
**RIVER MURRAY ACT
2003 ANNUAL REPORT
AND TRIENNIAL REVIEW
2010-2011
SUPPORTING DOCUMENT**

**DEPARTMENT FOR
WATER**

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CONTRIBUTING PROGRAMS AND PROJECTS

A range of government agencies have responsibilities to contribute towards achieving the *River Murray Act 2003* Objects and Objectives for a Healthy River Murray (ORMs). Agencies were asked to nominate current programs and projects that were relevant in 2010-2011 and to describe the outcomes achieved. Projects were often collaborations with other agencies, the community or scientific groups.

Agencies nominated projects for which they were either the lead or a major partner.

Projects and programs are listed under the relevant lead agency and grouped against the four key ORMs;

- River Health;
- Environmental Flows;
- Water Quality; and
- The Human Dimension.

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1 SOUTH AUSTRALIAN MURRAY DARLING BASIN NATURAL RESOURCES MANAGEMENT BOARD

In relation to the *River Murray Act 2003*, the South Australian Murray-Darling Basin Natural Resources Management (SA MDB NRM) Board implements a range of relevant programs and projects under the direction of its *Regional Natural Resources Management Plan 2009* and associated sub-plans.

1.1 RIVER HEALTH

1.1.1 Community Wetland Program

The SA MDB NRM Board's wetland program provided technical support to wetland projects that have community involvement. This included providing advice on the management of wetlands for ecological benefit, monitoring wetland health and objectives of environmental watering, and assisting with infrastructure operation.

In 2010-11, the SA MDB NRM Board wetland program worked in conjunction with the Department for Water (DFW) to undertake monitoring and assisted in the management of 31 wetlands. Objectives of wetland management and environmental watering included preventing the loss of native species such as the Southern Bell Frog, the Regent Parrot and the Murray Hardy Head, and maintaining important key habitats and features of River Murray wetlands.

Data collected through the wetland program has been used in a number of projects, including the development of the Basin Plan, assessing the vulnerability of native fauna under the Climate Change project, and the management of Acid Sulfate Soils (ASS) in wetlands between Lock 1 and Wellington.

1.1.2 Southern Bell Frog Census

Following its previous work in 2009-10, the SA MDB NRM Board undertook a census and habitat assessment of the nationally vulnerable Southern Bell Frog within Lake Alexandrina, Lake Albert and the Tributaries area. Southern Bell Frogs were recorded at six of the 36 sites surveyed. The SA MDB NRM Board has completed and distributed a report on the census and habitat assessment to stakeholders. Continued monitoring of the populations will assist in managing Southern Bell Frogs in the long term.

1.1.3 Water Allocation Planning for the River Murray

Development of an amended Water Allocation Plan (WAP) for the River Murray continues. In 2010-11, the SA MDB NRM Board and DFW scoped out the works program that will drive draft policy production during 2012. The SA MDB NRM Board is aiming to release a draft River Murray WAP for public consultation by mid 2013. The amended River Murray WAP, is not likely to be required to fully comply with the Basin Plan until 2019.

1.1.4 Water Allocation Plan for the Eastern Mount Lofty Ranges

The SA MDB NRM Board consulted on the draft WAP for the Eastern Mount Lofty Ranges (EMLR) in May and June 2011. A key policy area that underpins the draft EMLR WAP is the provision of an environmental water regime. The Sustainable Diversion Limits (SDLs) included within the draft EMLR

WAP have been provided to the Murray-Darling Basin Authority (MDBA) as input into the Basin Plan. In turn, it is expected that the SDLs within the draft EMLR WAP will be consistent with the Basin Plan.

1.1.5 Restoring Environmental Flows and Connectivity

Improved flow conditions within the South Australian River Murray during 2010-11 led to the inundation of large areas of floodplain and wetlands, and improved connectivity within the South Australian River Murray. The SA MDB NRM Board worked with DFW, Local Action Planning (LAP) associations and community groups in the reconnection of a number of managed wetlands so that they could be inundated during the high river flows.

1.1.6 Environmental Water Requirements of the Ecological Assets of the River Murray in South Australia

The SA MDB NRM Board worked in conjunction with DFW in the development of environmental water requirements for the River Murray channel, wetlands and floodplain within South Australia in response to the *Guide to the proposed Basin Plan*. The completed environmental water requirements report has undergone scientific review by the Commonwealth Scientific and Industrial Research Organisation.

As part of the development of water bids for sites within the South Australian Murray-Darling Basin (MDB), the SA MDB NRM Board identified the environmental water requirements for individual priority wetland sites.

1.1.7 Environmental Watering

In 2010-11, as part of the SA MDB NRM Board wetland program 19 environmental water bids were developed for submission to the Commonwealth Environmental Water Holder with the objectives of preventing the loss of native species and maintaining important key habitats and features of the River Murray wetlands.

Monitoring of environmental watering at wetlands undertaken in 2009-10 continued in 2010-11, and reports of the ecological response to this watering were submitted to DFW. The SA MDB NRM Board also provided input to DFW on the development of environmental water bids and monitoring proposals for the 2011-12 water year.

Data collected through the wetland program has been used in a number of other programs including the development of the Basin Plan, assessing the vulnerability of native fauna under the Climate Change project, and the management of ASS in wetlands between Lock 1 and Wellington project.

1.2 WATER QUALITY

1.2.1 Community Land and Water Management Plan Initiatives

Land and Water Management Plans (LWMPs) are locally based plans that identify strategies to protect the key assets of the region with a major focus on managing and minimising the salinity impacts on the River Murray. The LWMPs have a high level of community ownership and community groups receive significant support from government agencies to develop and implement plans.

Implementation of the community LWMP initiatives continued, albeit on a reduced scale, in 2010-11 due to changes in Commonwealth funding programs. Active community committees continue to operate in the Pike, Bookpurnong to Lock 4, Pyap to Kingston on Murray, and the Angas Bremer LWMP districts. Investigations in 2011-12 are planned to support the finalisation of the LWMP process in Taylorville North.

A revised LWMP framework has been developed that will encourage plans to be more holistic in their focus and address broader natural resources management (NRM) issues within LWMP districts. The upgrade of the Pyap-Kingston LWMP will be finalised using this new template and it is anticipated that the plan will be completed in late 2011. Stronger linkages between LWMPs and higher level strategies, including the SA MDB NRM Board regional NRM plan, River Murray WAP and the Basin Salinity Management Strategy (BSMS), are also a key aim of the revised LWMP framework.

1.2.2 Improving Irrigation Efficiency Project

The Improving Irrigation Efficiency Project (IIEP) has traditionally focused on the delivery of irrigator education and awareness activities across the South Australian MDB region however the scope of the project was refined in 2010-11. Nine irrigation training workshops were delivered in 2010-11 on a broad range of topics including soils, and irrigation system maintenance and management.

IIEP staff actively supported a Young Irrigator Group in the Riverland West region and facilitated a number of on-farm trials as part of this project, including the continuation of root zone salinity management trials in the Lower Murray region and a District Root Zone Salinity Monitoring project at Langhorne Creek. The scope of the IIEP will be further refined in 2011-12, with key activities likely to be closely integrated with the implementation of the Commonwealth Government's Water for the Future (WFTF) program.

1.2.3 Commonwealth Water for the Future Program

The SA MDB NRM Board was successful in attracting \$1.652m of funding through round one of the On-Farm Irrigation Efficiency Program (OFIEP) which is a major component of the Commonwealth Government's WFTF program. Projects funded under round one of the OFIEP continued to be implemented during 2010-11, with a number now fully complete and commissioned. Approximately 0.7 gigalitres (GL) of water savings will be generated by the 21 on-farm projects funded through round one of the OFIEP. A share of these water savings will be returned to the Commonwealth Environmental Water Holder with the balance remaining with the 21 irrigators involved in the program.

