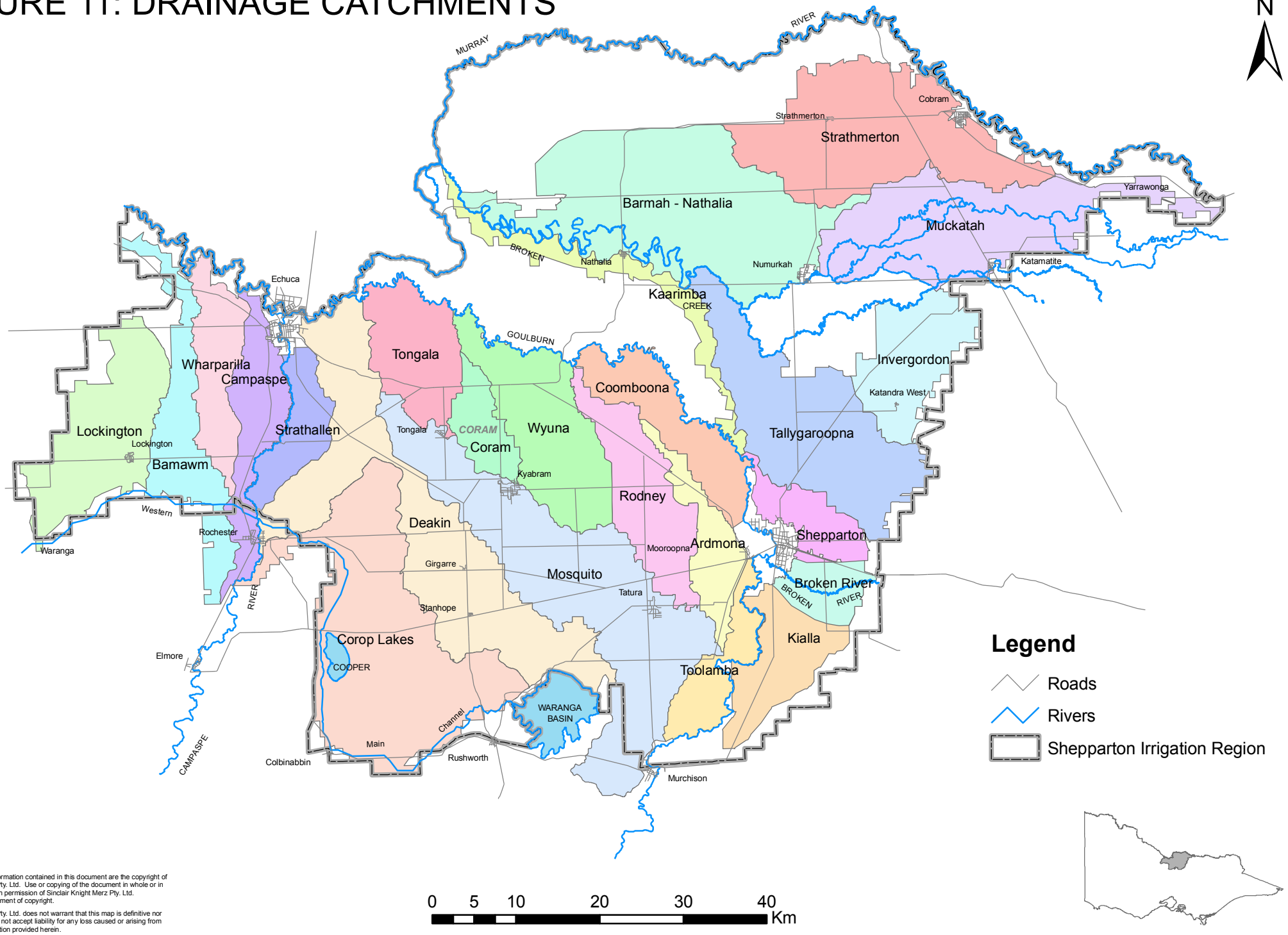
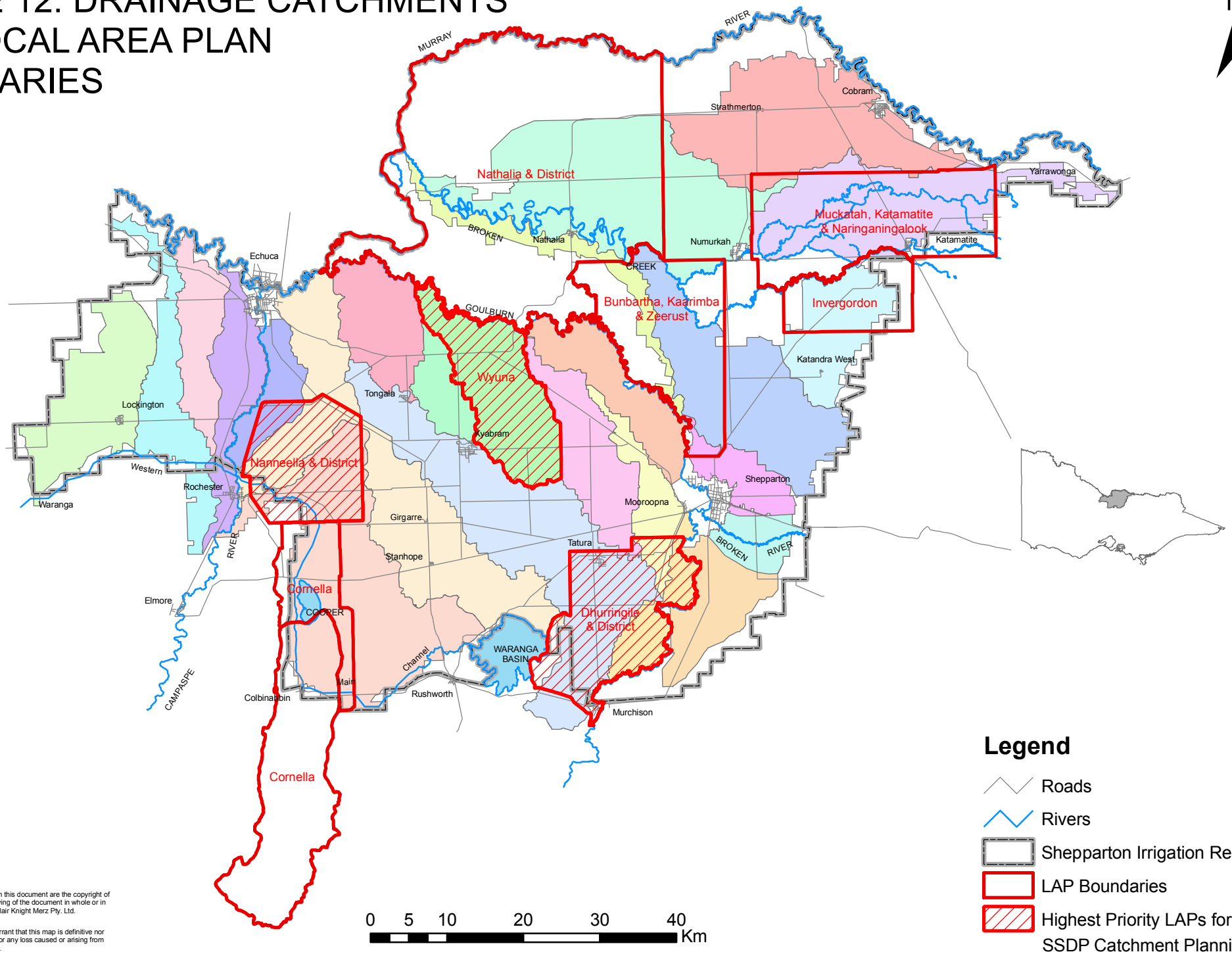


FIGURE 12: DRAINAGE CATCHMENTS AND LOCAL AREA PLAN BOUNDARIES



4.7. Monitoring

4.7.1. Groundwater Levels

The dry weather conditions have had a significant impact on groundwater levels across the SIR, with lower than average natural rainfall and lower irrigation water allocations, reducing recharge to the regional and local aquifer systems which has resulted in changes to the shallow watertable pattern.

Table 28 presents a breakdown of the changes in the depth to watertable between 2000/01 and 2004/05. These results are diagrammatically presented in **Figure 13**.

Between 2000/01 and 2004/05 the area with the watertable at less than one metre below the natural surface decreased from 18,000 ha to 1,500 ha. Over the same period, the area with the watertable greater than three metres below the natural surface increased from 293,000 ha to 371,000 ha. As shown in **Table 28** and **Figure 13**, the depth to the watertable was greater than three metres across the majority of the SIR in all years, increasing from 52% in 2000/01 to 66% in 2004/05.

Table 28: Changes in the depth to watertable between 2000/01 and 2004/05

Year	Watertable Depth							
	0-1m		1-2m		2-3m		>3m	
	ha	%	ha	%	ha	%	ha	%
2000/01	18,020 ha	3%	134,050 ha	24%	116,590 ha	21%	293,680 ha	52%
2001/02	10,560 ha	2%	121,560 ha	22%	118,860 ha	21%	311,370 ha	55%
2002/03	1,260 ha	0%	68,280 ha	12%	156,010 ha	28%	336,790 ha	60%
2003/04	11,350 ha	2%	78,350 ha	14%	112,780 ha	20%	359,860 ha	64%
2004/05	1,490 ha	0.3%	60,160 ha	11%	128,990 ha	23%	371,710 ha	66%

Note: Area monitored in the SIR WSPA was 562,340 ha.

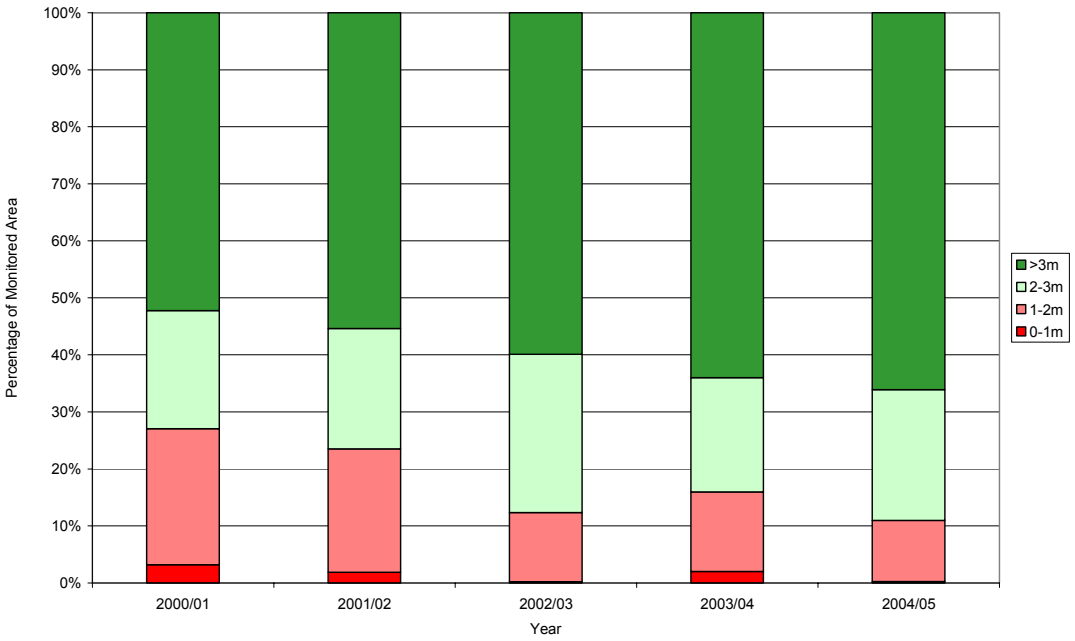


Figure 13: Percentage of SIR area with 0-1m, 1-2m, 2-3m and greater than 3m depths to groundwater (2000/01 to 2004/05)

Figure 14 presents the total monitored area of the SIR with groundwater levels less than three metres between 1990/91 and 2004/05. The figure shows an upward trend to 1995/96 followed by a significant downward trend, particularly in the years from 2000/01 to 2004/05. Based on current climatic forecasts this trend is expected to continue, at least in the immediate future. The combined implications of continued dry conditions and the implementation of the SSDP are significant from a groundwater perspective. Some of these implications are explored in **Section 5.6**.

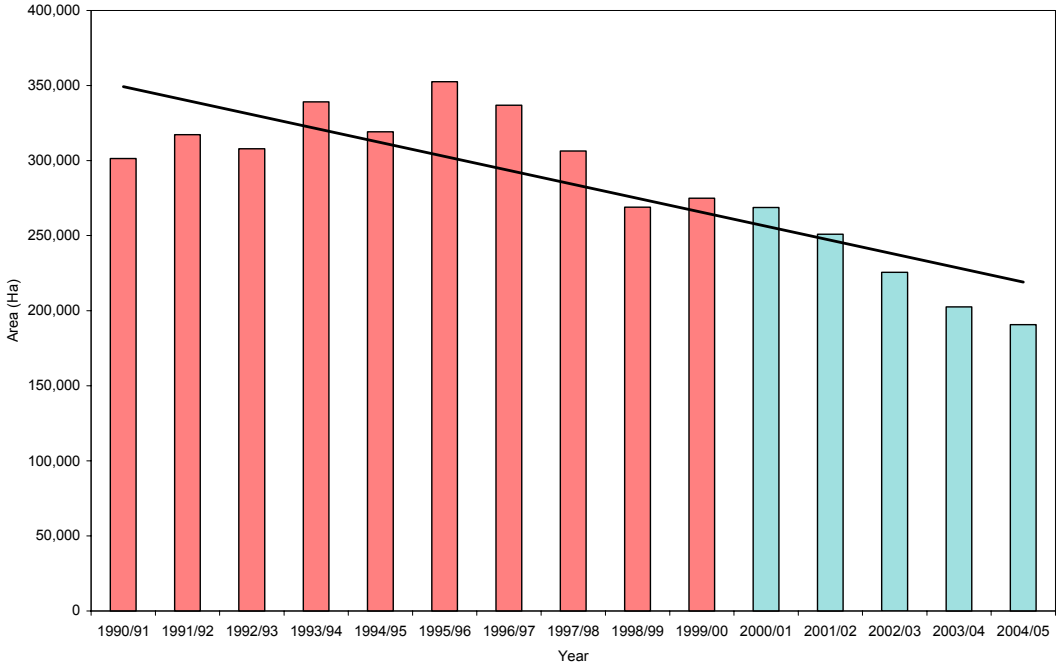


Figure 14: Trend in groundwater levels (0-3m) in the SIR from 1990/91 to 2004/05

Figure 15 and **Figure 16** respectively, present the SIR depth to watertable in August 2000 and August 2005 and have been included to show the spatial change in the depth to groundwater across the SIR over the five years to August 2005.

For comparative purposes, an additional figure has been included in the executive summary of this SSDP 5-Year Review report, showing the watertable depth in August 1996. As shown in **Figure 14,** groundwater levels at this time were at their highest for the 15 year period since implementation of the SSDP commenced.