The SA MDB NRM Board received in-principle funding approval for \$13.5m through round two of the OFIEP which will support approximately 100 individual on-farm projects and generate total water savings of close to 4.8 GL. Additionally, the SA MDB NRM Board is awaiting the outcome of an application through round two of the Private Irrigation Infrastructure Program – South Australia; which is anticipated in the 2011-12 financial year.

The SA MDB NRM Board has invested considerable effort in providing support to irrigators to develop applications and identifying potential savings, as well as developing water use efficiency plans.

1.2.4 Automatic Weather Monitoring Network

The SA MDB NRM Board completed a major upgrade to the automatic weather monitoring network in 2010-11, with funding secured through round four of the Modernisation and Extension of Hydrologic Monitoring Networks program. This program is part of the Commonwealth Government's WFTF Program and is administered by the Bureau of Meteorology. The upgrade involved the development of a formal data quality assurance system and a new website featuring additional functionality, and will result in an improved capacity to schedule irrigation within the South Australian MDB region. An additional monitoring site was also established at Lowaldie (Karoonda) during 2010-11.

In 2011-12, it is planned to refine the website to encourage increased adoption of the data to facilitate adaptive and sustainable land and water management practices across the South Australian MDB region.

1.2.5 Community Stream Sampling Program

The community stream sampling program supports more than 40 community groups across the South Australian MDB region. The Program supports communities within the South Australian MDB region by providing them with the means to identify areas within their catchments that are at risk from salinity. The information obtained is used by groups to better understand their local water resources. In addition, this local-scale monitoring is used to enhance the regional water resource picture. Salinity monitoring forms part of a broader community water monitoring program that also captures nutrient levels, turbidity and pH levels, and supports field observations and biological monitoring. In 2010-11, the SA MDB NRM Board supported the continued operation and development of an online database that became operational in June 2010. This included uploading historic data and developing an automated interface with the Bureau of Meteorology.

1.3 HUMAN DIMENSION

1.3.1 Aboriginal Partnerships Project

The SA MDB NRM Board's Aboriginal Partnerships Project aims to increase the participation of the Aboriginal community in NRM, increase cultural awareness within the NRM community, and protect and restore cultural assets.

A highlight of the project in 2010-11 has been the continued success of the Aboriginal Learning on Country and Working on Country programs that provide training and employment to Aboriginal community members. Aboriginal Learning on Country projects have taken place at Calperum Station and Monarto Zoological Park, and a project has been established with the Department of Environment and Natural Resources (DENR) to work on the Pike River, Chowilla and other public land. The Riverland Working on Country project has continued with six aboriginal rangers employed and receiving conservation and land management training.

1.3.2 Lower Lakes and Coorong Oral History Project

This project involves the collection of oral histories and local NRM knowledge for the Coorong and Lower Lakes region.

In 2010-11, the SA MDB NRM Board and the Goolwa to Wellington LAP Association, with the support of Flinders University, progressed the Lower Lakes and Coorong Oral History Project by linking historical records to a Geographical Information System. This means that historical information can now be displayed or searched for spatiality.

1.3.3 Local Action Planning

In 2010-11 the SA MDB NRM Board continued to support the region's 11 LAP groups to engage extensively with their local communities in NRM programs. The LAP groups played a major role in the delivery of on-ground works for the SA MDB NRM Board's biodiversity, wetlands and land management programs. They also undertook a variety of activities including community awareness raising, building community skills and knowledge, supporting the recruitment and retention of volunteers and assisting the community to access technical and financial assistance.

1.3.4 Natural Resource Management Schools Education

In 2010-11, the SA MDB NRM Board's NRM education program worked with 80 schools across the region to actively engage students in learning about River Murray issues and participating in community monitoring programs such as Waterwatch. A range of initiatives were delivered including

school sustainability action planning, school education sessions (e.g. weed warriors), the Upper and Lower Murray youth councils, delivery of junior youth environment forums, the development of new resources (biodiversity, carbon, sustainable farming), professional development sessions for teachers, and support for the Upper and Lower Murray Environmental Education Working Groups.

1.3.5 Adaption Planning for Natural Resource Management in the SA MDB NRM Board Region

This project, run under the SA MDB NRM Board's "atmosphere program," commenced in 2010-11 with effort focussed on identifying key gaps and promoting NRM multiple benefit opportunities through the carbon market. The program works closely with Regional Development Australia (RDA) (Murraylands and Riverland) in providing regionally appropriate mitigation and adaptation information at carbon forums. The SA MDB NRM Board's Local Government team works with Local Councils to attain similar goals.

2 DEPARTMENT FOR ENVIRONMENT AND NATURAL RESOURCES

The Department for Environment and Natural Resources (DENR) has responsibilities in relation to the *River Murray Act 2003* to manage extensive areas of land as directed by the *National Parks and Wildlife Act 1972*, *Crown Land Management Act 2009* and *Coast Protection Act 1972*. The department also manages native vegetation through the *Native Vegetation Act 1991* and protects heritage values through the *Heritage Places Act 1993* and *Historic Shipwrecks Act 1981*. Natural resources including those in the MDB area are protected through DENR's administration of the *Natural Resources Management Act 2004* and the *Wilderness Protection Act 1992*.

2.1 RIVER HEALTH

2.1.1 Conservation Park Management Plans

Action in accordance with a number of park management plans has occurred within the South Australian MDB including weed and pest animal control, revegetation, and visitor management programs.

An amendment to the management plan for Murray River National Park was adopted which established improved objectives for improving environmental flow management and the connectivity between river, creek, wetland and floodplain environments within the National Park. Draft management plans were released for consultation for Billiatt Conservation Park; Billiatt Wilderness Protection Area; Danggali Conservation Park; Danggali Wilderness Protection Area; Karte Conservation Park; and Peebinga Conservation Park.

2.1.2 Emergency interventions in Lower Lakes to address acidification

Aerial seeding, vegetation planting, and aerial dosing of limestone continued to be implemented in Lakes Alexandrina and Albert in 2010-11 in response to low lake levels that exposed large areas of ASS.

Planting sedges and aerial seeding were undertaken to encourage natural regeneration to stabilise soils, reduce wind erosion and incorporate organic carbon into the soil to counter acidification. Following the refilling of Lake Alexandrina with Murray-Darling floodwater, some vegetation such as phragmites is successfully resisting prolonged inundation and continuing to supply organic matter to sediments and drive sulfate reduction processes.

Limestone treatment of Boggy Lake in northern Lake Alexandrina occurred up to September 2010 to coincide with improved inflows to the Lower Lakes. Water quality and benthic ecological monitoring were carried out by the Environment Protection Authority (EPA) throughout the dosing period to ensure an appropriate amount of limestone was used to stabilise water pH levels. Water quality monitoring throughout the lakes indicated other areas with acidic water, such as around the western margin of Lake Albert, several creeks on Hindmarsh Island and Loveday Bay, but these had sufficient buffering capacity (alkalinity) to counter the acidity and so limestone treatment was not required in them.

With water levels increasing to previously managed levels at around 0.75 m Australian Height Datum, the Narrung Bund and the temporary regulator near Clayton were breached under high flow

conditions in September 2010. The structures were installed as part of an emergency drought response to prevent the impacts of ASS exposed by low water levels in 2008-09. Removal of the Narrung Bund was completed in August 2011 and the regulators near Clayton and in Currency Creek will be removed using a phased approach.