4.7.2. Groundwater Salinities

As part of the SIR WSPA GMP, each year during the irrigation season, G-MW conducts a mail out survey to operators of licensed irrigation bores. As part of this mail-out, a sample bottle is provided to the registered owner with a request to fill the bottle with groundwater from their bore and return it to G-MW for analysis.

It is a condition on groundwater irrigation licences that licensees submit a sample of groundwater from their licensed irrigation bore. **Table 29** presents an overview of the number of samples requested and returned to G-MW between 2000/01 and 2004/05.

FIGURE 15:
WATERTABLE CONTOURS
AUGUST 2000

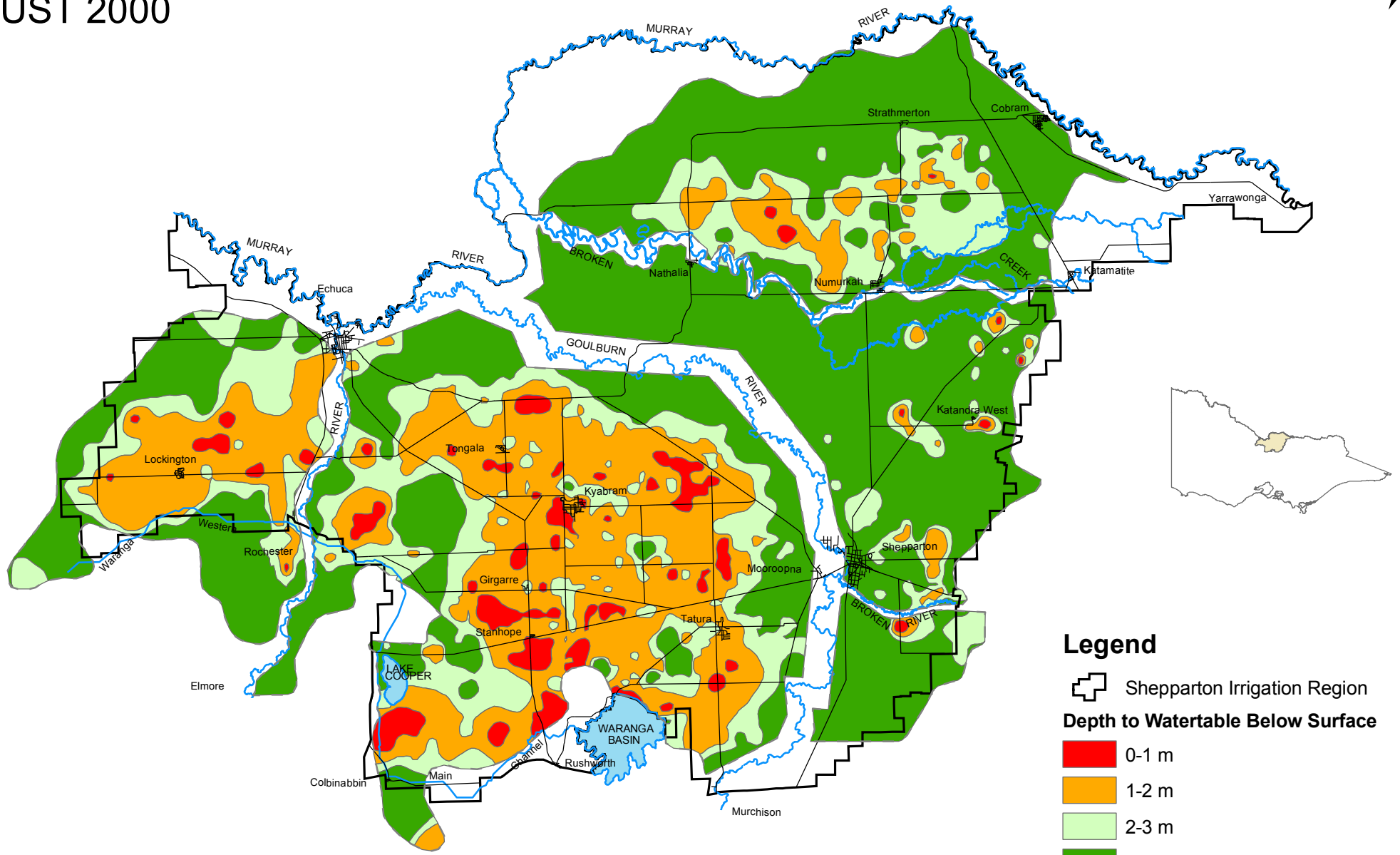


FIGURE 16:
WATERTABLE CONTOURS
AUGUST 2005

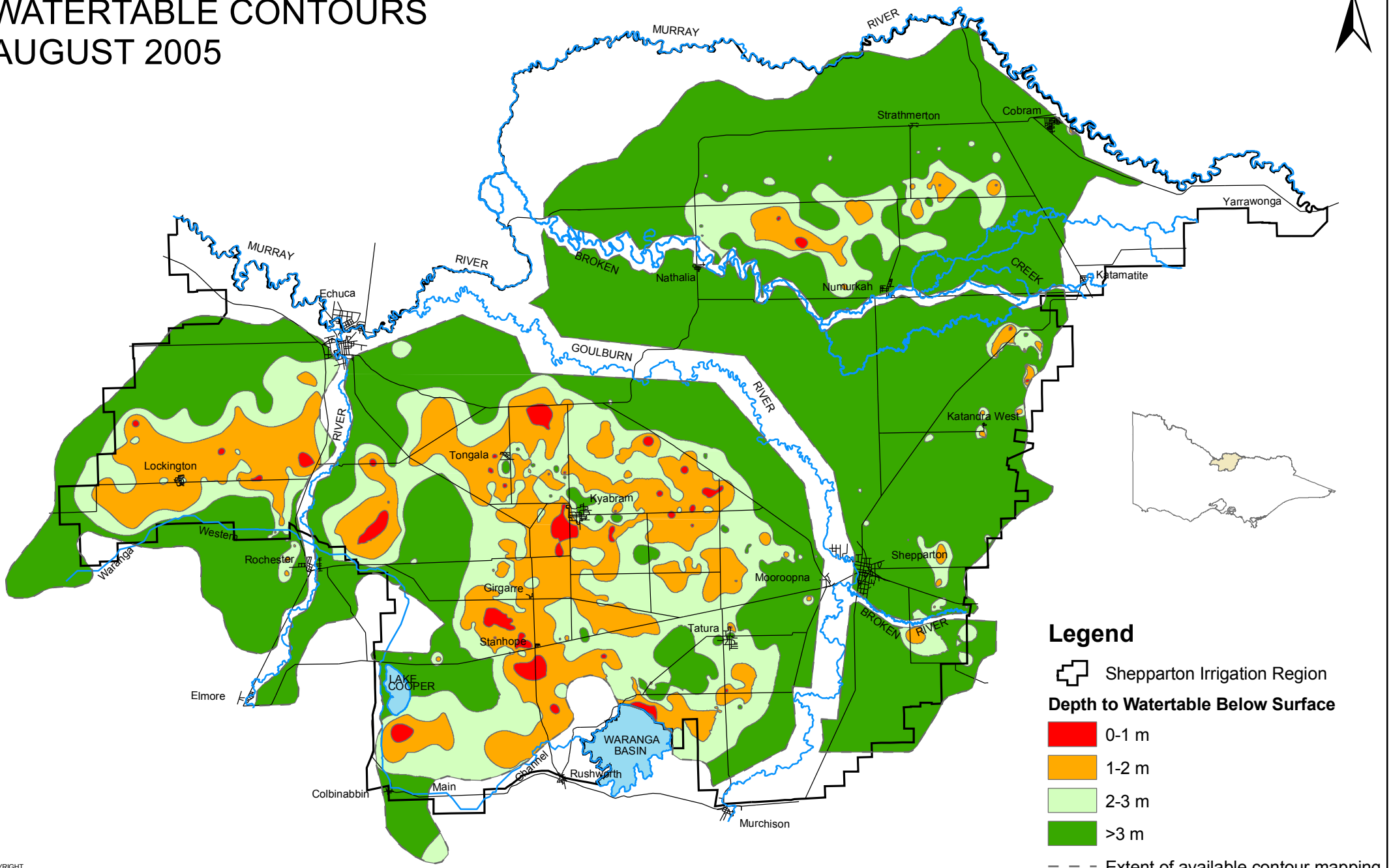


Table 29: Groundwater salinity samples requested and returned for 2000/01 to 2004/05

Year	No. of Sample Requested	Total No. of Samples Returned	Percentage Requests Returned (%)
2000/01	N/A	439	N/A
2001/02	N/A	492	N/A
2002/03	983	488	50%
2003/04	908	450	50%
2004/05	1,060	510	48%

Source: - SIR Groundwater Management Plan Annual Reports for years 2002/03 to 2004/05
- Preliminary Summary of Private Groundwater Bores in the SIR GSPA (2000/01 and 2001/02)
- extract from private pump records by Ian Oppy.

During the period reported, on average 49% of the sample requests were returned to G-MW for analysis. G-MW is endeavouring to improve compliance with the sampling program through providing feedback to licensees on the sampling results, and improving the understanding of the purpose and benefits of providing groundwater salinity data.

Table 30 presents a summary of the groundwater salinity data obtained between 2000/01 to 2004/05.

Table 30: Bore salinity data for the SIR over the reporting period

Year	Average EC (uS/cm @ 25°C)	% of Bores with less than 3,000 EC	% of Bores with 3,000 EC to 5,000 EC	% of Bores with greater than 5,000 EC
2000/01	2,278 EC	78%	15%	7%
2001/02	2,261 EC	78%	16%	6%
2002/03	2,447 EC	72%	22%	6%
2003/04	2,247 EC	73%	21%	6%
2004/05	2,271 EC	75%	20%	5%

Source: Adapted from
- SKM (2006) Salinity Monitoring Update for Years 1999/2000 to 2001/2002
- SIR Groundwater Management Plan Annual Reports for 2002/03 and 2003/04
- extract from private pump records by Ian Oppy.

In addition to the results of the GMP groundwater sampling program, a three year metering program was undertaken between 1999/2000 and 2001/02 in which average salinity concentrations were reported, these results are also incorporated into the figures in **Table 30**.

A key conclusion of the annual GMP sampling program was that annual inconsistencies in temporal data from individual bore sites made reporting on trends on a year by year basis difficult. This conclusion has been supported by independent reviews of the data carried out by Sinclair Knight Merz and G-MW (pers. com. Heinz Kleindienst and Ian Oppy, 2007).

Further focus needs to be placed on the ongoing collection and analysis of groundwater salinity concentrations from representative bores across the SIR in order to gain more accurate data, and improve the confidence and understanding of salinity trends.

4.7.3. Groundwater Nutrient Levels

There is limited groundwater nutrient data available across the SIR, with the 'Review of Public Pump Hydrochemistry Data' (SKM, 2002) being the only data able to be sourced.

As part of the 2002 review, the Total Nitrogen (TN) and Total Phosphorus (TP) concentrations from 15 Phase A pumps were analysed, generating the following results:

- Average TN concentrations were 2.4 mg/L (with a range of 0.32 to 10.1 mg/L)
- Average TP concentrations were 0.075 mg/L (within a range of 0.05 to 0.14 mg/L).

As a comparison, the State Environment Protection Policy Waters of Victoria (SEPPWoV) sets the following as the 75th percentile desirable water quality limits for waterways in the lowlands of the Goulburn, Broken and Campaspe catchments:

- TN - 0.9 mg/L
- TP - 0.045 mg/L.

While the average nutrient concentrations are higher than the desirable stream water quality limits, there is insufficient data to draw any conclusions as to the impact of groundwater pumping undertaken as part of the SSDP on downstream nutrient concentrations. Furthermore, given that the majority of the Phase A pumps are installed in horticultural areas, which are not generally representative of the average conditions across the SIR, the results obtained from the review can not be extrapolated across the entire SIR.

4.7.4. Impact of SSDP on Receiving Waterways

There are around 31 active surface water monitoring sites located across the SIR. The monitoring sites comprise a mixture of drains, channels, creeks and rivers which flow from a range of catchment types including irrigated, dryland and undeveloped catchments.

With the exception of winter 2000, between 2000/01 and 2004/05 there was no winter/spring disposal opportunity. In winter 2000 there was an opportunity and actual disposal from public pumps. Disposal on that occasion was estimated to be 1,001 ML (G-MW, 2007).

Given the limited opportunity for disposal from public pumps (with no disposal from private pumps) between 2000/01 and 2004/05, the impact of the SSDP on the salinities and nutrients of receiving waterways is considered to be negligible.

4.8. Reporting

4.8.1. SSDP Key Performance Indicators

Key Performance Indicators (KPIs) are quantifiable measurements which are used to demonstrate the success of a particular program or initiative. In response to a need for regular reporting on the performance of the SSDP to key stakeholders, the managers of the SSDP have worked towards the development of an annual SSDP KPI report. Prior to the preparation of the annual SSDP KPI report, there was an informal KPI reporting process in place to measure SSDP performance.

Over the period of the SSDP 5-Year review, two KPI formal reports have been produced, the latest presenting data over the 2004/05 financial year. The first annual SSDP KPI report was not released to the broader stakeholder group, but instead was used to refine the KPIs and the format of reporting. The second report was widely distributed.

The preparation of the annual SSDP KPI report has generated a number of benefits including the development of standard reporting method and approach for the calculation of the Program outputs and outcomes. The report allows upfront evaluation of Program performance and ensures that key information is easily understood by all stakeholders.

Key Performance Indicators reported on the SSDP for the 2004/05 financial year, include:

- Area Served by SSDP works
- Program Works (Public Pumps commissioned)
- Program Works (Private Pumps commissioned)
- Program Outputs (Salinity Control Pumps, Volume pumped for the year vs. design capacity)
- Program Outputs (Private irrigation bores pumped volume vs. licence volume)
- SSDP Budget/Revenue/Expenditure and their composition
- Environmental Indicators (Area subject to shallow water tables (i.e. <2m).

Data for most of these KPIs are presented in **Section 4.4**.

4.8.2. MDBC Register A and Register B

The primary mechanism for tracking the achievement of the Murray-Darling Basin Salinity Target is through the Murray Darling Basin Commission (MDBC) Schedule C Register A and Register B. The Registers track all actions that are assessed to have a significant effect on the average daily salinity of the River Murray at Morgan (i.e. at least 0.1 EC within any of the 100 years after the action is undertaken).

Register A contains details of any actions, after a nominated baseline date (1 January 1988), which are considered to have a significant effect, excluding those actions that have the express purpose of offsetting delayed salinity impacts. The type of actions that may give rise to an entry in Register A include the installation of groundwater pumps or tile drains that discharge to regional drains.

Register B records delayed salinity impacts (i.e. that part of impacts which accrue after 1 January 2000) due to actions taken before the baseline date of 1 January 1988. It also contains details of the predicted future effects of actions aimed at addressing these and other delayed salinity impacts. The type of actions that may give rise to an entry in Register B include land use changes (i.e. revegetation, afforestation and conversion to deep rooted pastures) and irrigation efficiency improvement.