2.1.3 Katarapko Eckert Creeks Demonstration Reach for Native Fish (Katfish Reach)

MDBA Native Fish Strategy funding was again obtained by DENR to continue the implementation of the Katfish Reach Monitoring and Evaluation Framework and Community Engagement Plan. DENR and the South Australian Research and Development Institute (SARDI) staff and volunteers from the Friends of Riverland conducted monitoring activities. On ground activities were significantly impacted due to the River Murray flood event.

2.1.4 Coorong, Lower Lakes and Murray Mouth Living Murray Icon Site

The South Australian Government has developed a long-term plan for the Coorong, Lower Lakes and Murray Mouth (CLLMM) region with input from community, scientists, industry and government.

Securing the Future: A Long-term Plan for the Coorong, Lower Lakes and Murray Mouth aims to secure a future for the region as a healthy, productive and resilient wetland system of international importance. Achieving this will directly support the local economy and communities that rely on a healthy environment to prosper.

The long-term plan builds on the framework outlined in the *Directions for a Healthy Future* document and the management options presented in *Managing for a Healthy Future*.

The Australian Government has committed up to \$200 million to help secure a long-term future for the region. This is part of the South Australian Government's \$610 million *Murray Futures* program funded by the Australian Government's WFTF strategy.

2.1.5 Aquatic and littoral vegetation monitoring of Goolwa Channel

Aquatic and littoral vegetation monitoring in the Goolwa Channel was undertaken by SARDI Aquatic Sciences for the second year to support the Goolwa Channel Water Level Management Program in 2010-11.

Goolwa Channel flora was assessed against selected sites in Lake Alexandrina which were coordinated with The Living Murray (TLM) CLLMM Icon Site Vegetation Condition Monitoring program. Results suggest that following the return of flows to the region, plant communities are transitioning away from the terrestrial and salt tolerant communities found in Lake Alexandrina and the Goolwa Channel in 2009-10. However several aquatic species present prior to 2007 have not re-established and areas that historically were dominated by submergent taxa are yet to be colonised to the same extent. This study was undertaken less than one year following the refilling of the Lower Lakes with Murray-Darling floodwaters and showed that the plant community of the Goolwa Channel is dynamic but recovery to pre-2007 communities may not occur or will require multiple years of high water levels and flushing flows.

2.1.6 Aquatic and Littoral Vegetation of the Murray River Downstream of Lock 1, the Lower Lakes, Murray Estuary and Coorong

A literature review was undertaken which summarises the available information on the aquatic and littoral vegetation communities of the Murray River downstream of Lock 1, Lakes Alexandrina and Albert, Murray Estuary and Coorong. The purpose of the review was to provide background information for:

- identification of key drivers that influence the aquatic and littoral vegetation of the system;

- determining key knowledge gaps;
- a series of risk assessments that will investigate the potential impacts of proposed management scenarios for ASS mitigation in the Lower Lakes;
- the potential recovery of the system when freshwater flows return; and
- long-term planning.

2.1.7 An Environmental History of the Lower Lakes and the Coorong

This report reviews the diatom-based evidence for the history of salinity and pH in Lake Alexandrina and the Coorong. Diatoms are a type of aquatic algae that have species compositions highly influenced by the salinity and pH of their host waters. In addition, because they build their cell wall from silica, diatoms preserve in sediment. Hence, by examining the species composition of diatoms in dated sediment cores, it is possible to obtain a record of pH and salinity change through time.

The review has found that for Lake Alexandrina:

- There is no evidence in the 7000 year record of substantial marine incursions into Lake Alexandrina.
- In addition, there is no evidence in the Lake Alexandrina record of any periods of significant acidification events. Evidence suggests that pH at the sites examined has always remained well above seven.
- There were substantial alterations to the diatom community in Lake Alexandrina following European settlement and particularly after barrage installation.
- The review of the Coorong has found that:
 - The pre-European diatom flora from the Coorong is dominated by diatoms associated with marine and estuarine environments.
 - Diatoms derived from the River Murray and Lake Alexandrina penetrated no further south than Noonameena in the North Coorong Lagoon.
 - The data suggest that the primary role of River Murray discharge was to:
 - keep the Murray Mouth open and allow sea water into the Coorong;
 - generate estuarine conditions at the northern end of the North Lagoon during high flow periods; and
 - facilitate circulation and mixing in the North Lagoon such that salinities were maintained at or below those of seawater.
- Fresh/brackish surface and groundwater flows from the South East region played a major role in controlling salinity levels in the South Lagoon.
- The post-European diatom floras in the Coorong are substantially different to those of the pre-European and suggest a widespread increase in salinity.

2.1.8 Perpetual Lease Accelerated Freeholding Project

The Perpetual Lease Accelerated Freeholding Project sought to return (where possible) high conservation wetland areas to the Crown to improve land management of these areas and to limit grazing of land adjacent the water's edge. All new waterfront boundaries are fixed by survey and the reserves have been expanded to a minimum width of 50 metres wherever possible. The project has

now been completed but ongoing applications to freehold continue to be assessed on the basis of the creation of a minimum 50 metre reserve of Crown land.

2.1.9 Riverland Ramsar Site Management Plan

The Management Plan for the Riverland Ramsar Site - *A Plan for Wise Use 2010-2015* has been accepted by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities.

2.1.10 Threatened River Murray Fauna Recovery Program

DENR has continued to monitor Bush-stone Curlews in Chowilla Game Reserve and Calperum Station. Landholder Carpet Python Surveys have been sent out with positive results and more python sightings than recorded four years ago.

In 2010 a Regent Parrot survey was undertaken and recorded a number of nesting sites from the South Australian Border to Swan Reach. This study recorded 300 breeding pairs, down from 400 in 2004.

2.1.11 Drought Action Plan for threatened native freshwater fish in the South Australian Murray-Darling Basin & Critical Habitat and Refuge for native freshwater fish

The Drought Action Plan for South Australian MDB threatened freshwater fish populations was initiated by DENR, which aims to provide a framework for the management and conservation of populations of five threatened fish species, protected under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and the *Fisheries Management Act 2007*, during drought conditions.

As part of the Drought Action Plan, 28 significant wild sites for these species within the South Australian MDB were monitored from 2008-11 focussing on sites that are at greatest risk and hence in need of immediate management intervention. Additionally, from 2009-11, four newly established surrogate refuge sites were monitored. This monitoring aimed to investigate the status of these populations with respect to their suitability as source populations for later reintroductions upon the return of favourable environmental conditions at wild sites. Regular water quality, fish surveys and habitat surveys were conducted at all sites throughout the year.

The 2010-11 Drought Action Plan monitoring program has shown that improved inflows in 2010-11 has improved short to medium-term water security of most catchments and sites and has generally facilitated improvements in aquatic habitats. Nonetheless, positive responses were only detected from a select number of wild threatened fish populations. Some species (i.e. Murray Hardyhead) were sampled from fewer sites and in diminished abundance in 2010-11, relative to preceding years.

Captive bred populations are currently being held (i.e. aquaria/ponds) or maintained in surrogate refuges for four of the five threatened species. Monitoring in 2010-11 indicated that surrogate refuge populations for the Yarra Pygmy Perch and Murray Hardyhead are becoming well established in all surrogate refuges and the populations are favourable for the sourcing of individuals for re-introductions at wild sites.

The Southern Purple-Spotted Gudgeon population at Paiwalla Wetland has shown that it has a high chance of becoming firmly established at this surrogate refuge also.

A significant Murray Hardyhead population was discovered within the Gurra Gurra Lakes. This new population was found to be widespread throughout the system and in very good health. A translocation of captive Murray Hardyhead was undertaken into Causeway Lagoon, a DENR managed wetland.