Each Authority which is directly or indirectly releasing salt to the Murray-Darling river system is required to provide the MDBC with details of their annual salt uptake. The salt uptake includes salt debits and credits which are reported in terms of Physical EC and Economic Impact (i.e. dollars).

4.8.3. GB CMA Salt Register

In Victoria, the GB CMA, along with the North Central CMA and the Mallee CMA are responsible for providing the MDBC, and DSE, with details of their respective regions annual salt uptake. Over the period of the SSDP 5-Year review, the GB CMA utilised a set of spreadsheets and tables to capture and store the necessary inputs to enable the reporting of downstream salinity impacts. As data was held in a number of places it was often difficult to locate the current and accurate data, or track historic inputs needed to govern its validity.

In recognition of the importance of accurate salt accounting the GB CMA embarked on a project to establish a 'Salt Register', containing Register A and Register B (refer to **Section 4.9.2**). The establishment of the GB CMA Salt Register would enable efficient and transparent data storage and reporting of downstream salinity impacts. Governance will be a large component associated with the utilisation of the salt register and will heavily influence the way data is entered, stored and tracked in the registers, as well as recording Register version control.

The GB CMA Salt Register would be used to satisfy its annual reporting requirements to the MDBC and DSE, in terms of region's salt uptake. All data entered into the salt register would be referenced to individual accountable actions and calculated to derive their downstream impacts. It is expected that the minimum requirement for data entry and reporting the salt register would be yearly, although increased input or reporting requirements may result in greater utilisation of this database.

The GB CMA Salt Register A and Register B will account for actions covering the entire region under the jurisdiction of the GB CMA plus the part of the SIR within the NCCMA area of jurisdiction.

The GB CMA Salt Register is expected to be completed and fully operation in 2007 to enable the reporting of the 2006/07 period.

4.8.4. Other Reporting Requirements

In addition to the annual preparation of the SSDP KPI report (prepared in January – based on data for the previous year) and the provision of salt uptake data to the MDBC (provided in September each year – based on data for the previous year), other high priority reporting requirements of the SSDP include:

- RCIP (expenditure and achievements) (Quarterly to DSE)
- SSDP Works Program (May – for following year)
- SSDP R&I Works Program (May – for following year)
- GB CMA Annual Report (August – based on data for the previous year)
- SSDP R&I Strategic Plan Annual Report (August – based on data for the previous year).

In order to facilitate communication and information exchange a high priority is placed by all stakeholders in attending planning and management meetings. This support has enabled the SSDP to be adaptive in management and implementation.

Table 31 presents the meeting cycle of the different committees and working groups with an interest in the implementation of the SSDP in the SIR.

Table 31: Committee and Working Group Meeting Cycle

Committee /Working Group	Meeting Cycle
SSDCG	Quarterly
SSDWG	Quarterly
SIRTEC	Two Meetings per Quarter (Eight Annually)
SIRIC	Two Meetings per Quarter (Eight Annually)
GB CMA Board	Two Meetings per Quarter (Eight Annually)
GB Partnership Meetings	Monthly meeting with DSE and DPI
G-MW Board	Monthly
North Central CMA Board	Monthly
VSDIWG	Quarterly
Shepparton WSC	Monthly (1st Thursday)
Central Goulburn WSC	Monthly (4th Wednesday)
Murray Valley WSC	Monthly (1st Thursday)
Rochester WSC	Monthly (3rd Friday)

4.9. Implementation of Groundwater Management Plans

4.9.1. Overview

As discussed in **Section 3.4**, the SIR comprises three Water Supply Protection Areas (WSPAs), each which has a corresponding Groundwater Management Plan (GMP). These WSPA GMPs are:

- SIR WSPA GMP
- Campaspe Deep Lead WSPA GMP
- Katunga WSPA GMP.

The SIR WSPA GMP, which focuses on the shallow aquifer (i.e. <25m below the natural surface), has the greatest interaction and influence on the implementation of the SSDP. It is the shallow aquifer that the Program is specifically targeting in its endeavour to manage waterlogging and land salinisation. Considerable effort has been made to ensure that the SIR WSPA GMP and the SSDP are complementary management tools.

While the deep lead WSPAs do not have a significant impact on the delivery of the SSDP, there is some interaction between the shallow and deep lead aquifers, and water from the deep lead is used on land served by SSD works. On this basis and for completeness in reporting, delivery under all three GMPs has been briefly reported in the SSDP 5-Year review.

For further information on each of the WSPAs refer to the respective GMPs and their annual reports.

4.9.2. Bore Metering and Licensing

The key action undertaken between 2000/01 and 2004/05, in relation to the implementation of GMPs, has been the instalment of flow meters on groundwater pumps. Metering allows the determination of how much water is being pumped from each bore, and across the WSPAs, and whether groundwater entitlements are being exceeded. As outlined in the following sections, across each of the WSPAs there are a number of individual irrigators that are exceeding their licensed entitlement.

Volumetric flow recording meters are required to be fitted to all new licensed groundwater irrigation bores in the SIR. All private dewatering bores are also fitted with a flow meter.

G-MW is currently working on the development of an asset and data management database for its licensed bores. When completed, the database will store all records relating to fitted meters and metering records.

4.9.3. Shepparton Irrigation Region WSPA GMP

Table 32 presents a summary of the SIR WSPA GMP bore metering program and groundwater usage between 2000/01 to 2004/05.

Between 2000/01 and 2004/05, there was an overall increase in both the number of bores licensed for irrigation use and the number of bores fitted with a meter. In 2004/05, 82% of all bores licensed for irrigation use were fitted with a meter. This compares with only 41% in 2000/01. The initial focus of the metering program in the SIR has been on bores with a licence entitlement greater than 20 ML/yr.

Over the 5 year period, the total volume of water pumped did not exceed the total licensed entitlement. Groundwater pumping peaked in 2002/03 at 102,000 ML (or 82% of total licensed entitlements). This result is not surprising given the drier than average climatic conditions experienced during this irrigation season.

While overall the total volume pumped did not exceed the total licensed entitlement, there were a number of individual licence entitlements that were exceeded. The greatest number of breaches in licensed entitlements occurred in 2002/03, where 222 bores exceeded entitlements (with the total volume overused being approximately 27,570 ML).

Table 32: SIR WSPA GMP bore metering and groundwater usage between 2000/01 and 2004/05

SIR WSPA		2000/01	2001/02	2002/03	2003/04	2004/05
Metering and Licensing	Number of Bores Licensed for Irrigation Use	951	894	691	763	852
	Number of Licensed Irrigation Bores Fitted with a Meter [1] [2]	393	552	604	622	702
	Licensed Irrigation Bores Fitted with a Meter (%)	41%	62%	87%	82%	82%
	Summer Meter Readings Completed	Yes	Yes	Yes	Yes	Yes
Groundwater Usage	Annual Allocation (ML)	86,410	121,432	121,757	118,132	138,669
	Volume Pumped (ML)	39,532	62,323	102,039	64,288	64,820
	Proportion of Irrigation Allocations Used	46%	51%	84%	54%	47%
	No. Licensed Metered Irrigation Bores which Exceeded Allocation	N/A	N/A	222	107	91
	Total Volume Overused (ML)	N/A	N/A	27,563	10,299	6,752

Note: [1] Operational for Full Irrigation Season
[2] Initial focus of metering program on bores with a licence entitlement of less than 20 ML.

4.9.4. Katunga WSPA GMP

As the Katunga WSPA GMP was approved August 2003, data is only available for the 2003/04 and 2004/05 period.

During meter reading programs in 2004/2005, inspectors visited each licensed bore (except for bores used for dairy wash which do not require metering). Un-metered pumps were identified as part of this program with work currently underway to install meters on these pumps.

Table 33 presents a summary of the Katunga WSPA GMP bore metering program and groundwater usage between 2000/01 to 2004/05.

In 2004/05, 61% of the licensed irrigation bores were fitted with a meter.

Similar to the SIR WSPA, over the period reported, the total volume pumped did not exceed the total licensed allocation. In each year however, there were several individual licensed entitlements that were exceeded. The maximum number of individual licensed entitlements exceeded occurred in 2003/04 when a 135 ML (representing <1% of the total licensed allocation) of over extraction occurred.

Table 33: Katunga WSPA GMP bore metering and groundwater usage between 2000/01 and 2004/05

Katunga WSPA		2000/01	2001/02	2002/03	2003/04	2004/05
Metering and Licensing	Number of Bores Licensed for Irrigation Use[1]				194	184
	Number of Licensed Irrigation Bores Fitted with Meter [2 3]				113	112
	Licensed Irrigation Bores Fitted with a Meter (%)				58%	61%
Groundwater Usage	Annual Allocation (ML)				30,100	44,000
	Volume Pumped (ML)				23,784	26,197
	Proportion of Irrigation Allocations Used				79%	60%
	No. Licensed Metered Irrigation Bores which Exceeded Allocation				7	2
	Total Volume Overused (ML)				135	39

Note:
[1] A decrease in licence numbers as reported in 2003/2004 annual report is due to the amalgamation of some licences as permitted under clause 10.1 of the Management Plan
[2] Operational for Full Irrigation Season
[3] Initial focus of metering program on bores with a licence entitlement of less than 20 ML.

4.9.5. Campaspe Deep Lead WSPA GMP

As with the Katunga WSPA GMP, data is only available for the 2003/04 and 2004/05 period.

Table 34 presents a summary of the Campaspe Deep Lead WSPA GMP bore metering program and groundwater usage between 2000/01 to 2004/05.

The Campaspe Deep Lead WSPA has the highest number of licensed irrigation bores which are fitted with a meter (90% in 2004/05). Over the two year period just over 50% of the total licensed entitlement was pumped by irrigators. There were a small number of irrigators however, that exceeded there licensed entitlement in both years (two in 2003/04 and five in 2004/05).

Table 34: Campaspe Deep Lead WSPA bore metering and groundwater usage between 2000/01 and 2004/05

Campaspe Deep Lead WSPA		2000/01	2001/02	2002/03	2003/04	2004/05
Metering and Licensing	Number of Bores Licensed for Irrigation Use[1]				106	109
	Number of Licensed Irrigation Bores Fitted with Meter[2 3]				99	102
	Licensed Irrigation Bores Fitted with a Meter (%)				93%	94%
Groundwater Usage	Annual Allocation (ML)				46,521	46,521
	Volume Pumped (ML)				23,931	25,721
	Proportion of Irrigation Allocations Used				51%	55%
	No. Licensed Metered Irrigation Bores which Exceeded Allocation				2	5
	Total Volume Overused (ML)				16	367

Note:
[1] An increase in licence numbers from the 2003/2004 annual report is a result of reporting errors in the previous report
[2] Operational for Full Irrigation Season
[3] Initial focus of metering program on bores with a licence entitlement of less than 20 ML.

4.10. Communication

Over the last 5 years the SSDP has had a strong focus on communication with the community, and other stakeholders (both internal and external to GB CMA). This has been evident through the following:

- Formation of the agency based high level SSDCG to coordinate agency input
- Reinvigoration of the SSDWG to undertake a more strategic role
- Strengthening of technical capacity in the areas of research and investigation, and on-ground works
- Strengthening of relationships between G-MW, the Department of Primary Industries (DPI) and PIRVic in particular, which has created a more united approach to the management of salt in the region (e.g. joint project submissions, targeted extension, etc.)
- Improved dissemination of information to the community (e.g. Community Reference Kit)
- The number and regularity of SSDP Working Group and management meetings including multiple agencies and community members.

A move towards drainage catchment scale planning and management is expected to further strengthen the lines of communication with the community in the future.

Further details relating to the consultation undertaken in the preparation of the SSDP 5-Year review are presented in **Volume 2**.

PART C:
The Future for the SSDP

5. SSDP 2030 Implementation Targets

5.1. Background

In setting the original implementation targets and delivery timeframe for the SSDP a number assumptions were made relating to the area served by different SSD works. As part of the development of the SSDP 5-Year review it was agreed that there was a need to have greater certainty associated with these assumptions, particularly in light of the extent to which implementation had occurred to June 2005.

In response to these concerns, a supporting project was commissioned by GB CMA. The aim of the 'SSDP Baseline Statistics' project was to document the base assumptions relating to the area currently served and projected to be served by the SSDP. This included determining a revised delivery timeframe and implementation schedule.

A key outcome of the project was a fundamental change in the delivery philosophy of the SSDP, with greater emphasis now being placed on the delivery of 'outcomes' (i.e. area served) rather than to 'outputs' (i.e. the number of pumps installed), which have been the focus of past SSDP reporting.

A further fundamental shift occurred as part of the SSDP Baseline Statistics project in the determination of the area served. Prior to this review the projected area served included the overlap between the area served by specific SSD works. This review, for the first time, accounts for the overlap in setting future targets and in determining achievement of historic targets. The previous approach led to an over estimate of the area actually served by specific SSD works.

A copy of the SSDP Baseline Statistics report is included in **Volume 2** of the SSDP 5-Year review report.

5.2. Area to be Served

The revised target area served by the SSDP, as defined as part of this review, is 185,000 ha. This area to be served, which is 13,700 ha more than the area of 171,300 ha assumed in the 2000 SSDP review, includes 37,390 ha to be served by Non-SSDP private pumps.

The SIR comprises areas classified as B Type and C Type areas with the classification depending upon the presence of aquifers. The C Type areas are areas underlaid by high groundwater levels with no or low yielding aquifers. Groundwater salinities vary from low to high. The B Type areas are areas underlaid by high groundwater levels with medium to high yielding aquifers. Similar to C Type areas groundwater salinities in B Type areas vary from low to high.

The SSDP is primarily targeting projected areas at risk due to high watertables where aquifers can be located. Although the C Type areas were nominally included in the SSDP, to date a strategy has not been developed to cost effectively services these areas.

The total estimated area at risk of salinisation and waterlogging, including the C Type areas, is 350,350 ha. This area is defined in **Figure 19**.

The detail of the methodology used to determine the revised target area to be served by the SSDP is summarised in **Figure 17**.

Put simply, the revised area to be served of 185,000 ha was based on determining the area at risk of salinisation and waterlogging, where the installation of SSD works could cost effectively be installed and would have a positive influence (i.e. excludes C Type Areas and other areas which can not be cost effectively serviced).

Type B Management Area (high - medium yielding aquifers) within the projected 2020 0-2 m watertable contour within the SIR	177,337 ha
+	
Area of 1996 0-3 m watertable contour that extends beyond the projected 2020 0-2 m watertable contour	60,220 ha
X	
Assumed[(i)] relative proportion of B Type Management Area within the Total Area of 1996 0-3 m contour that extends beyond the projected 2020 0-2 m watertable contour	30%
+	
Phase A Area outside of the Composite Boundary	6,423 ha
-	
Area currently served by Phase A pumps and the Girgarre Evaporation Basin System (installed prior to SSDP)	-19,749 ha
+	
Area currently served by pumps that have been installed and upgraded with SSDP assistance (Capital Grants) outside of the Defined Area at Risk of Salinity and Waterlogging	2,901 ha
=	
Area at Risk to be served by the SSDP	**185,000 ha**

(i) There is a sound understanding that the majority of the additional area located outside the 2020 0-2 m boundary is C Type, and have assumed that only 30% of this area is B Type.