2.1.12 Bioremediation Program Coorong Lower Lakes and Murray Mouth

A vegetation program has addressed multiple impacts of low water levels across the CLLMM region whilst supporting the restoration of ecological functions within the broader wetland region. Following improved Murray-Darling inflows to the Lower Lakes in 2010-11, the program has adapted to higher water levels by concentrating effort and investment in shore erosion zones.

The program has been successful as part of the South Australian Government's plans to address the legacy of severe drought and re-establish functioning ecosystem resilience.

Aerial seeding and sedge planting in 2010-11 has reduced shoreline erosion, provided habitat and food sources, encouraged the natural bioremediation of ASS and assisted in restoring wetland health.

An important component of the vegetation program has been the involvement of local community and Ngarrindjeri groups involved in planning, seed collecting, propagation, planting, monitoring and site maintenance.

A fencing program complements planting and seeding activities by protecting plants from grazing by livestock. The fencing program has already protected around 130 kilometres of Lake Alexandrina and Lake Albert shoreline, and protected native plants are naturally regenerating.

2.1.13 Coorong Connect Drainage System

DFW and DENR have worked together on a project to divert water that currently drains from the South East catchment to the ocean, into the south lagoon of the Coorong.

This action is one of three complementary actions designed to improve the health of the Coorong. Together with the maintenance of the Murray Mouth and pumping hypersaline water out of the Southern lagoon, the drainage project will help to reduce salinity in the South lagoon, slow or prevent a future increase in salinity levels and maintain connectivity between the Coorong and the sea.

The focus to date has been on investigations and assessments that are required in order for the project advisory group to make a recommendation to the Minister for Environment and Conservation on the preferred alignment for the project. A recommendation on the preferred alignment is expected in September 2011 and the project will then progress to the concept design stage.

2.2 WATER QUALITY

2.2.1 Coorong Lower Lakes and Murray Mouth Project

2.2.1.1 Lower Lakes and Tributaries Monitoring Program

Water quality monitoring was undertaken in the Lower Lakes in 2010-11 as part of a Lower Lakes and Tributaries Monitoring Program to support the Long Term Plan for the CLLMM region. Monitoring is used to provide early warning of changes to water quality and ecology, to guide adaptive management responses and better prepare for future periods of low inflows and rewetting events.

In 2010-11 water quality monitoring showed that higher water levels from Murray-Darling floodwaters diluted previously acidic hotspots so that pH levels are within Australia and New Zealand Environment and Conservation Council water quality guidelines (pH between 6.5 and 9). Despite this, some areas are still at risk around the lake margins and these continue to be monitored.

Salinity reduced to less than 700 EC in Lake Alexandrina as a result of floodwaters, however it still remains high in Lake Albert (close to 6,000 EC) due to difficulties in cycling water through the Narrung

Narrows into Lake Albert. Water levels and barrage releases are being managed to draw salinity out of Lake Albert.

A key water quality concern in 2010-11 was the large blackwater event from upstream that affected Lake Alexandrina from January 2011 to April 2011. Blackwater occurs naturally when organic material from floodplains flows back into the main river channel following major rainfalls, but this particular event was exacerbated by a long period of drought. Dissolved oxygen levels dropped to below 4 mg/L, with anything less than 2 mg/L posing a significant risk to fish and other organisms.

2.2.1.2 Coorong Water Quality Monitoring

Water quality testing in the Coorong in 2010-11 was undertaken through the Coorong Ambient Water Quality Monitoring Program and the Barrage Flows Ecological Monitoring Project. The former has been undertaken at eight sites in the Coorong North and South Lagoons since 1998 and the results of this monitoring are used to assess the ecological health of the system and inform management responses.

Monitoring through the Barrage Flows Ecological Monitoring Project was undertaken in 2010-11 by Adelaide University. Salinity monitoring showed considerably reduced salinity levels in the North Lagoon of the Coorong, Murray Mouth and Southern Ocean near shore environment subsequent to improved inflows and barrage releases. Continued high flows broke down the salinity stratification observed at the beginning of the study and dissolved oxygen concentrations increased after an initial drop. The inflows appeared to increase total nutrient concentrations reflecting riverine input into the Coorong. A gradual fall in pH during the study was most likely associated with inputs from the Lower Lakes, where lower pH water was observed during the high flow event.

2.2.1.3 Investigations into the Coorong South Lagoon Salinity Reduction Scheme and South East Flows Restoration projects

Ecological and hydrological monitoring was initiated in 2010-11 as part of investigations to support a decision regarding the potential implementation of the Coorong South Lagoon Salinity Reduction Scheme and South East Flows Restoration Project. These management actions form part of the CLLMM Recovery Project and, if implemented, will aim to 'reset' salinity levels in the Coorong South Lagoon to below threshold levels and provide ongoing benefits to the ecology of the site.

2.3 HUMAN DIMENSION

2.3.1 Friends of Riverland Parks

Friends of Riverland Parks, are actively involved in biodiversity related works in the Riverland. The group currently manages the bi-annual Regent Parrot surveys, and also run the annual Riverland and Mallee surveys within parks for the Malleefowl, Bush Stone-curlew and Brushtail Possum. The group undertakes annual biological surveys at two of DENR's near-river Mallee parks, gaining important information on species diversity at both areas. Riverland parks fox baiting (Murray River National Park, Cooltong and Pooginook Conservation Parks) is assisted by the Friends group. The Friends group also undertakes targeted weed control in specific River parks, and was instrumental in the development of the Ngak Indau, Craggs Hut and Mallee Pine drive trails.

2.3.2 Limestone Coast and Coorong Coastal Action Plan and Conservation Priority Study

The Limestone Coast and Coorong Coastal Action Plan is a coastal conservation assessment and coastal action plan for the South East coast between the Murray Mouth and the South Australian -

Victorian border. It was developed by DENR for the South East NRM Board with funding from the Commonwealth 'Caring for Country' initiative. The plan facilitates the conservation, protection and maintenance of the region's natural coastal resources and establishes conservation priorities for action in the region.

2.3.3 Kungun Ngarrindjeri Yunnan Agreement

Ngarrindjeri are the traditional owners of the region encompassing the lower Murray, and CLLMM. The State and the Ngarrindjeri Regional Authority signed off on the Kungun Ngarrindjeri Yunnan Agreement in June 2009. The Kungun Ngarrindjeri Yunnan Agreement establishes a consultation and negotiation framework to support full participation of Ngarrindjeri in the planning and future management arrangements for the region. The agreement also enables Ngarrindjeri cultural beliefs to become integral to all planning and management.

2.3.4 Coorong Lower Lakes Murray Mouth Ngarrindjeri Partnerships Project

The Ngarrindjeri Partnerships project is a key component of the CLLMM Long-Term Plan as it seeks to support capacity building within the Ngarrindjeri Regional Authority to enable full and informed participation in the CLLMM Program and a range of government-led environmental management projects that occur within the region.

The Ngarrindjeri Partnerships project supports aspirations documented in the *Ngarrindjeri Nation Sea Country Plan*, 2006. The capacity building within the Ngarrindjeri Regional Authority will support Ngarrindjeri in developing and implementing responsive and adaptable management arrangements in the CLLMM region that are culturally appropriate.

2.3.5 Maritime Heritage Program

This Program aims to identify, conserve, and protect the built and maritime heritage of South Australia, including maritime heritage along the River Murray. The program protects and conserves the heritage value of maritime heritage sites and enhances community awareness of historic sites. Shipwreck trails have been established along the River Murray for the community which explore the ships' graveyards and their abandoned vessels.

2.3.6 Meningie Lakefront Habitat Restoration

Lakefront restoration is being undertaken adjacent to the township of Meningie. This will assist management of ASS in the area, increase habitat for local species and provide improved amenity for the local community.