Figure 17: Summary of Methodology to determine the Revised SSDP Target Area Served

Based on the target of 185,000 ha, and the SSDP achievement to June 2005 of 73,200 ha served (refer to **Section 4.4**), there is 111,800 ha remaining to be served by future SSDP works.

Figure 18 presents the SSDP outcome based implementation targets and shows the area served to 2000/01; area served between 2000/01 and 2004/05; and the area to be served following the full implementation of the SSDP.

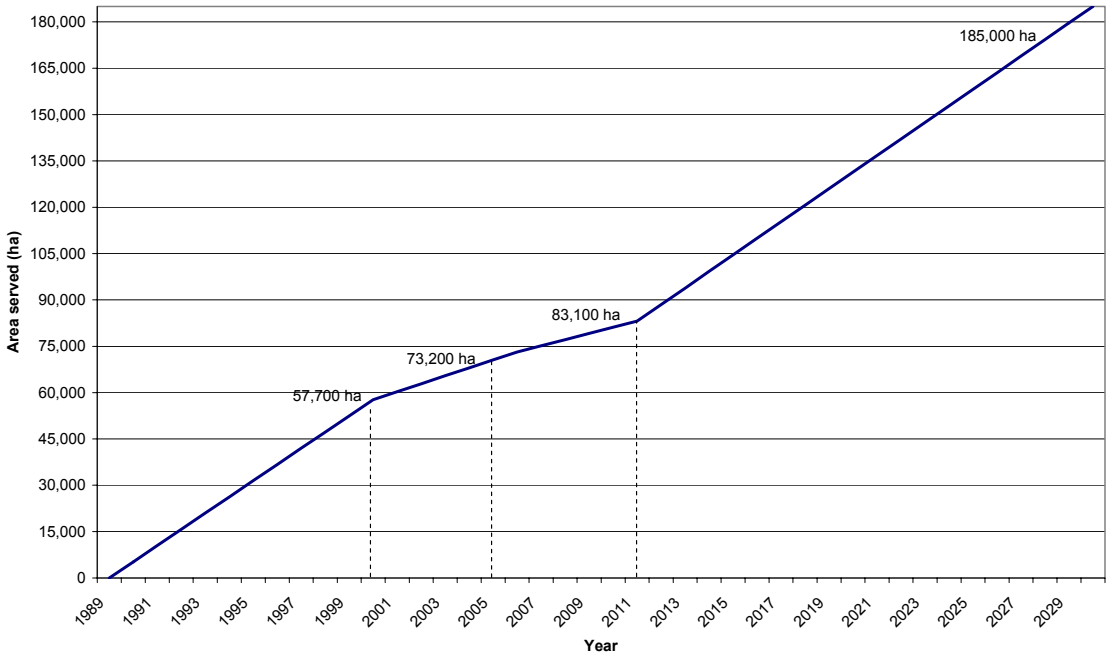


Figure 18: Area Served at different Implementation Timeframes

5.3. Sub-Surface Drainage Works

The total package of SSD works to be implemented to serve the 185,000 ha includes:

- **1,571 pumps**
- **50 evaporation basins**
- **300 ha of tile drainage.**

Table 35 presents a summary of the SSD works delivered to 30 June 2007 and works still to be delivered based on the revised 2029/30 delivery targets (see **Section 5.4**).

Table 35: SSD Works Delivered and Still to be Delivered Under the SSDP

SSD Works	Works Delivered to 30 June 2005	Target Works to be Implemented to 30 June 2030	Works Still to be Delivered (2005/06 – 2029/30)
Public Pumps			
Public Pasture Pumps – channels or drains	43 pumps	375 pumps	**332 pumps**
Public Pasture Pumps – basins	0 pumps	50 pumps	**50 pumps**
Private Pumps			
Private Pasture Pumps Installed	254 pumps	541 pumps	**287 pumps**
Private Pasture Pumps Upgraded	59 pumps	112 pumps	**53 pumps**
Non SSDP Private Pasture Pumps	443 pumps	443 pumps	**0 pumps**
Private Horticulture Pumps Installed	20 pumps	50 pumps	**30 pumps**
Tile Drainage			
Tile Drainage	16 ha	300 ha	**284 ha**

In summary, the target number of SSD works to be implemented was determined by:

- Estimating the area served by different SSD works, after excluding any overlap:
  - » Public Pumps – 1 ML of water pumped equates to 1 ha served
    – average area served per pump of approximately 200 ha. It should be noted that this is the same ratio assumed at the commencement of the SSDP
  - » Private Pasture Pumps – 1 ML of water pumped equates to 1 ha served
    – 1 ML of licence entitlement equates to 0.6 ha of area served
    – average area served per pump of approximately 90 ha
  - » Private Horticulture Pumps – 2 ML of SSDP Capital Grant pump volume equates to 1 ha of area served
    – average area served per pump of approximately 20 ha
  - » Area of Tile Drains – 1 ha of tile drainage equates to 1 ha of area served.
- Based on these assumptions and the number of SSD works installed to June 2005 was determined (refer to **Section 4.4**). It should be noted that the revised implementation program assumed that the total number of public pumps would be the same as that determined in 1990, with any changes being a reflection of changes in the assumptions of the area served under the Private Pump Programs.
- Using the ratio between the number of different SSD works installed to June 2005, the works were extrapolated up to achieve a collective area served of 185,000 ha. A breakdown of the works required is as follows:

-	Public Pumps	– 425 pumps	(85,000 ha served)
-	Private Pasture Pumps	– 1,096 pumps	(99,000 ha served)
-	Private Horticulture Pumps	– 50 pumps	(1,000 ha served)
-	Area of Tile Drains	– 300 ha of tile drains	(300 ha served).

The estimated area served and to be served excludes double counting of overlap areas and is based on the volume pumped by public pumps and 0.6 times the licensed volume for private pumps. With the installation of meters on private pumps the actual volume pumped will be able to be determined and used for these calculations in the future.

It is expected that as part of 2011 SSDP review the area served will be reported on the basis of the metered volume measured as being extracted from all pumps with 1 ML equating to 1 ha of area served. Due to a lack of data this approach could not be used for this review.

5.4. Revised Implementation Timeframe and Work Program

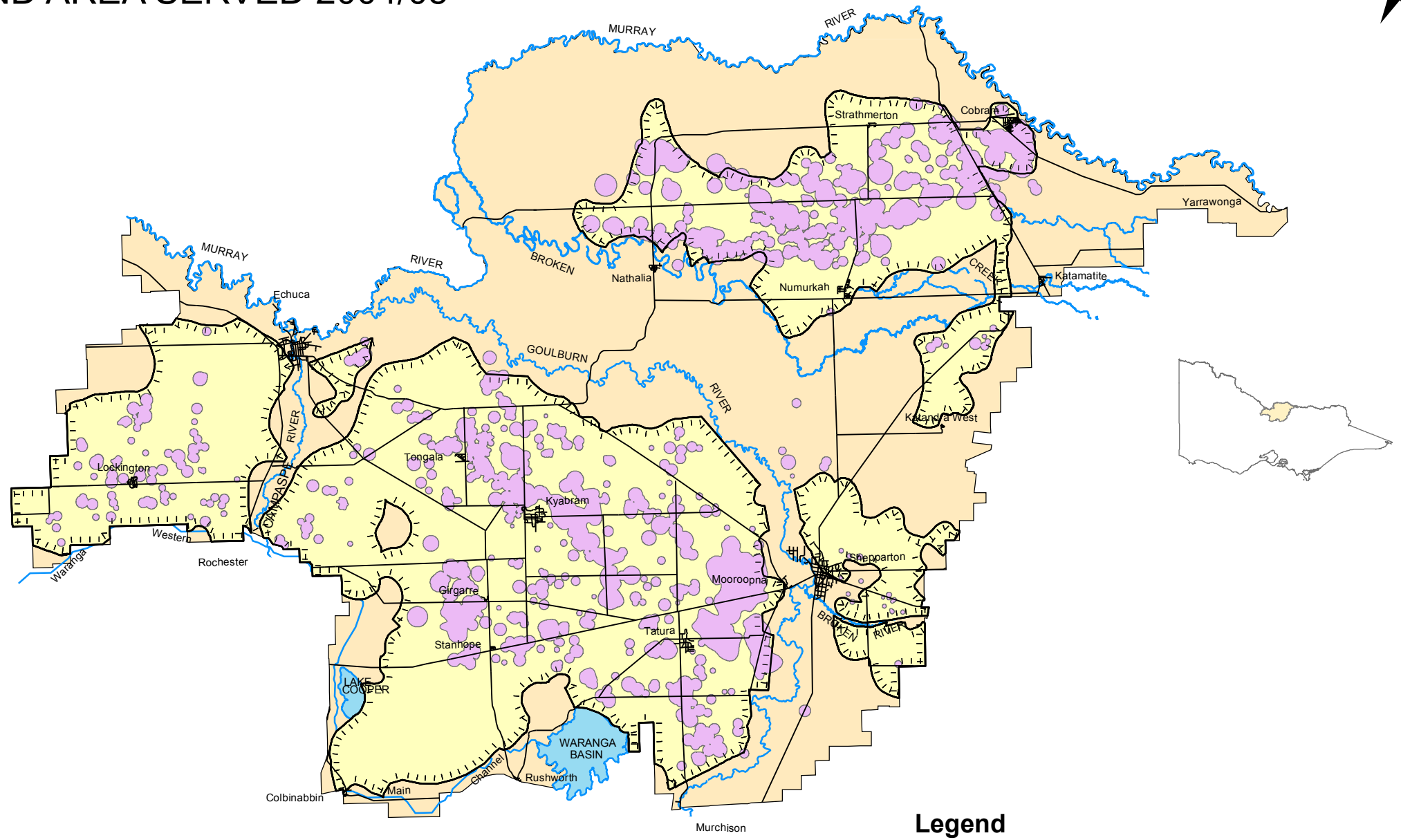
A revised SSDP full implementation timeframe of the year 2030 has been established as part of this review.

This revised implementation timeframe was based on a combination of the following:

- The total number of SSD works that are still required to be implemented under the SSDP (refer to **Section 5.3**).
- The number of works that had been implemented under the SSDP each year to June 2005
- Historic and projected levels of annual funding. This was particularly used to determine the level of implementation to 2010/11. The proposed annual Work Program to 2010/11 is presented in **Section 6**.

Beyond 2010/11 it was generally assumed that there will be an incremental increase in the level of funding and subsequent number of works installed. In most cases an incremental increase was assumed up to maximum number of pumps to be installed or upgraded each year (e.g. for new private pumps a cap of 13/yr was imposed, while for public pumps a cap of 20/yr was adopted).

FIGURE 19: AREA AT RISK AND AREA SERVED 2004/05



5.5. Total Program Cost

The total cost to implement the SSDP, including capital cost of works and Program Support and Development, is estimated to be $225.5M (based on 2005 dollars and is GST exclusive).

A breakdown of the total cost is as follows:

- Private Pasture Pump Program - $72.9M
- Private Horticulture Program - $11.1M
- Public Pump Program - $119.1M
- Program Support - $12.8M
- Program Development - $9.6M
- **Total cost** **- $225.5M**.

In 2005 dollars of this $225.5M to fully implement the SSDP, $51M had been spent by 1 July 2005. This leaves $174.5M to be raised and spent between 2005 and 2030.

This total cost was based on the following unit rates per activity of:

- Public Pump - $220,000 / pump installed
- Evaporation Basin - $260,000 / basin installed
- Private Pasture Pump (Install) - $130,000 / pump installed
- Private Pasture Pump (Upgrade) - $30,000 / pump upgraded
- Private Horticulture Pump - $125,600 / pump installed
- Tile Drainage - $15,300 / ha tile drains
- Program Support - $320,000 /yr
- Program Development - $240,000 / yr.

The above costs are GST exclusive and based on the costs as at 30 June 2005.

Further details relating to the cost share split between public and private investment in the implementation of the SSDP is presented in **Section 7.5**.

These costs are a fundamental part of the economic assessment and **Section 7.1** presents the outcomes of the economic assessment of the Program.

6. 2011 Implementation Targets

6.1. Overview

Between 2005/06 and 2010/11 it is expected that an additional 9,970 ha of the SIR will be served by works implemented as part of the SSDP, bring the total area served to 83,140 ha by 30 June 2011. The additional area served will be achieved through the delivery of the following works:

- Installation of 18 new public pumps discharging to regional channels and drains
- Installation of 49 new private pumps to serve areas of pasture
- Upgrading of 12 existing private pumps to serve areas of pasture
- Installation of 7 new private pumps to serve areas of horticulture.

Table 36 presents the SSDP implementation targets to the Year 2011. The implementation targets are based on the following factors:

- Level of historic uptake of works
- Projected funding constraints
- Assumed area served by specific SSD works (refer to **Section 5.3**)
- Required area to be served by SSD works.

The implementation targets relating to the projected areas to be served allow for the overlap between the area served by specific SSD works. For example, if a public and private pump are installed such that there was an overlap between their respective area served, this overlapping area is only included for one pump.

6.2. Funding Requirements

The total funding requirement to implement the SSDP between 2005/06 and 2010/11 is estimated to be $25.5M.

Table 37 presents a breakdown of the annual SSDP funding requirements between 2005/06 and 2010/11.

The average annual expenditure between 2005/06 and 2010/11 is estimated to be $4.3M. This compares with the previous 5 year period when average actual expenditure was approximately $4.48M.

While the average budget is projected to remain relatively constant over the next 6 years, it is expected that there will be a shift in the distribution of funds between the different SSDP sub-programs. **Table 38** presents the expected breakdown of investment between the SSDP sub-programs between 2005/06 and 2010/11 and this information is diagrammatically shown in **Figure 20**.

As of 2006/07, to meet the requirements of the GB CMA Monitoring, Evaluation and Reporting (MER) Strategy (refer to **Section 6.7**), there will be strategic shift in the allocation of funds from SSDP Program Support to the Monitoring sub-Program (refer to **Table 38**). This will see some of the historic activities delivered through the SSDP Program Support, being delivered under the Monitoring sub-Program in the future (e.g. Annual SSDP KPI reporting).

The funding allocation for the implementation and program development sub-programs is expected to remain relatively constant for the next six years. Additional funding has been allocated under the implementation sub-program, as of 2007/08, in recognition of the recommencement of the installation of horticulture pumps in the SIR.

Table 36: SSDP 2011 Implementation Targets

Activity	6-Year Target to 2011 (2005/06 to 2010/11)	2011 Cumulative Target (1990/91 to 2010/11)
OVERALL	• 9,970 ha served • 86 pumps • 0 ha tile drains	• 83,140 ha being served • 905 pumps • 16 ha tile drains
Public Pumps		
1. Continue operation of Phase A pumps where technically appropriate	Ongoing operation – review performance of scheme	Ongoing operation – review performance of scheme
2. Install new public pumps discharging to regional channels or drains	• 18 pumps installed • 3,580 ha served	• 61 pumps installed • 12,550 ha served
3. Install new public pumps discharging to evaporation basins	• 0 pumps and basins • 0 ha serviced	• 0 pumps and basins • 0 ha serviced
4. Provide salinity and waterlogging control for new high value crops in the region	Develop and adopt a cost effective strategy	Develop and adopt a cost effective strategy
Private Pumps		
5. Consistent pumping and reuse by existing private pumps (Non-SSDP Private Pumps within Area of Risk)	Target Achieved	• 443 pumps • 37,390 ML/yr reused • 37,390 ha served
6a Existing private pumps upgraded with Capital Grant assistance	• 12 pumps • 1,230 ML/yr reused • 1,230 ha served	• 71 pumps • 6,210 ML/yr reused • 6,210 ha served
6. Installation of new SSDP private pumps	• 49 installed • 5,020 ML/yr reused • 5,020 ha served	• 303 pumps installed • 26,460 ML/yr reused • 26,460 ha served
7. Installation of private pumps to serve existing horticulture areas (mainly at Shepparton East)	• 7 pumps installed • 140 ha served	• 27 pumps installed • 530 ha served
Tile Drains		
8. Installation of tile drains to serve existing horticulture areas	0 ha	16 ha
9. Installation of tile drains/low capacity pumps to serve non-horticultural areas	Develop and adopt a cost effective strategy	Develop and adopt a cost effective strategy
Pump Discharge		
10. Regulated discharge of pumped groundwater to regional channels, drains and streams within agreed guidelines	(As needed)	(As needed)
11. Regulated discharge of pumped groundwater to River Murray to minimise salt accumulation within the Region's soils and aquifers	0.7 EC	3.9 EC
12. Regulated discharge of pumped groundwater to River Murray to minimise salt accumulation within the Region's soils and aquifers (including 3.8EC for C Type areas as per the 2000 SSDP review)	0.7 EC	3.9 EC
13. Installation of SSDP Pumps to serve environmental features (such as remnant vegetation, wetlands and streams)	1,385 ha environmental feature served	3,455 ha environmental feature served

Source: (Hydro Environmental, 2006).

Table 37: SSDP Projected Funding Requirements between 2005/06 and 2010/11

SSDP Sub-Programs	Financial Year						Total
	2005/06 [1]	2006/07	2007/08	2008/09	2009/10	2010/11	
Program Support							
- DPI Extension	-	$110,000	$110,000	$110,000	$110,000	$110,000	$660,000
- G-MW Mgt, Support and Extension	-	$600,000	$600,000	$600,000	$600,000	$600,000	$4,100,000
Total Program Support ($)	**$1,630,178**	**$710,000**	**$710,000**	**$710,000**	**$710,000**	**$710,000**	**$4,760,000**
Implementation							
- Public Pumps ($)	-	$660,000	$660,000	$660,000	$660,000	$660,000	$3,960,000
- Private Pumps ($)	-	$920,000	$920,000	$920,000	$920,000	$920,000	$5,630,000
- Horticulture ($)	-	$0	$120,000	$240,000	$240,000	$240,000	$840,000
Total Implementation ($)	**$1,389,062**	**$1,580,000**	**$1,700,000**	**$1,820,000**	**$1,820,000**	**$1,820,000**	**$10,430,000**
Program Development ($)	**$1,130,055**	**$1,200,000**	**$800,000**	**$800,000**	**$950,000**	**$1,000,000**	**$5,850,000**
Monitoring ($)	**$179,806**	**$820,000**	**$820,000**	**$820,000**	**$820,000**	**$820,000**	**$4,420,000**
TOTAL Funding ($)	**$4,329,101**	**$4,310,000**	**$4,030,000**	**$4,150,000**	**$4,300,000**	**$4,350,000**	**$25,460,000**

Note: 1. Figures presented for 2005/2006 reflect actual expenditure for the financial year
2. Figures presented in the table above do not include grants paid to landowners
Source: Hydro Environmental, 2006.

Table 38: Breakdown of Investment between the SSDP Sub-Programs

SSDP Sub-Programs	Financial Year						Average all years
	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	
Program Development (%)	25%	28%	19%	19%	22%	23%	23%
Program Support (%)	28%	16%	17%	17%	17%	16%	19%
Implementation (%)	39%	37%	44%	44%	42%	42%	41%
Monitoring (%)	7%	19%	20%	20%	19%	19%	17%
TOTAL (%)	100%	100%	100%	100%	100%	100%	100%

Source: Hydro Environmental, 2006.

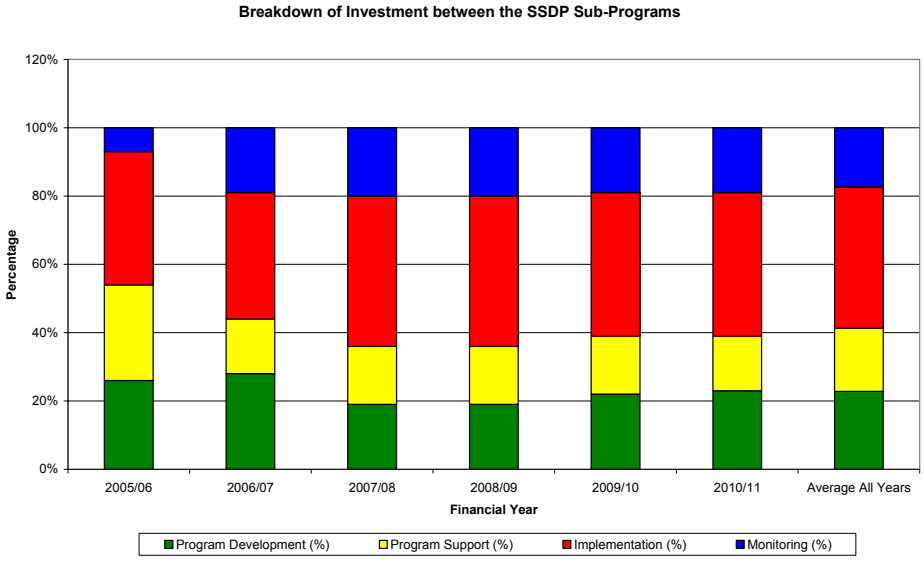


Figure 20: Breakdown of Investment between SSDP Sub-Programs

6.3. Research and Investigation Priorities

A review of the 2003 SSDP R&I Strategic Plan has commenced to coincide with the SSDP 5-Year review. **Figure 21** presents the process that has been adopted in the review of the SSDP R&I Strategic Plan.

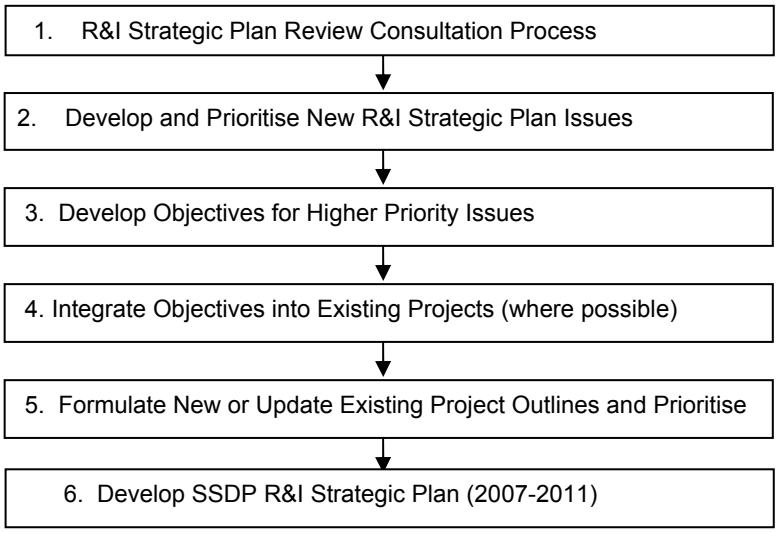


Figure 21: Process for the review of the SSDP R&I Strategic Plan

To date, the review has resulted in the identification 89 issues which are deemed to be of key importance to the SSDP. These issues have resulted in the development of about 40 new projects, and additions and amendments being made to 10 existing projects, which already form part of the R&I Work Program.

Of the 89 key issues identified as part of by the 2007 SSDP R&I Strategic Plan, the following have been designated as the main emerging issues that will affect the SSDP over the next 10 years:

- Management of salt disposal
- Balance between protecting water as a resource and salt management needs
- Managing salt at a sub-regional scale
- Land use change (including water movement and changes in availability)
- Rationalisation of G-MW's supply system infrastructure (including reconfiguration)
- Asset management to ensure optimal long term operation of public and private pumps
- Possible use of real-time monitoring of water quality and automatic operation to maximise pumping opportunities
- Level of protection required for environmental assets
- Review of the level of protection required for irrigated and dryland agricultural land
- Cost share for works protecting assets
- Weather pattern and climate change impacts on water table levels
- Impact of local salt redistribution and storage
- Succession planning for agencies and the community
- Need to ensure efficient and effective communication between all stakeholders
- C Type area protection issues.

Further details relating to the SSDP R&I Strategic Plan (2007-2011) are included in **Volume 2** of the SSDP 5-Year review report.

6.4. SSDP 6-Year Implementation Work Program

Between 2005/06 and 2010/11 it is expected that an additional 9,970 ha will be served by works implemented as part of the SSDP. The additional area served will be achieved through the delivery of the following works:

- Installation of 18 new public pumps discharging to regional channels and drains
- Installation of 49 new private pumps to serve areas of pasture
- Upgrading of 12 existing private pumps to serve areas of pasture
- Installation of 7 new private pumps to serve area of horticulture.

Table 39 presents a breakdown the SSDP Implementation Work Program between 2005/06 and 2010/11.

Between 2006/07 to 2010/11, it is projected that eight new SSDP private pasture pumps will be commissioned and two pumps will be upgraded with SSDP Capital Grant assistance each year. No further new non-SSDP Private pumps that meet the requirements to provide salinity control, are expected to be installed for the remainder of the SSDP implementation period.

Primarily due to funding constraints it is assumed that only three SSDP Public pumps will be commissioned each year.

It is expected at there will be no new tile drains installed with SSDP Capital Grant assistance to serve horticulture, however, it is projected that up to two new pumps will be installed to serve horticultural areas with SSDP Capital Grant assistance from 2007/08.

6.5. SSDP Salt Disposal Needs

Based on the proposed implementation program in **Table 37**, the additional salinity impact at Morgan will be 0.7 EC which will have an Economic Impact of $161,000 after the next 6 years. The basis of these figures is shown in more detail in **Table 40**.

Further details relating to the implication SSDP salt disposal needs are presented in **Volume 2** of the SSDP 5-Year review report.

Table 39: SSDP 6-Year Implementation Work Program

SSDP Funding	Financial Year						Total
	2005/06	2006/07	2007/08	2008/09	2009/10	2009/10	
Private Pumps							
- New SSDP Pumps (No.)	9 pumps	8 pumps	8 pumps	8 pumps	8 pumps	8 pumps	**49 pumps**
- Existing Pumps Upgraded (No.)	2 pumps	2 pumps	2 pumps	2 pumps	2 pumps	2 pumps	**12 pumps**
- Non SSDP Private Pumps (No.)	0 pumps	0 pumps	0 pumps	0 pumps	0 pumps	0 pumps	**0 pumps**
Area Served (ha)	1,127 ha	1,024 ha	1,024 ha	1,024 ha	1,024 ha	1,024 ha	**6,247 ha**
Public Pumps							
- Reuse Pumps (No.)	3 pumps	3 pumps	3 pumps	3 pumps	3 pumps	3 pumps	**18 pumps**
- Pumps Discharging to Basins	0 pumps	0 pumps	0 pumps	0 pumps	0 pumps	0 pumps	**0 pumps**
Area Served (ha)	597 ha	597 ha	597 ha	597 ha	597 ha	597 ha	**3,582 ha**
Horticulture Pumps							
- New Pumps (No.)	0 pumps	0 pumps	1 pump	2 pumps	2 pumps	2 pumps	**7 pumps**
- Tile Drains (ha)	0 ha	0 ha	0 ha	0 ha	0 ha	0 ha	**0 ha**
Area Served (ha)	0 ha	0 ha	20 ha	41 ha	41 ha	41 ha	**143 ha**
Total No. of New Pumps (No.)	**12 pumps**	**11 pumps**	**12 pumps**	**13 pumps**	**13 pumps**	**13 pumps**	**74 pumps**
Total No. of Existing Pumps Upgraded (No.)	**2 pumps**	**2 pumps**	**2 pumps**	**2 pumps**	**2 pumps**	**2 pumps**	**12 pumps**
Total New Area Served (Ha)	**1,724 ha**	**1,621 ha**	**1,641 ha**	**1,662 ha**	**1,662 ha**	**1,662 ha**	**9,972 ha**

Source: Hydro Environmental, 2006.

Table 40: Expected SSDP Related EC Needs

Item		2006-11	1990 - 2011	2030
Non Plan Private				
Area	ha	0	37,700	37,700
Salt Discharge	**EC**	**0**	**1.2**	**1.2**
Private Plan				
Pumps	ha	5,020	26,460	51,000
Upgrades	ha	1,230	6,210	10,000
Total	ha	6,250	32,670	61,000
Salt Discharge	**EC**	**0.22**	**1.12**	**2.10**
Public				
Area	ha	3,580	12,550	75,000
Salt Discharge	**EC**	**0.42**	**1.49**	**8.90**
C Type areas				
Area	ha	140	546	1300
Salt Discharge	**EC**	**0.02**	**0.08**	**0.20**
Total EC Needs		**0.7**	**3.9**	**12.4**
Total Salinity Costs		**$161,000**	**$89,000**	**$2,852,000**

These figures do not include an allowance for C Type areas of 3.8 EC.

6.6. Groundwater Management Plans

Over the next six years it is expected that there will be a further aligning of the GMPs, particularly the SIR GMP, with the strategic direction of the SIRCIS and the SSDP.

As the meter installation programs under the GMPs are completed, the role of the GMPs will move from a planning to an operational phase. Key operational activities will include:

- Measuring, recording and tracking the volume pumped by licensed groundwater diverters
- Working with irrigators who have exceeded their licensed allocation to put in place measures to ensure that it does not reoccur
- Improving the annual response rate for the provision of groundwater samples for water quality analysis
- Determining any trends or patterns in groundwater salinity concentrations over time.

Of particular interest to the implementation of the SSDP will be the implications any future increase in demand for groundwater resources. Greater uptake of the groundwater resource may result in changes in regional groundwater salinity concentrations, along with changes in where, and what, SSD works need to be implemented.

Over the next 6 years, it is also expected that WSPAs will be declared for the Kialla GMA (Zone 2) and Mid-Goulburn GMA.

6.7. SSDP Management

A key to the success of the SSDP has been its adaptive management approach. The SSDP has been proactive in understanding the environment in which it is being implemented and putting in place strategies such that its objectives can ultimately be realised.

As outlined in **Section 9**, over the next six years it is expected that the SSDP will face some significant challenges. This review is an example of the proactive approach being adopted by the SSDP to identify these challenges and develop strategies to address them.

The R&I Program will continue to be an integral part of the delivery of the SSDP through ensuring that the Program is being implemented based on the **best available knowledge and science**.