In conjunction with a community reference group, Ngarrindjeri community, the Coorong District Council and local school students, an Interpretive Trail has been developed and installed. Woodland plantings have been undertaken by Friends of Meningie volunteers and Meningie Area School students.

3 DEPARTMENT FOR WATER

The Department for Water (DFW) is the department responsible for administering the *River Murray Act 2003*, including coordinating referrals across other agencies and ensuring referral and compliance mechanisms are in place. It also administers and provides a South Australian position on a range of national initiatives including the National Water Initiative and is the lead agency for input into the Basin Plan, the MDB Agreement and programs being undertaken by the MDBA. DFW also shares responsibility for administration of the *Natural Resources Management Act 2004* with DENR.

3.1 RIVER HEALTH

3.1.1 South Australian Input into the Basin Plan

The MDBA is responsible for developing a Basin Plan for the integrated and sustainable management of water resources in the MDB. The Basin Plan is due to be finalised in 2012-13, containing an Environmental Watering Plan and a Water Quality and Salinity Management Plan, and will set new SDLs for water extractions from surface water and groundwater sources in the MDB. In 2010-11, DFW led the South Australian Government's response to the MDBA's *Guide to the proposed Basin Plan*, the first stage of a three-stage process in developing a Basin Plan. This response, together with ongoing engagement with the MDBA, will contribute to the development of the draft Basin Plan expected to be released in 2011-12.

DFW worked with the Goyder Institute for Water Research, South Australian scientists, policy makers, irrigators and the broader community to respond to the *Guide to the proposed Basin Plan*. The response was based on careful engagement and analysis; the response is available on the *Water for Good* website (www.waterforgood.sa.gov.au) and the Goyder report is available at <http://goyderinstitute.org>.

In 2010-11, the South Australian Government participated in the MDB Ministerial Council and the Basin Officials Committee to lead the State's participation in strategic MDB management, operations and policy matters. Additionally, the Minister for the River Murray appeared before Commonwealth parliamentary inquiries relating to the impacts of the Basin Plan on regional communities, the management of the MDB as it relates to rural affairs and transport, and the legal and constitutional validity of provisions of the *Water Act 2007* (Cth).

3.1.2 Coorong, Lower Lakes and Murray Mouth Icon Site Program

The CLLMM is one of six sites in the MDB identified as a Living Murray Icon Site by the MDBA. Through the TLM program a range of projects have been funded and implemented in the CLLMM. Key focus areas of the program in 2010-11 included:

- ecological monitoring;
- environmental water delivery;
- minor on-ground works in the fringing wetlands;
- the development of a CLLMM Icon Site Environmental Watering Plan; and
- community engagement (including with the Aboriginal community).

3.1.3 Coorong, Lower Lakes and Murray Mouth Icon Site Condition Monitoring Program

The CLLMM Living Murray Condition Monitoring Program, undertaken in collaboration with DENR, tracks progress against a series of 17 ecological targets set within the Icon Site Environmental Watering Plan. Monitoring focused on aquatic vegetation, threatened and commercial fish species, waterbirds, and invertebrates. The monitoring informs on-ground management including delivery of environmental flows and installation of infrastructure, such as flow control structures in wetlands. All information is collated into an annual report for the MDBA that documents the condition of the Icon Site.

3.1.4 Lower Lakes Wetland Reconnection

During the drought, many fringing wetlands of the Lower Lakes dried out. Compounding this, a large proportion became completely disconnected by sand drift into connecting inlet channels. DFW secured funding from the SA MDB NRM Board in 2010-11 to undertake a project to reconnect four Lower Lakes wetlands (Tolderol, Loveday Bay, Narrung and Teringie). This was initiated during September 2010 and coincided with a return of flows to the Lower Lakes.

3.1.5 Levee Bank Cracking Investigation Project

The Levee Bank Cracking Investigation project was undertaken due to the drying and cracking of levee banks along the River Murray caused by the drought.

A geotechnical engineering analysis was undertaken in 2010-11 to determine current condition of government and private owned levee banks, to assist in the development of remediation options, design options, time frames, costs, and a remediation plan.

3.2 ENVIRONMENTAL FLOWS

3.2.1 Assessing Risks for Water-Dependent Ecosystems

During 2010-11, DFW developed a state-wide tool to assess risks to water dependent ecosystems. Whilst the tool has a broader focus, it will be of significant benefit for the River Murray within South Australia. This tool records current information on the dependence of particular ecosystems on groundwater resources, surface water resources or a combination of both. It also gives an indication of which ecosystems within the state are likely to be at risk from water resource development and identifies priority regions where South Australia could improve its current knowledge and understanding.

The tool has been applied to a number of key initiatives and core functions within DFW, including statutory assessments required through implementation of plans on which DFW is required to make comment (such as WAPs) and an assessment of risks to water dependent ecosystems under a number of future climate scenarios. Further development of the tool will occur during 2011-12, with the aim to improve its ability to identify risks at a specific or local scale.

3.2.2 Restoring Environmental Flows and Connectivity

Delivery of environmental water plays a vital role in supporting the health of the River Murray and its floodplains and wetlands. Over the past five years environmental watering has ensured the maintenance of drought refuges, prevented the loss of species and habitat, and enabled re-colonisation and re-establishment of species and ecosystem functions when higher flows returned.

Flows in South Australia during 2010-11, reached levels not seen since the early 1990's (above 90,000 megalitres (ML) per day at the border), resulting in the natural reconnection of the floodplain and wetlands to the main river channel. With the return of high flows the importance of the previous environmental watering effort to provide drought refuge and preserve species and habitat, was reinforced.

3.2.3 Environmental Water Requirements of the Ecological Assets of the River Murray in South Australia

Work continued in 2010-11 to determine the environmental water requirements for River Murray ecosystems in South Australia, including a comprehensive, evidence-based assessment of the water needs of the River Murray ecosystems. The results of this work are informing South Australia's input to the Basin Plan development process and the review of the River Murray WAP.

3.2.4 Weir Pool Manipulation Program

Locks and weirs can be used to raise and lower water levels in a weir pool to mimic more natural water level variability, thereby improving aspects of the ecology to deliver benefits to the river channel, ephemeral wetlands, anabranch creeks and low lying parts of the floodplain.

The objectives of the weir manipulation project are to:

- Increase in-channel water level variability to improve diversity of native riparian vegetation.
- Create temporary seasonal habitats for aquatic flora/fauna, and increase aquatic productivity.
- Improve the watering regime of low level wetlands and floodplains, including nationally and internationally significant sites.
- Provide additional feeding, breeding and recruitment opportunities for flood dependent plant and animal species.
- Improve the connectivity of the river and its floodplain and wetlands and increase the transfer and cycling of energy and nutrients.

During 2010-11 a preliminary investigation into the salinity impacts of weir raising was finalised and significant work was undertaken to incorporate ongoing development of the program as a key component of the *Murray Futures* Riverine Recovery Project. Planning was also commenced to incorporate weir pool manipulation into the delivery of environmental water during 2011-12.

3.2.5 Environmental Watering

DFW successfully negotiated the allocation and delivery of 305.5 GL of environmental water to priority sites in 2010-11. An additional 1.9 GL of water carried over from 2009-10 was also delivered to South Australian sites.

The majority of the water (305.4 GL) was delivered to the CLLMM icon site where it contributed to managing lake water levels and providing for water releases through the barrages. This enhanced the natural unregulated flow event experienced during 2010-11. By increasing the volumes delivered through the barrages from Lake Alexandrina to the Murray Mouth/Coorong estuary, there were improvements in system connectivity, the estuarine area was increased and salinity levels in the Coorong decreased. It also contributed to continued barrage fishway releases through winter 2011, a critical time for adult female Congolli to move from Lake Alexandrina to the estuary and ocean to breed.