Over the next six years it is expected that there will be greater focus on succession planning. This will encompass those managing the SSDP as well those on SSDP committees and those who have the charter to undertake the works on the ground. Appropriate succession planning will ensure that there are adequate resources to support the ongoing implementation of the SSDP.

6.8. Monitoring, Evaluation and Reporting (MER)

The monitoring, evaluation and reporting aspects the SSDP, along with the other SIRCIS Programs, are being aligned with the requirements of the 2004 GB CMA Monitoring, Evaluation and Reporting (MER) Strategy. A planned shift in funding from Program Support to the Monitoring sub-Program in 2006/07 is an example of the changes that are being enacted by the SSDP, in light of the MER Strategy.

Historically monitoring, evaluation and reporting components have been addressed separately by the individual SIRCIS Programs, with greater emphasis often being placed on one particular area. For example, extensive monitoring may take place under a SSDP Program; however, the monitored data may not be adequately evaluated or communicated to its stakeholders.

The GB CMA MER Strategy recognises the need for a coordinated approach across all three areas (Monitoring, Evaluation and Reporting), both within and between the Programs. A key aim of the Strategy is to ensure that natural resource management in the Goulburn Broken catchment is monitored, evaluated and communicated in an efficient and cost-effective manner. Through the Strategy it is expected that information relating to natural resource management will be readily available to make sure that the community is well informed and that decisions made are based on the best available environmental, economic and social data.

In terms of the SSDP, the preparation of the SSDP KPI annual report will be a key input to the MER framework. It is expected that the full impact of the MER Strategy will be realised over the next six years of the implementation of the SSDP.

6.9. Communication

The SSDP will continue to have a strong focus on communication with the community and other stakeholders (including DPI groundwater extension officer and DPI CAS group) over the next six years of implementation. As a result of past achievements in the area of communication (e.g. formation of the agency based high level SSDCG to coordinate agency input, etc.), the SSDP has a strong platform from which to work. This base is also expected to assist in the Program meeting its MER requirements.

A move towards drainage catchment scale planning and management is expected to further strengthen the lines of communication with the community.

7. Triple-Bottom Line Assessment

Overall the SSDP has shown to be delivering significant economic, environmental and social benefits at local, regional and state level. These benefits are expected to continue and strengthen as the Program is fully implemented.

As part of the SSDP 5-Year review, separate assessments have been carried on each of the economic, environmental and social components of the SSDP. The outcomes of these assessments provide the State Government with the evidence that its support and investment in the SSDP to date has been justified, and that its future support and investment is warranted.

A summary of the outcomes of the three assessments are presented in the following sections. Further details relating to each of the assessments are included in **Volume 2** of the SSDP 5-Year review report.

7.1. Economic Assessment

The economic assessment undertaken as part of the SSDP 5-Year review shows that the overall SSDP (1990/91 to 2029/30) is financially attractive with a BCR of 1.5 and a Net Present Value (NPV) of $48M (based on a discount rate of 4%). If the assessment timeframe is altered to 30 years, in line with current Government economic assessment requirements, the SSDP remains extremely viable as is shown below:

Plan to 2020

- 1990 to 2020 – Benefit Cost Ratio (BCR) of 1.4 and an NPV of $23M (based on a discount rate of 4%)

Plan Looking Forward

- 2005 to 2035 - BCR of 1.9 and an NPV of $74M (based on a discount rate of 4%).

All values are expressed in June 2005 dollars.

The outcomes of the economic assessment have been derived using a modelling package referred to as the Murray Darling Basin Commission "Drainage Evaluation Spreadsheet Model" (or DESM), which takes into account the benefits and costs associated with the actions being implemented under the SSDP.

The following factors were considered as part of the economic assessment:

- Agricultural production benefits (with and without the implementation of the SSDP). These benefits assume 60% perennial pasture or horticulture, 20% of the area served is dryland and 20% is annual pasture.
- Salinity losses
- Waterlogging losses
- Capital, Operation and Maintenance (O&M) costs of SSD works (with and without the implementation of the SSDP)
- Water reuse benefits
- Downstream salinity impacts
- Research and Investigation (R&I) costs
- Program support costs.

The economic assessment takes into account the expected benefits and costs with and without the implementation of the SSDP.

As the non-SSDP private pumps were considered common to both the with and without Program scenario, the costs benefits and salt load requirements for these pumps were not considered. Similarly because the requirements, costs and benefits of the C Type areas is unknown these areas were also not considered as part of the economic assessment. The potential road benefits were also not considered as part of the economic assessment. Anecdotally however, they are expected to be significant.

A cumulative SSDP SDE debit of 11.1 EC was used as part of the economic evaluation. The financial value of other environmental benefits resulting from the implementation of the SSDP have been included in the environmental assessment, with the economic assessment primarily focusing on farm productivity benefits.

A summary of the net economic benefits associated with the implementation of the SSDP is presented in **Table 41**.

Table 41: SSDP Economic Assessment – expressed in June 2005 dollars

Economic Assessment	Private Pumps (Pasture Protection)		Public Pumps (Pasture Protection)		Horticulture Protection	Total
	Existing	New	Reuse	Evaporation Basins		
1990/91 to 2019/2020 (30 Years)						
Net Present Value ($,000)	$2,304	$12,666	$7,531	$76	$324	**$22,901**
Benefit Cost Ratio (4%)	1.5	1.4	1.4	1.1	1.1	**1.4**
Benefit Cost Ratio (8%)	1.3	1.0	1.1	0.8	0.8	**1.1**
1990/91 to 2029/2030 (40 Years)						
Net Present Value ($,000)	$3,745	$23,918	$18,455	$964	$613	**$47,695**
Benefit Cost Ratio (4%)	1.7	1.6	1.5	1.2	1.2	**1.5**
Benefit Cost Ratio (8%)	1.4	1.1	1.2	0.9	0.8	**1.1**
2005/06 to 2034/35 (30 Years)						
Net Present Value ($,000)	$3,867	$29,556	$37,900	$2,825	$203	**$74,352**
Benefit Cost Ratio (4%)	2.6	2.5	1.8	1.3	1.1	**1.9**
Benefit Cost Ratio (8%)	2.1	1.7	1.4	0.9	0.7	**1.4**

The outcomes of the economic assessment show that the SSDP is a financially attractive investment, with a BCR greater than one (1) over each of the reporting periods assessed. This outcome was expected given the significant agricultural benefits delivered through the SSDP across the SIR, relative to its costs to implement.

Of the three sub-programs, the horticulture sub Program is least economically attractive as a stand-alone sub program. This is due to the small area that is covered by the horticulture sub Program and the higher capital costs per hectare relative to the other sub programs.

Interestingly, as a result of including the downstream cost of salt disposal in the economic assessment, the BCR for disposal to evaporation basins is only marginally lower than reuse disposal which impacts on the River Murray (i.e. the majority of the additional cost to construct an evaporation basin has been off-set by the capitalised salt disposal cost).

A further sensitivity analysis of the BCR was undertaken as part of the economic assessment. This involved altering the gross margins used to calculate the agricultural benefits. Even with a 20% reduction in gross margins, the overall BCR for the SSDP was assessed to be 1.2 (based on an assessment period of 1990/91 to 2029/30 and a discount rate of 4%).

A copy of the SSDP economic assessment is included in **Volume 2** of the SSDP 5-Year review report.

7.2. Environmental Assessment

It is expected that the SSD works implemented under the SSDP will serve an estimated 9,000 ha of key environmental features in the SIR. This represents approximately 60% of the total area of key environmental features (being 15,090 ha) at risk due to land salinisation and waterlogging.

The environmental assessment was undertaken as a desk assessment using available information and the experience of DPI's environmental group.

The net financial value of the environmental benefits delivered through the SSDP are estimated to be $17M (based on an assessment period of 1990/91 to 2029/30 and a discount rate of 4%).

The environmental assessment undertaken as part of the SSDP 5-Year review focussed on the following:

- The area of key environmental features that were at risk from salinisation and waterlogging in 1990/91 and 2004/05
- The area of key environmental features that were served by the SSDP in 2004/05 and expected to be served by the SSDP in 2029/30.

The estimated change in average River Murray salinity of 11.1 EC, resulting from the implementation of the SSDP, has been taken into account as part of the economic assessment. From the perspective of managing salinity in the River Murray the environmental impact is expected to be minimal, and difficult to quantify.

Table 42 presents the area of environmental features to be served by works implemented as part of the SSDP and the remaining area at risk for the periods 1990/91, 2004/05 and 2029/30. For the purpose of the environmental assessment it is assumed that there would be no environmental benefits without the implementation of the SSDP, with any SSD works undertaken outside of the SSDP having a negligible environmental impact. On this basis, a 'No Program' scenario was not considered as part of environmental assessment.

Table 42: Summary of the Area of environmental features at Risk and Area Served as a Result of Implementing the SSDP

Year	Area of key Environmental Features served by SSDP works (ha)	Area of key Environmental Features not served by SSD works within the 'Area at Risk' (ha)
1990/91	0 ha	15,090 ha
2004/05	2,070 ha	13,020 ha
2029/30	9,000 ha	6,090 ha

Note: In 2004/05 the area of healthy wetlands was estimated to be 10 ha.

The 9,000 ha of key environmental features to be served by SSDP works was considered to be an appropriate target based on the assumed agricultural areas at risk to be served by SSD works under the Program. The percentage area of environmental features to be protected is assumed to be 60% (the same as the agricultural area at risk to be served within the total area at risk).

The financial value attributed to the key environmental features served through works delivered as part of the SSDP was determined based on choice modelling studies conducted in Western Australia (van Bueren and Bennett, 2004) and New South Wales (Whitten and Bennett, 2001).

The studies draw on two key aspects of the environmental assessment:

1. **Key Environmental Features**
   The area of bushland expected to be repaired and/or served as a result of the implementation of actions under the SSDP (also referred to as 'LOOK') and the area of healthy wetland ecosystems maintained through SSDP works (refer to **Table 42**).
2. **Species protection**
   The number of endangered and threatened flora and fauna that will be served from further decline through the implementation of actions under the SSDP. There were eight (8) threatened flora species and nine (9) threatened fauna species identified in the area of key environmental features to be served.

Table 43 shows the net financial value of the environmental benefits attributed to the SSDP based on a discount rate of 4% and 8% over various implementation periods.

Table 43: Net Financial value of the environmental benefits attributed to the SSDP

Period	Total Environmental Benefit ($M)		
	1990/91 to 2019/2020 (30 Years)	1990/91 to 2029/2030 (40 Years)	2005/06 to 2034/35 (30 Years)
Discount rate of 4% ($M)	$16.4M	$17.0M	$44.9M
Discount rate of 8% ($M)	$8.8M	$9.0M	$24.8M

In addition to the NPV of $48M determined as part of the economic assessment, the total environmental benefit based on full implementation of the SSDP (i.e. 1990/91 to 2029/30) is $65M, at a discount rate of 4%. The combined benefit makes the SSDP attractive from a financial and environmental perspective for continued Government investment.

A copy of the SSDP environmental assessment is included in **Volume 2** of the SSDP 5-Year review report.

7.3. Social Assessment

Similar to the economic and environmental assessment, the social assessment provides an indication of the social benefits attributed to the implementation of the SSDP. Overall, it is considered that the SSDP has already delivered some positive social benefits and that these benefits will continue as the Program is fully implemented.

The social implications of the SSDP were determined based on a series of workshops involving the F&EWG, SSDWG and SWMWG. All three working groups comprised community and agency representatives. Each working group was requested to assess the social implications of the SSDP against eight social themes.

These social themes were:

1. Community Wellbeing – population stability and community health
2. Sense of Community – cohesion
3. Natural Resource Knowledge Base – understanding of issues and processes
4. Improved Business Confidence – reduced business risk and greater preparedness to invest in the SIR
5. Security of Water Supply – SSDP impact
6. Change in Landscape – aesthetics/environment
7. Confidence in SSDP – likelihood of objectives being achieved
8. Protection of Significant Cultural and Historical Sites.

The social themes were scored from +5 (Strongly positive outcome) through to -5 (strongly negative outcome) for the following two periods:

- 1990/91 to 2004/05 (the commencement of the SSDP to the end of the review period)
- 2005/06 to 2029/30 (period remaining to achieve full implementation of the Program).

The overall assessment of the social benefit is +2 which is equivalent to an adjusted score of 7 out of 10 and is very positive.

Table 44 presents a summary of the social assessment workshop outcomes.

Given the lack of current research relating to the financial value of social impacts in Australia, no attempt has been made to quantify the expected benefits in dollar terms.

The key outcomes from the social assessment are as follows:

- The SSDP has delivered a positive social impact up to June 2005 and is expected to continue to deliver a social benefits into the future
- Overall the expectations looking forward are the same as those achieved by the Program to June 2005
- The community related social themes were judged to be marginally less positive for the future SSDP activities than they have been in the past
- Confidence in the SSDP and its associated landscape, environmental and cultural and heritage benefits are expected to be greater in the future than they were in the past.

A copy of the SSDP social impact assessment report is included in **Volume 2** of the SSDP 5-Year review report.

Table 44: Summary of the outcomes of the SSDP Social Assessment Workshops

No.	Social Theme	F&EWG	SSDWG	SWMWG	Average	F&EWG	SSDWG	SWMWG	Average
		1990/91 to 2004/05				2005/06 to 2029/30			
1	Community Wellbeing	+2.5	+3	+3	**+3**	+1.5	+2	+3	**+2**
2	Sense of Community	+3	+2.5	+2	**+2.5**	+2.5	+1	+2	**+2**
3	Natural Resources Knowledge Base	+2	+4	+2	**+2.5**	+3	+3	+2	**+2.5**
4	Improved Business Confidence	+1.5	+2	+3	**+2**	+2.5	+1-3	+2	**+2**
5	Security of Water Supply	+1.5	+3	+2	**+2**	+1	+1-3	+3	**+2**
6	Changes in Landscape (including environmental)	+1	+2	+1	**+1.5**	+3	+1.5	+2	**+2**
7	Confidence in the Sub-surface Drainage Program	+1.5	+3	+2	**+2**	+2.5	+2	+3	**+2.5**
8	Protection of Significant Cultural and Historical Sites	0	0	0	**0**	+1	+1	+1	**+1**
	Average overall social impact	**+2**				**+2**			

Scoring System:

+5: strongly positive outcome
+3: definitely positive outcome
+1: marginally positive outcome
0: neutral, neither positive or negative social outcome
-1: marginally negative outcome
-3: definitely negative outcome
-5: strongly negative outcome.

7.4. Triple Bottom Line Assessment

The triple bottom line assessment shows that the SSDP has delivered some significant benefits, from an economic, environmental and social perspective over the last 15 years, and that these benefits are going to continue as the Program moves toward full implementation. The SSDP has been shown to be:

- **Economic (financially attractive)** – with a BCR ranging between 1.4 and 1.9 over the different reporting timeframes assessed and a NPV of between $22.9M and $74M
- **Environmentally Attractive** – serving some 9,000 ha of key environmental features with a value of $17.0M
- **Socially Beneficial** – delivering a medium level social benefit to the regional community.