The remaining water was delivered to eight wetlands: five on the Chowilla floodplain, two on the Pike Floodplain and one on the Katarapko Floodplain.

There was a significant improvement in water resource conditions during 2010-11 and by September 2010 South Australia was receiving unregulated flows. These unregulated flows were ongoing at the end of June 2011. The individual wetlands and drought refuges previously watered through scheduled environmental watering were inundated by the natural high flow event, providing an important platform for broader system recovery.

3.2.6 Development of Improved Environmental Water Policy

An Environmental Water Policy Reform Project was established in 2010-11 to assist in the development of improved environmental water policy for the South Australian River Murray through the review of existing policies and plans, targeted consultation, and the development of new policy directions. The progress to date includes the development of a draft document critiquing existing policies and a review of environmental water policy and management in other jurisdictions. An environmental water policy workshop was held as part of the consultation process. Environmental water policy review and amendment will enable the provision of greater protection through security and flexibility in application of environmental water.

3.2.7 Chowilla Floodplain Icon Site

The Chowilla floodplain is one of six sites in the MDB identified as a Living Murray Icon Site by the MDBA and is also part of the Riverland Ramsar Wetland. Through the TLM program a range of investigations and works have been funded and implemented at Chowilla.

The Chowilla Environmental Water Management Plan was reviewed and updated during 2010-11. The plan identifies and discusses the works and measures required at the Chowilla Icon Site to achieve the following objectives:

- maintaining high value wetlands;
- maintaining the current area of river red gum; and
- maintaining at least 20 percent of the original area of black box vegetation.

3.2.8 Chowilla Creek Environmental Regulator

Construction work at the Chowilla Creek environmental regulator (and ancillary structures) took place until October 2010, when work was suspended due to high river flows. As of 30 June 2011, work was yet to recommence. Once work recommences, a further 18 months of construction activity remains at Chowilla to complete the regulator and ancillary works; whilst six months is required to complete the Pipeclay and Slaney works. When complete, the operation of these structures will enable inundation of up to one third of the Chowilla floodplain under low flow conditions, helping to achieve ecological objectives and preserve the values of the site.

In addition to the construction work a range of other activities and investigation are in progress at Chowilla. Numerous ecological investigations have been undertaken to inform the operation of the Chowilla Creek regulator and to ensure comprehensive monitoring and risk management plans are developed. Consultation and communication activities have also continued throughout 2010-11, with regular tours and media presentations occurring. These activities are fundamental to delivering the Chowilla Icon Site objectives.

3.2.9 Pike Floodplain

The Pike floodplain region has been identified as one of three priority floodplain regions for rehabilitation within the MDB in South Australia (the other two sites are Chowilla and Katarapko). The Pike Floodplain has been identified as a High Conservation Value Aquatic Ecosystem on a national scale due to its unique ecological and hydrological characteristics and the presence species of national significance and State Conservation significance.

In 2010-11, funding for the construction of a new network of environmental regulators, fishways, ancillary by-pass regulators, blocking banks and other works has been secured. This achievement was significant for the community, with local groups involved in developing the funding submissions. Caring for Our Country funding will be used to undertake an ecological risk assessment and develop a soil management and rehabilitation strategy. Funding from the *Murray Futures* Riverine Recovery Project (RRP) will be used to progress environmental works in the Pike anabranch including the replacement of the existing inlet structures and the provision of fish passage at key sites.

3.2.10 Riverine Recovery Project

The RRP is a component of *Murray Futures*, funded through the Commonwealth Government's WFTF program, and aims to achieve measurable long-term improvements in the health of the riverine environment between Wellington and the South Australian border.

The project will also enable more effective use of environmental water and help to secure regional communities through an investment of up to \$98.874 million over the next five years.

3.2.10.1 Early On-ground works package

Funding was announced in March 2011 for the \$9.2 million RRP's Early On-ground works package. South Australia will contribute 10 percent of the overall cost.

The proposed on-ground works are:

- Pike Floodplain - Establish and upgrade critical infrastructure to improve environmental flows, fish passage and habitat within the Pike floodplain.
- Katfish Reach - Establish and upgrade critical infrastructure to establish habitat for the vulnerable Murray Hardyhead, improve environmental flows and establish fish passage connectivity within the Katfish Reach area.
- Yatco Lagoon - Enable the implementation of the community-developed wetland management plan without disrupting local irrigators and domestic water users.

The RRP Early On-ground Works were approved by the Public Works Committee on 6 April 2011. The project is scheduled to be completed by March 2012. DFW has, and is continuing to, progress negotiations with relevant landholders, State Government agencies, local councils and other key stakeholders.

3.2.10.2 World Environment Day Package

Further funding of \$86.7 million was announced in June 2011 for the RRP.

The Australian Government has committed up to \$78 million to the project and the South Australian Government has committed up to a further \$8.7 million.

The Project aims to improve ecological outcomes for floodplains and wetlands, use environmental water more effectively, provide social benefits, and deliver up to 15 GL of water savings to the Commonwealth to help protect or restore environmental assets in the MDB.

Areas to benefit under the RRP include:

- Floodplains: Major works to restore the health of the Pike and Katfish Reach floodplains. This will enhance environmental flows, encourage fish passage and habitat and enable connectivity of the floodplain and the river channel;
- Wetlands: New infrastructure and investigation into ways to improve wetland health by re-introducing more natural wetting and drying cycles to improve ecosystem health;

- Enhanced River Operations: Investigating opportunities for enhanced river operations through flow and weir pool manipulation to ensure optimal use of available water resources; and
- Information Management to support decision making: Monitoring various indicators of wetlands and floodplains including wildlife, vegetation and water quality to better inform the management of environmental water, and to maximise ecological and biological outcomes.

The project is also linked to the *Murray Futures* Long-Term Plan for the CLLMM, extending efforts to build resilience and address river health across the whole of the River Murray system in South Australia.

3.2.11 Murray Mouth Sand Pumping Project

Since October 2002, dredging work has been undertaken at the Murray Mouth 24 hours a day 7 days a week under the Murray Mouth Sand Pumping Project to maintain connectivity between the ocean and the Coorong.

In October 2010, dredging was reduced to one 12 hour shift a day due to the significant barrage releases resulting from the high flow event. In December 2010 the decision was made to cease dredging of the Murray Mouth because reasonable barrage releases were expected well into 2011.

Cessation of dredging provided an opportunity to develop a monitoring framework and plan the necessary contingency activities to re-establish dredging, if required. A Murray Mouth Monitoring Plan and Murray Mouth Contingency Plan have been developed to inform future decisions on dredging. The Monitoring Plan outlines the preferred methods for sampling physical data used to monitor the Murray Mouth and the Goolwa and Tauwichee channels. The Monitoring Plan will inform when the Contingency Plan should be activated to reinstate dredging activities at the Murray Mouth, if required in the future.

3.3 WATER QUALITY

3.3.1 Salinity Management Program

South Australia is committed to managing salinity under the MDBA's Basin Salinity Management Strategy (BSMS). A Salinity Management Program Plan was developed in the first quarter of the 2010-11 financial year, to set directions for the coming three years. Good progress has been made against the Program milestones in the reporting period.

Key achievements to manage salinity in 2010-11 included:

- South Australia's balance on the BSMS Salinity Registers remains positive, indicating that actions that increase river salinity have been offset by actions that reduce river salinity.
- Active engagement with the MDBA to develop policy guidelines for accounting for salinity impacts of environmental watering.
- Groundwater modelling to support annual update of entries on the BSMS Salinity Registers, including initiation of peer review of a number of South Australia's models with MDBA. This will enable accreditation of the models and further update of BSMS Salinity Registers entries by November 2011.
- Funding was secured from the MDBA to enable additional monitoring of the recession of the recent high flow event. This information will improve insight into the salinity risk from various floodplains in the South Australian Riverland and enable development of management strategies.