Table 45 presents a summary of the outcomes of the economic, environmental and social assessments undertaken as part of the SSDP 5-Year review.

Table 45: Triple-bottom Line Assessment

Assessment	1990/91 to 2019/2020 (30 Years)	1990/91 to 2029/2030 (40 Years)	2005/06 to 2034/35 (30 Years)
Economic			
Benefit Cost Ratio (4% discount rate)	1.4	1.5	1.9
Total Economic Net Present Value ($M) (A) (4% discount rate)	$22.9M	$47.7M	$74.4M
Environment			
Total Environmental Net Present Value ($M) (B) (4% discount rate)	$16.4M	$17.0M	$44.9M
Total ($M) (A + B)	$39.3M	$64.7M	$119.3M
Social			
Expected Social Benefits	Medium Level Social Benefits		

On this basis, continued government investment in the SSDP is warranted. The adaptive management approach adopted by the Program will ensure that the benefits detailed in the 5-Year SSDP review are fully realised.

Traditionally the outcomes of the economic assessment have been regarded as more important by Government, than the environmental and social assessments, with following weightings applied:

- Economic Assessment - 55%
- Environmental Assessment - 25%
- Social Assessment - 20%.

The weightings provide a guide as to which outcomes will ultimately drive the decision process. In light of the fact that all of the SSDP assessment outcomes are positive, it was considered that the application of weightings as part of the triple bottom line assessment was not warranted. As such, no attempt has been made to weight the outcomes of the three assessments with each of the outcomes considered to be of equal weighting.

7.5. Overall Cost Share Arrangements

Table 46 presents the projected SSDP cost share following full implementation of the Program.

These costs were determined by assuming that all of the capital (implementation) cost of $225M was spent on day one and all SSDP works relating to operation and maintenance costs were capitalised over 50 years at 4%. Extension and R&I costs were not capitalised but were included as their arithmetic total in the capital cost.

The overall cost share split between private and public investment is 30% and 70%, respectively. This compares to the original cost share split of 43% private investment and 57% public investment (refer **Section 1.4**).

The main reasons for the shift in cost share between private and public investment are as follows:

- Public capital investment for the Public Pump Program is much greater than was initially envisaged
- Public capital investment for the Private Pump Program is much greater than was initially envisaged. This is primarily due to the number of unsuccessful FEDS investigations (i.e. 75% - 80% unsuccessful investigations) being greater than expected
- Increased public investment required for increased research, monitoring and reporting requirements.

Table 46: Projected SSDP Cost Share Arrangements through to Full Implementation

SSDP Activity	Capital Cost		Annual Cost		Overall	
	Private Cost Share	Public Cost Share	Private Cost Share	Public Cost Share	Private Cost Share	Public Cost Share
Works Related						
SSDP Private Pasture Pump Program	15%	85%	100%	0%	39%	61%
SSDP Private Horticulture Program	21%	79%	100%	0%	32%	68%
SSDP Public Pump Program	0%	100%	100%	0%	29%	71%
Other						
Monitoring [1]	[redacted]		10%	90%	10%	90%
Program Support (e.g. Extension and community engagement)			0%	100%	0%	100%
Program Development (e.g. plan development/review and R&I)			0%	100%	0%	100%
Overall Cost Share	**7%**	**93%**	**75%**	**25%**	**30%**	**70%**

Note
1. The monitoring cost share is based on the following breakdown of monitoring costs:
   - R499 Effectiveness of G/Water Pumping - Federal and State funding 5%
   - GB CMA Monitoring, Evaluating and Reporting (MERS) - Federal and State funding 61%
   - D841Shep Region Drain Salt Load Monitoring - Federal and State funding 24%
   - D841Shep Region Drain Salt Load Monitoring - Local Irrigators 10%

2. Non-SSDP Private pumps have not been considered to determine the cost share.

8. Risk Assessment

The implementation of the SSDP poses different levels of risk to each of the stakeholders involved. The SSDP stakeholder implementation risks were determined based on a workshop involving representatives from each of the key stakeholder groups that have a role in the implementation of the Program. The stakeholders either represented, or assessed, as part of the workshop, included:

- Catchment Management Authorities (GB CMA and North Central CMA)
- G-MW
- MDBC
- DSE
- DPI
- Broader community.
- Municipal Councils
- Local Consultants (Sinclair Knight Merz Pty Ltd, Bill Trewhella Consulting Pty Ltd, Hydro Environmental Pty Ltd, etc.)
- Landowners requiring SSD protection

The assessment focused on the risks faced by each stakeholder group as a result of the implementation of the SSDP over the next 5 years.

The risks were assessed against eleven 'risk areas'. These risk areas were:

1. Staffing
2. Perception of Customers
3. Management of assets
4. Management of Salt Disposal on a local scale
5. Management of Salt Disposal out of the region
6. Financial uncertainties
7. Level of service committed
8. Change of Disposal rules
9. Salinity accounting
10. Stewardship (catchment condition)
11. Social impact.

Not all of the risk areas were applicable to each stakeholder group. The assessment therefore only focused on the risk areas that were applicable to the stakeholder group being assessed on each occasion.

The level of risk posed to each stakeholder group was determined by assessing the likelihood of the risk occurring, and the consequence if the risk did occur on the stakeholder group. **Figure 22** shows the risk ranking matrix used determine the level of risk.

		Consequences				
		Insignificant	**Minimal**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Rare**	L	L	M	H	H
	Unlikely	L	L	M	H	E
	Possible	L	M	H	E	E
	Likely	M	H	H	E	E
	Almost Certain	H	H	E	E	E

E = extreme risk – mitigation strategy
H = high risk
M = moderate risk
L = low risk – little impact, address through routine management

Figure 22: Risk Assessment Matrix

Table 44 presents a summary of the key outcomes of the risk assessment. The table identifies the overall level of risk posed to each stakeholder group as a result of the continued implementation of the SSDP and the areas where each of the stakeholder groups are considered to be more significantly exposed.

Further details relating to risk assessment are included in **Volume 2** of the SSDP 5-Year review report.

Table 47: Summary of the risk assessment outcomes for each stakeholder group

Stakeholder Group	Overall level of risk posed by SSDP implementation	Areas of Highest risk (i.e. Extreme or High Risk)
GB CMA	High	• Financial uncertainty • Management of regional salt disposal • Uncertainty and lack of control with the changing salt disposal rules • Land stewardship
MDBC	High	• Salt disposal accounting • Perception of customers (States)
Local Consultants	High	• Staffing • Financial uncertainty • Perception of Clients
G-MW	Moderate	• Customer perception • Local salt disposal • Level of service obligations • Lack of control and uncertainty with the out of region salt disposal rules
Local Department of Primary Industries (Vic)	Moderate	• Land stewardship
Municipal Councils	Low	• Financial uncertainty
DSE	Low	• Custody of landscape assets
Landowners requiring SSD protection	Low	• Management of local salt disposal
Broader Community	Low	• Management of local salt disposal

The key outcomes concluded from the risk assessment are as follows:

- Overall there is a far higher risk to the majority of stakeholders by the SSDP not being implemented than is posed by its implementation
- More than one area of 'High risk' has been identified associated with the implementation of the SSDP for the 2005-2010 period
- The GB CMA, MDBC and local consultants are the stakeholders most at risk as a result of the implementation of the SSDP. Salt management is the key factor for this high level of risk from a CMA and MDBC perspective, with financial and staffing implications the most significant issue for local consultants.

While the risk assessment did identify that the SSDP posed an element of risk to each stakeholder group, it also highlighted that strategies have already been developed, or are being developed, by most organisations to address these areas of risk. For example, the GB CMA has commenced the development of a 'Salt Register', to enable the transparent tracking and reporting of salt uptake across the region. The register will overcome a number of uncertainties which currently exist around the accuracy of the data, and will allow for easier integration of any future MDBC imposed salt disposal rule changes.

9. Further Major Challenges Facing the SSDP and Future Strategies

9.1. Overview

The key challenges facing the implementation of the SSDP over the next 5 to 10 years are considered to be:

- Further refinement of the SSDP and its deliver y to ensure outputs and outcomes meet the needs of the community and are delivered in the most cost effective way
- Climate change and changing weather patterns (climate variability)
- Reduced water availability for irrigators
- Managing the effect of changing water use efficiency on groundwater systems
- Land use change resulting from water trading and industry changes
- Water supply infrastructure rationalisation impacts
- Managing salt disposal at a local and regional scale
- Maintaining landowner support and participation in implementation
- Future use of 'Market Based Instruments' to support implementation
- Future funding security.

These challenges and how they will be addressed by the SSDP are generally discussed in the following sections of this review.

9.2. Climatic Conditions

9.2.1. Global Warming

It is expected that the impact of human induced climate change will continue for many years to come. Increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change. On a global scale it is predicted that mean temperatures will increase between 0.4°C and 2.2°C by 2050 (Howe et al 2005). Evaporation will increase as the climate warms, which will increase average global precipitation. Soil moisture is likely to decline in many regions, and intense rainfall (storms) is likely to become more frequent.

In Australia, it is envisaged that our natural environment will suffer significantly. The number of times the current design standards of service for water supply, sewerage and drainage services are exceeded is expected to increase, with more hot days, more dry days and increased rainfall intensities during storm events (Howe et al 2005).

In the SIR, it is anticipated that warmer and drier conditions will continue, resulting in lower than average annual precipitation. Extremely heavy precipitation events may become more intense. Demand for water is expected to increase as a result of increases in temperature and evaporation, leading to less water in dams and catchments. This will subsequently result in changes in the way that deliveries are managed to avoid the need for additional infrastructure.

These changes would bring about some serious implications to the implementation of the SSDP. Warmer and drier conditions are likely to see a continued lowering of the water table, decreasing the risk of land salinisation. It is anticipated that demand for water will increase and farmers will further rely on groundwater as a key source of supply. In the interim, this will lead to greater local distribution and storage of salt in the upper soil profile. The increase in water and soil salinity will increase the level of accessions to the water table which may lead to further rises in water tables.

A better understanding of these relationships for the different sub-catchments is required and will be addressed by the SSDP through its R&I Program over the next five years.

It is imperative that a better understanding of climate variability, particularly decadal rainfall variability be developed. Site specific research into changes in rainfall totals, temporal patterns and intensities associated with storm events would increase regional understanding and allow for better adaptation to climate change (Howe et al 2005).

9.2.2. Irrigation Futures

It is crucial that the future needs of irrigated agriculture industry are considered as part of the planning and implementation of the SSDP. These needs however, are extremely difficult to predict. As part of the implementation of the SIRCIS, Primary Industries Research Victoria (PIRVic), which is part of the DPI, has developed four feasible future scenarios which reflect possible weather, commodity prices, political and water supply asset ownership that will assist in determining the irrigation infrastructure needs in the SIR.

The four scenarios are referred to as; (1) Moving On; (2) New Frontiers; (3) Pendulum; and (4) Drying Up. Each scenario is designed to reflect a range of challenges and opportunities that the irrigation industry may face as a result of changing operating environment over the next 30 years.

The scenarios are briefly described as follows:

- Scenario 1 – 'Moving On' presents drier than average climatic conditions during the first period (2005-2020) that persists into the second period (2020-2035).
- Scenario 2 – 'New Frontiers' proposes drier than average climatic conditions in the first period (2005-2020) with even drier climatic conditions predicted in the second period (2020-2035).
- Scenario 3 - "Pendulum" presents slightly drier than average climatic conditions during the first period (2005-2020). Wetter than average climatic conditions are predicted in the second period (2020-2035) with several seasons of above average rainfall and floods.
- Scenario 4 - "Drying Up" initially presents wetter than average climatic conditions in the initial stages of the first period (2005-2020) with drier than average climatic conditions in the later stages. Climatic conditions in the second period (2020-2035) are expected to be slightly wetter than average.

Under each scenario the impact on a range of land and water management factors is assessed. The factors that are considered particularly pertinent to the implementation of the SSDP are:

- Environmental flows
- Rainfall levels
- Change in water use efficiency
- Temperature
- Introduction of High and Medium Reliability Water entitlements
- Water Trade into and out of the region
- Water Use change
- Irrigated Area
- Possible privatisation of the supply system.

Table 48 presents an overview of the modelled impact of the four irrigation future scenarios on each of the factors listed above.

A brief description of the likely impact to the SSDP under each of the four irrigation future scenarios is presented following **Table 48**.

Table 48: Modelled impact of each of the factors under the four irrigation future scenarios

Scenario	Period	SSDP Related Drivers												
		White Paper	Environmental Flows	Rainfall	Runoff	Temperature	High Reliability Water	Medium Reliability Water	Water Traded out of Region	Water Traded into the Region	Water Use	Irrigated Area	Privatisation	Water Use Efficiency
1. Moving On	2005-2020	-	-	↓2	▼4	↑2	-	▼5	↑2	-	↓1	↓1	-	↑2
	2020-2035	-	-	↓2	↓2	↑3	-	▼4	↑1	-	↑2	↑2	▲5	↑2
2. New Frontiers	2005-2020	-	↑3	↓2	↓3	↑2	↑1	▼5	↑2	-	↓3	↓3	-	↑2
	2020-2035	-	↑3	↓3	↓2	↑3	-	-	▲5	-	▼4	▼4	-	↑3
3. Pendulum	2005-2020	-	▲5	↓2	↓2	↑2	- ▼4	▼5	-	↑2	▼4	▼4	-	↑2
	2020-2035	-	↓2	↑3	↑2	-	-	-	↑2	↑2	▲5	▲5	-	↑2
4. Drying Up	2005-2020	-	-	↑2 ▼5	↓2	▲5	▼4	▼5	-	-	▼5	▼5	-	▲4
	2020-2035	-	-	↑1	↓2	↓1	-	▼4	↑2	-	↑1	↓3	-	↓1

Under Scenario 1 ("Moving On") there would be a slight reduction in the need for SSD works (~100 less pumps than the current target) during the first period (2005-2020). The need for SSD works would increase slightly in the second period (2020-2035) with approximately 200 more pumps required than the current target.

Under Scenario 2 ("New Frontiers") there would be a slight reduction in the need for SSD works (~100 less pumps than the current target) during the first period (2005-2020). The need for SSD works would reduce significantly in the second period (2020-2035) with around 500 pumps that were installed in the first period, needing to be decommissioned.

Under Scenario 3 ("Pendulum") the need for SSD works in the first period (2005-2020) would again be reduced with just 450 pumps likely to be required based on the current target. The need for SSD works in the second period (2020-2035) however would be enhanced when approximately 600 more pumps than the current target would be required.

Under Scenario 4 ("Drying Up") the need for SSD works in the first period (2005-2020) would be reduced with approximately 400 pumps installed to 2005 needing to be decommissioned. The need for SSD works in the second period (2020-2035), however, is likely to be significantly in need when around 1,100 more pumps than the current target being required to serve the area under threat.