- Completion of the 'How efficient are we?' report documenting the historical improvement of water use efficiency in the South Australian MDB.
- Completion of initial salinity assessment of proposed operation of the Chowilla environmental regulator (under construction). Further work is occurring to update the groundwater model to inform a more accurate salinity assessment.
- Work commenced in 2010-11 for further progress in 2011-12, includes:
- Provision of further advice and input on the Basin Plan's water quality and salinity management plan.
- Revision of policy documents for the South Australian River Murray Salinity Zoning Policy to ensure the policy is consistent with the unbundled water rights system.
- An Annual Water Use report on River Murray irrigators to understand current patterns in irrigation water use and hence future salinity impacts.
- Development of a code of practice for irrigated agriculture aimed at improving irrigation efficiencies with the benefit of minimising salinity impacts of irrigation.

3.3.2 Salt Interception Schemes

Infrastructure such as salt interception schemes (SIS) have proven valuable in reducing saline groundwater inflow to the River Murray, thereby playing a vital role in reducing in-river salinity. SIS have been constructed along reaches of the River Murray in areas of high irrigation development to reduce the inflow of saline groundwater into the River Murray.

Within South Australia there are seven operating SIS that intercepted 190,759 tonnes of salt during 2009-10, preventing it from entering the River Murray. The Loxton SIS was commissioned in September 2010 and construction of Stage One of the Pike River SIS was completed in June 2011. The Murtho SIS is under construction and is expected to be completed by February 2012. The scheme has been designed to intercept 99.4 tonnes of salt per day with a 20.2 EC benefit at Morgan over a 30 year average.

3.3.3 Salinity Modelling and Investigations

Groundwater modelling of drought scenarios at Loxton and Bookpurnong to investigate the relative salt loads to the river from reduced irrigation, SIS and increased evapo-transpiration was completed in 2010-11. This work has been documented in draft form and will be published following review. Resources have been diverted to flood preparedness for the last quarter of 2010-11. This work will lead to an increase in modelling knowledge and capacity of the surface water team.

3.3.4 Modelling for Proposed Chowilla Regulator

The DFW secured funding from the MDBA to upgrade the Chowilla 2004 model to assess the potential salinity impacts associated with the operation of the Chowilla Regulator on the Chowilla Floodplain. The Chowilla groundwater model upgrade will improve simulation of flood events (nature and artificial) and calculation of flood induced salt load.

Model upgrade and revised salinity impact assessment will be completed by late 2011 using funding provided by the MDBA. Following the upgrade, MDBA approval for operation of the Chowilla environmental regulator will be sought.

3.3.5 Development of MODFLOW Groundwater Models

A series of MODFLOW groundwater flow models have been developed to enable South Australia to meet its obligations under Schedule B of the BSMS. With the completion of the Morgan to Wellington

model in 2009-10, these models now cover the entire River valley in South Australia, from the border to Wellington.

A key component of groundwater model development is the accreditation of each model and their use in relation to each of the modelling scenarios. Accreditation involves a process of independent and peer review of each model and ensures the models are sufficiently robust to be used as the basis for BSMS Salinity Registers entries. Groundwater modelling in turn supports salinity management decisions and planning, design and implementation of SIS infrastructures.

The Loxton-Bookpurnong groundwater model was updated to include new data and a better understanding of the system was obtained from investigations and the SIS constructions.

3.3.6 Goolwa channel water level management project

The Goolwa Channel Water Level Management Project was implemented in 2009 as an emergency response to emergent ASS in the lower reaches of Currency Creek, Finniss River and Goolwa Channel.

In order to raise and maintain water levels above the critical acidification threshold a number of key works and measures were required, including the construction of temporary flow regulators at Clayton and Currency Creek and the pumping of water from Lake Alexandrina into a newly created Goolwa Channel pool.

In late August/early September 2010 as flow into South Australia and subsequently the Lower Lakes improved considerably it became apparent that the Clayton Regulator would need to be removed. In mid-September 2010, continuing improvements in water resource availability led to the activation of triggers for the partial removal of the Clayton Regulator.

On completion of the partial removal, work commenced on planning and the development of concept designs for the full removal of the Clayton Regulator.

3.3.7 Drainage Disposal Basins

DFW operates and maintains seventeen drainage disposal basins in the Riverland area. Ongoing operation and maintenance of each disposal basin has been undertaken and tasks such as rabbit and weed control will continue.

Infrastructure plans were developed for the Disher Creek Disposal Basin in order to provide a sustainable habitat for the endangered fish species, Murray Hardyhead. Repair work began on structures at the Loveday Basin.

3.3.8 Noora Disposal Basin

Intercepted saline groundwater from SIS between Loxton and the South Australian border is pumped and allowed to evaporate at the Noora Disposal Basin.

Work was completed to ensure the long term sustainability of the Noora Disposal Basin as the disposal location for intercepted saline groundwater from the Loxton, Bookpurnong, Murtho and Pike River SIS.

This involved the purchase of additional 546 hectares of land, increasing the size of the Noora Disposal Basin ensuring it has the capacity of the volume of water that is expected to be disposed over the next 100 years. Work to ensure that the Noora Disposal Basin is managed in a sustainable manner included a rabbit management program, revegetation, and removal of rubbish and pest plants.

Revegetation Plans for a 'buffer zone' and internal areas of the Basin have been completed and will be used in revegetation programs that commenced in June 2011. A risk assessment has been

completed which focused on the existing risk assessment and the analysis of additional operational risks associated with access and use of the Noora Basin.

3.3.9 Lake Albert Water Level Management Project

The Narrung Bund was constructed in 2008 as part of the Lake Albert Water Level Management Project to allow the water level in Lake Albert to be managed independently from Lake Alexandrina through the pumping of water from Lake Alexandrina to prevent potential future large-scale acidification of Lake Albert.

As a result of increased River Murray flow into South Australia in late August/early September 2010, water levels in the Lower Lakes rose significantly over a short period and the Narrung Bund was submerged. This jeopardized the stability and integrity of the bund and it was decided to breach the bund, allowing water to flow through the Narrung Narrows into Lake Albert.

In mid-September 2010, continuing improvements in water resource availability activated the triggers to fully remove the Narrung Bund. Work commenced in March 2011 to fully remove the Narrung Bund and the structure was fully removed in July 2011.

3.3.10 River Vessel Waste Disposal Stations

There are 13 River Vessel Waste Disposal Stations, sited along the River Murray in South Australia. These stations accept black water and solid waste free of charge. Recent legislative changes require the stations to also accept grey water.

A station upgrade program continued during 2010-11 to meet increased houseboat traffic, accept grey water and to modernise ageing facilities nearing the end of their useful life.

Refurbishment of the Blanchetown station was completed in September 2010 and consisted of modified mooring piles, a floating pontoon, an aluminium walkway, new concrete on the land based area, a high flow pump and flushing hose and ancillary equipment such as fencing and signage.

The Goolwa Waste Disposal facility was integrated with Alexandrina Council's short term mooring facility just south of Signal Point as part of a jointly funded and managed undertaking with the Alexandrina Council and the South Australian Boating Facility Advisory Committee. Work was completed in February 2011 and consisted of mooring piles, a floating pontoon and walkway, a new pump and ancillary equipment such as fencing and signage.

The Walker Flat Waste Disposal Station remained out of service during 2010-11 due to a high risk of river bank collapse. Remedial investigations to determine whether the station can be reopened are continuing.