Ultimately it is not known which, if any, of these particular scenarios or parts pf these scenarios will apply to the SIR, however, looking across the four scenarios, it is concluded that if the SSDP is to be effective and meet the needs of the local community, it is imperative that the SSDP continues to:

- Be community driven with a science based approach
- Adopt a long-term integrated, adaptive and strategic planning approach with regards to SSDP infrastructure
- Focus on private works in the short term and delay public works as long as possible
- Design works which are multipurpose (e.g. pumps which can be used for 'resource extraction' and 'salinity control')
- Ensure new public works complement the intent of the G-MW supply infrastructure rationalisation plans
- Maintain its strong knowledge base through good documentation and succession planning
- Protect agricultural and natural assets from salinisation and the affects of salt
- Ensure the protection of native biodiversity in the region
- Ensure effective management of salt within and external to the region
- Use up-to-date, cost effective technology and management systems
- Have access to a well informed SSDP advisory community.

Further details relating to the implication of the future irrigation scenarios on the SIR are included in **Volume 2** of the SSDP 5-Year review report.

9.3. White Paper "Securing Our Water Future Together"

In October 2005, the Victorian Government introduced its Water (Resource Management) Bill into Parliament. The Bill which was passed on 24 November 2005, addresses the policy changes heralded by the 2003 Green Paper *Securing our Water Future*, and the subsequent White Paper, *Our Water Our Future* (June, 2004).

The Victorian Government's *Our Water Our Future* initiative seeks to ensure the smarter use and more efficient and cost effective management of Victoria's scarce water resources. The central objective of the *Our Water Our Future* initiative is 'that all Victorians are able to do more with less water'.

It is likely that several of the initiatives detailed in the White Paper will, if introduced, either directly or indirectly impact on the implementation of the SIRCIS, including the SSDP. The initiatives which are particularly relevant to the SSDP are as follows:

- Extension of Water Allocation Framework (High and Low Security Water)
- Metering of Water Supplies
- Water Resource monitoring and Reporting
- Introduction of Water Accounts
- Water Use Licences - unbundling
- Water Entitlement Unbundling Capacity Share.
- Stranded Assets
- Trading Salt Discharge Permits
- Groundwater Management Plans and Groundwater Licensing
- Water for the Environment (80:20 etc)
- Full Pricing of Services
- Innovation and Capacity in Groundwater

Table 49 presents an overview of the possible implications and risk posed by the above initiatives on the delivery of the SSDP.

Table 49: White Paper Implications and Risks for the SSDP

White Paper Initiative	Implications for SSDP	Risk to SSDP	Indicative Timing of Action Required	Level of Action Required
1. Extension of Water Allocation Framework	Medium	Medium	Immediate	Proactive
2. Metering of Water Supplies	Low	Low	Short term	Discuss
3. Water Resource monitoring and Reporting	Low	Low	Immediate	Discuss
4. Introduction of Water Accounts	Low	Low	Immediate	Awareness
5. Water Use Licences	High	High	Immediate	Proactive
6. Unbundling Capacity Share	High	Low	Immediate	Discuss
7. Stranded Assets	High	Low	Medium Term	Awareness
8. Trading Salt Discharge Permits	High	High	Immediate	Proactive
9. Groundwater Management Plans and Groundwater Licensing	High	Low	Immediate	Discuss
10. Water for the Environment	High	Low	Medium Term	Awareness
11. Pricing of Services	High	Low	Immediate	Discuss
12. Innovation and Capacity in Groundwater	Medium	Low	Long Term	Awareness

Source: Memo from Peter Alexander to Terry Hunter dated 1 May 2005.

As the White Paper initiatives come into full effect over the next five years, it will be important that those involved in the implementation of the SSDP are proactive in monitoring developments and assessing the flow on implications to the Program. This may involve the need be adaptive and to adjust implementation targets and works priorities.

A comprehensive assessment of the impact of the Victorian Government's *Our Water Our Future* initiative should be carried out as part of the 2011 SSDP review.

9.4. Water Trade

Water Trade is expected to be an ongoing challenge for both the SIR and the implementation of the SSDP. Stemming the loss of permanent and temporary water to downstream irrigators, and managing landuse change as a result of water transfers will directly impact on what and where SSD works are needed across the SIR.

It is essential the SSDP remains adaptive to external influences such as Water Trade. This will occur through continued communication between natural resource management stakeholders and adopting a strategic implementation approach which is supported by all of the SIRCIS Programs.

The downstream transfer of irrigation water has a two fold positive impact on the SSDP in that additional dilution flows will be available in the upper and mid River Murray and there will be less salt to be exported due to the reduction in the need for SSD works.

9.5. Infrastructure Rationalisation

With the continued movement of water and improvements in water use efficiency, rural water authorities are faced with the dilemma of how to equitably continue to operate and maintain their infrastructure network with a changing and possibly diminishing customer base. This issue has been recognised by the Victorian Government in its White Paper (refer to **Section 9.3**). Broadly, infrastructure rationalisation is described as reviewing and re-investing in infrastructure according to the changing needs of irrigators.

G-MW is currently in the process of identifying areas in the SIR where the provision of infrastructure and its maintenance/replacement can no longer be justified. This could be due to the fact that farms are no longer active, as irrigators have retired, or decided to sell to non-active landowners.
A GIS 'Composite Layer' has been developed to identify these non-active areas across the SIR. The focus for G-MW is as much about determining where irrigation should take place in the future, as it is in identifying where its assets are being stranded through permanent movement of water out of the region.

Compulsory infrastructure reconfiguration could have a significant impact on the implementation of the SSDP, through altering what areas that need to be served, the level of protection required and the G-MW assets being available for salt conveyance.

G-MW is also undertaking its asset modernisation feasibility studies in association with its rationalisation planning. Asset modernisation could have similar implications on the SSDP as any proposed rationalisation. Asset moderisation could also enhance salt conveyance through using real time data and automatic system control hardware and software.

9.6. Land Use Change

A key driver of many of the challenges facing the SSDP is land use change. What are the most profitable agricultural enterprises and where are they best grown will determine where landowners want to invest. This will subsequently impact on where water is delivered to and what areas need to be serviced with water supply infrastructure. On the flipside, it will also dictate where investment is no longer sought and hence the areas which do not need to be serviced both in terms of water supply infrastructure and SSD and surface drainage works.

The collective nature of these issues is well understood in the SIR, with significant planning already underway to direct future investment in areas which are most suitable for irrigation development, taking into consideration factors such as:

- Water supply infrastructure needs
- Areas at risk of waterlogging and land salinisation
- Key environmental features
- Current SSD works and need to implement SSD works.

Such decisions may ultimately impact on the nature and composition of the SSDP.

9.7. Landowner Participation

The success of the SSDP is depended on the continued support and participation of landowners. Landowners are currently having to contend with issues such as drought, climate change, environmental water reserves, improvements in water use efficiency, land use change and infrastructure reconfiguration. As such, the implementation of SSD works is generally not considered a high priority. In fact, it is likely that, at least in the short term, the use of groundwater as a resource for irrigation purposes will be the major driver for the implementation of SSD works in the SIR.

It is important that considerable focus is placed on trying to understand the needs of the community and adapting the SSDP to ensure that these needs are addressed, while still achieving the objectives of the Program.

A SSDP R&I project has commenced to improve community ownership and participation in the SSDP (R&I Project GI02011). A key outcome of the project will be the development of an action plan, which will have strong links with the SIRIC Communication Strategy. Other outputs will include:

- The development of a 12 month communication cycle which will see a focus on the delivery of a key message relating to SSD
- Strengthening of links with Landcare, Local Area Plans and other community groups
- The development of key publications.

It is also expected that the shift towards drainage catchment scale planning will facilitate the engagement of stakeholders, by targeting works to meet the specific needs at a local scale (refer to **Section 4.6.1**).

9.8. 'Market-Based' Instruments

While it is recognised that 'Market-based instruments' (MBIs) will not solve all natural resource management issues, they have the potential to expand the tools available to achieve the best possible return from funds invested including improved social and environmental outcomes. MBIs use trading mechanisms, auctions and price signals to positively influence human behaviour. Their effectiveness is mainly due to the fact that they allow flexibility in the way participants choose to respond. They also encourage change by those who can achieve the change most cost effectively.

In Australia, a number of different projects are either investigating ways to improve the use of MBIs in natural resource management, or actually using MBIs on the ground to achieve improved environmental outcomes. The National Action Plan for Salinity and Water Quality National MBI Pilot Program is one example of this on-going investigation.

An example of the MBI approach within the context of the SSDP is the possible introduction of a tendering process for incentives to install/upgrade private pumps which support the SSDP.

MBIs can only effectively operate if a regulatory framework is in place, and hence are viewed as a complementary tool to the more traditional natural resource management change approaches.

9.9. State and Federal Funding

Any programs which are reliant on State and/or Federal funding are susceptible to loss of funding support. Governments can no longer make long term funding commitments in spite of the fact that the benefits of natural resource management programs may not be made evident without such long term support. Recent issues such as drought, bushfires and the establishment of water reserves demonstrate the unplanned demand being placed on the limited pool of resources.

To the credit of the SSDP, through its adaptiveness and on-going delivery of benefits to the SIR, it has been able to secure a stable funding base over the last 15 years, with support for the Program expected to continue into the future. The SSDP has been able to successfully tailor its works Program within any budget constraints.

The SSDP supports the current requirements for Government funding by:

- Improving productivity hence improving water use efficiency
- Creating resources by extracting groundwater which would otherwise not be harnessed
- Improving community well-being by improving productivity and reducing the risk of private investment
- Reducing the risk of government investment in water supply and other SIRCIS Programs
- Directly protecting environmental assets in the SIR
- Directly and indirectly protecting public infrastructure (e.g. roads, buildings, etc.).

Section 6 outlines the projected funding requirements of the SSDP over the next 6 years to 2011. These are based on both, historical funding commitments and, the needs of the Program to fulfil its objectives and targets by 2030. It is expected that the SSDP will continue to play a lead role in the implementation of the SIRCIS, delivering benefits far beyond the Program itself.

Based on the works Program, the projected benefits of the SSDP from an economic, environmental and social perspective have been ascertained. These benefits provide further justification for future Government support.

9.10. Salt Management

A primary objective of the SSDP is the management salt in the SIR. The Program needs to balance between the internal redistribution and removal of salt and its subsequent impact on downstream users. To date, this has been successfully managed with the SSDP falling well short of its original expected needs and the State SDE allocations (refer to **Section 4.4.7**).

The development of the GB CMA Salt Register will assist in the tracking and management of salt uptake as a result of the implementation of SDDP related works. It is through the need to annually report such data that the effectiveness of existing monitoring programs can be assessed.

9.11. Nutrient Management

Limited data on the nutrient concentration of the region's groundwater resources has made it difficult to ascertain whether the management of nutrients is an important issue for the implementation of the SSDP. In order to determine the potential impact and importance of SSDP mobilised nutrients, it is essential that the monitoring Program be extended to include the routine collection and analysis of groundwater nutrient concentrations at strategic sites across the SIR. This will enable an assessment of any localised and longer term trends, and the determination of the degree of effort that should be placed on managing groundwater nutrients.

It is proposed that the issue posed by SSDP mobilised groundwater nutrients be more fully addressed as part of the 2011 SSDP review.

10. 2011 SSDP Major Revision

The 2011 SSDP review will involve a major revision of the Program, including its underlying philosophy and principles. In order for such a significant revision to take place, there are a number of key actions which need to undertaken prior to 2011. These include:

- Determining the applicability of the current underlying principles which govern the standard and extent of works required under the SSDP (e.g. area at risk, area to be served, standard of service to be provided, area served per pump, etc.)
- Improving the governance relating to current data management systems
- Determining the standard of service needs to serve environmental features
- More accurately determine proposed actions as well as salt disposal needs and credit generation under MDB Agreement Schedule C
- Reviewing the SDE needs and sourcing SDE credits to support full SSDP implementation
- Quantifying the volume of water generated through the achievement of water use efficiency improvements and resource generation
- Confirmation of the area of watertable affected by SSDP works
- Better defining land use and expected land use in the areas at risk from high water tables
- Better defining the extent of the land at risk within the identified boundary of the area at risk shown in **Figure 19**
- Ensuring that data generated as part of the 2005 review is used and built upon over the next 6 years
- Assessing the required standards of service needs relative the current standards being delivered under the Program
- Site specific research into changes in rainfall totals, temporal patterns and intensities associated with storm events
- Quantification of the actual environmental benefits directly and indirectly delivered through the Program
- Improving the understanding of groundwater nutrients and trends in salinity groundwater salinity
- Determining the actual split in investment between the key stakeholders in the delivery of the Program
- Undertaking the necessary investigations to quantify the road benefits to be delivered through the Program. This information will be included as part of the economic assessment
- Estimation of works Program which requires completion of sub regional planning, water supply system reconfiguration arrangements to be known and resolving any issues with the redistribution of salts within the SIR via water supply channels and drains
- Further refinement of the SSDP and its deliver y to ensure outputs and outcomes meet the needs of the community
- Ensuring that the key actions outlined above are addressed in the most strategic and cost effective way.

A number of the actions outlined above are included in the current SSDP R&I Program or in the new issues to be addressed by the R&I Program (refer to **Section 6.3**).

The delivery of these actions through the SSDP Strategic Investigation component of the Program will assist in ensuring that the 2011 review is carried out in a timely fashion, and is based on the best available information.

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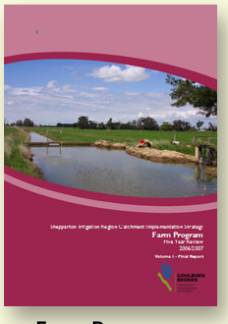
Success in delivery of the Shepparton Irrigation Region Catchment Implementation Strategy component of the Goulburn Broken Regional Catchment Strategy is due to strong:

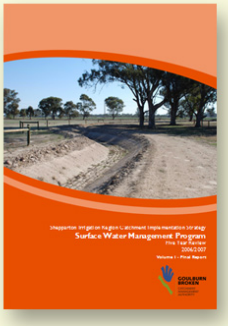
- Community involvement and empowerment through the Implementation Committee and working groups
- Partnerships between agencies and local, state and federal governments
- Partnerships with Landcare, Local Area Planning and the Goulburn Murray Landcare Network
- Integrated approach to tackling natural resource issues and protecting assets
- People skills, dedication and leadership in natural resource management

The five-year review of programs overseen by the Shepparton Irrigation Region Implementation Committee presents an opportunity to celebrate our achievements, describe our forward planning, demonstrate value of investment and describe our engagement of community and partner agencies.

Look for these other five-year reviews:


Environment Program


Farm Program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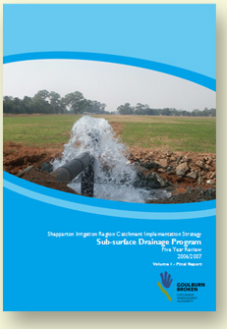
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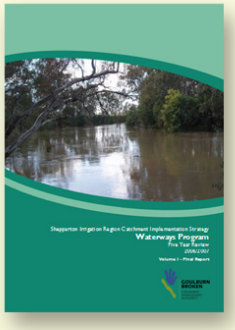
Waterways Program

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