3.3.11 Stormwater Strategy

On 5 July 2011, the South Australian Government released the Stormwater Strategy, a high-level 'road map' for the future of stormwater management in South Australia. The Stormwater Strategy was developed by the Stormwater Taskforce, which was established in September 2010. This will guide future infrastructure investment and policy requirements across Adelaide, and assist transition to a water sensitive city.

The Stormwater Strategy includes nine actions to improve stormwater management in Adelaide in a way that integrates it with other urban water resources. This includes introducing interim targets for water sensitive urban design, completing further studies to improve the knowledge and management of public health risks relating to the recycling of stormwater, and ensuring a strong scientific basis for our future approach to urban water management.

This Strategy will guide the work of the State Government in stormwater management for the next five years. Following its five-year term, the Stormwater Strategy will be reviewed, evaluated and updated as required in partnership with the organisations responsible for contributing to its implementation.

3.4 HUMAN DIMENSION

3.4.1 Icon Site Indigenous Facilitators

Indigenous facilitators are employed to enable a link between the government and community for the implementation of the TLM Icon Site program (Chowilla and CLLMM). Indigenous facilitators assist with consultation, site management, guidance on heritage processes for on-ground works, information exchange between government and the Aboriginal community, and the promotion of the TLM Icon Site program. In 2010-11, a report on the importance of native plants and animals of Chowilla to indigenous communities was prepared. Local indigenous groups provided assistance to the CLLMM Icon Site condition monitoring program.

3.4.2 Managing the Water Resource Impacts of Plantation Forests

The *Natural Resources Management (Commercial Forests) Amendment Bill 2010* was introduced into Parliament on 24 November 2010 by the Minister for Environment and Conservation, with debate deferred until later in 2011.

The Bill includes two legislative tools to manage forest water impacts (forest water licences and an expanded forest permit system) in the *Natural Resources Management Act 2004*. The proposed legislative tools align with the Statewide policy framework, *Managing the water resource impacts of plantation forests*, released by the State Government in June 2009, to be fully implemented. This will be relevant for plantation forest development in the River Murray Tributaries Protection Area.

3.4.3 Riverbank Collapse

Riverbank Collapse in the Lower Murray (between Blanchetown and Wellington) became an issue during the recent unprecedented period of low River Murray flow, during which water levels in this river reach dropped by up to 1.5 metres.

To date, these low flow conditions have culminated in 158 confirmed incidents associated with riverbank collapse, including:

- 72 riverbank cracks that present risk of collapse;
- 51 leaning trees at risk of de-stabilizing riverbanks; and
- 35 riverbank collapses.

In September 2009, riverbank collapse was declared a State Hazard for South Australia by the State Emergency Management Committee and the management response is being directed by the Riverbank Collapse Hazard Plan.

During 2010–11, DFW conducted a re-evaluation of its work activities to manage river bank collapse, including numerous investigations, risk assessments and ongoing monitoring efforts at affected sites, in the context of widespread changes to River Murray conditions.

The review process into riverbank collapse involved the creation of an international expert panel which met in October 2010 and February 2011. The panel advised that, while the restoration of near-

normal water levels was beneficial for riverbank stability, the damage done during the many years of drought and low water levels would continue indefinitely.

Much of the damage is a one-way process of compaction, shrinkage, cracking and slumping. These sites will not naturally repair, so risk assessment studies take these factors into consideration. Mitigation activities have focused on the prevention of accidents, injuries or losses using site-closure, fencing and signage techniques.

Several sites remained closed, including parts of Caloote Landing, Riverfront Road at Murray Bridge and East Front Road at Mannum, because of risks to the public. East Front Road continues to deteriorate and collapses along this road supported the decision to close it at Easter 2010. Some sites were re-opened this year following re-appraisal of the risks, notably Ngaut Ngaut Conservation Park and Dickson Reserve at Tailem Bend.

During 2011–12 the program will continue to co-ordinate monitoring and mitigation at a variety of sites.

3.4.4 Flood preparedness work

The interstate floods and events within South Australia have resulted in a state-wide review of flood management.

Late in 2010–11 DFW formed a flood inquiries taskforce, which will review and report to the Commonwealth Government on the Victorian and Queensland flood inquiries. These inquiries are expected to lead to reforms of flood management in South Australia, in a manner similar to the outcomes of the Victorian Bushfire Royal Commission.

DFW is also leading a review into River Murray preparedness in consultation with State Government agencies and River Murray councils, to ensure that lessons from the recent high flow event are incorporated into the management of future high flows and floods. A library of inundation mapping up to 1956 flood levels is also being prepared to aid future flood planning efforts. This work will be completed in September 2011.

3.4.5 Loveday Basin Management Project

The Loveday Basin Management Project was required to develop a long term management strategy to manage seasonal odour emanating from the Loveday Basin through the warmer (summer) months.

Investigations have been undertaken to understand and identify the causes of the odour for consideration in any proposed management strategy. The investigations have concluded that the most effective management technique is the inundation of the sediments. A management strategy is being developed to allow the Loveday Basin to be managed this way over the warmer months.

3.4.6 River Murray Operating Strategy

In 2010–11 the inter-agency South Australian River Murray Operations Coordinating Committee and South Australian River Murray Operations Working Group were established to develop the first draft of South Australia's River Murray Operating Strategy. Developed in early 2011, the Strategy considers the key strategic environmental, economic and social outcomes for the River Murray in South Australia and identifies the strategic river operations needed to deliver these outcomes.

The Coordinating Committee and Working Group also developed the first iteration of South Australia's River Murray Annual Operating Plan for 2011–12. This will be updated regularly in response to water management activities and to account for changing resource conditions and environmental and consumptive demands. The plan, guided by the strategy, seeks to optimise the delivery of water resources to, and within, South Australia to:

- accommodate the needs of all water users (within system constraints);
- ensure that the requirements are fulfilled under the Murray-Darling Basin Agreement 2008 and the associated schedules, and the MDBA's River Murray System Annual Operating Plan; and
- provide a documented and transparent rationale for South Australia's River Murray operational decisions.

3.4.7 River Murray Drought Water Allocation Framework 2010-11

The 2010-11 River Murray Drought Water Allocation Decision Framework (RMDWADF) was developed to share and allocate the limited water resources made available to South Australia through the water sharing arrangements set out in the MDB Agreement.

The RMDWADF has enabled allocation decisions to be made in a clear and transparent manner, taking into account the longer-term needs that underpin sustainable communities, industry and a healthy river system in South Australia. During development of the RMDWADF, the potential timing of allocations to South Australia and the probability of improvement in resources over the water year were considered. Complex decisions and associated trade-offs between different uses, such as environmental uses, irrigation, critical human water needs (CHWN), tourism and recreation, was also required.

The available water was shared between:

- accumulating a reserve for CHWN in the following year;
- assigning water for the environment; and
- allocating water for consumptive use (eg irrigation, recreation).

Accumulation of water for CHWN was the State's highest priority, consistent with the *Water Act 2007* (Cth) and requirements proposed for the Basin Plan. The CHWN reserve for 2011-12 was accumulated early in 2010-11.

An opening allocation of 21% was made on 1 July 2010 to ensure access for stock, domestic and industrial purposes that are provided through irrigation infrastructure. Access to 100% of private carryover was provided to supplement allocations and to provide additional water for trade.

Environmental water requirements were given a higher priority than in previous years and were also specifically allocated from the commencement of the water year. This would have ensured that water levels in the Lower Lakes and the river channel below Lock 1 were maintained above critical trigger levels if the high flow event had not eventuated.

Following significantly improved flow in the River Murray system in September 2010, South Australia was allocated its full 1,850 GL entitlement under the MDB Agreement. Water allocations for general purposes increased to 67% of licensed water access entitlement from 1 October 2010. This 67% allocation, when combined with the 228 GL of carryover allocated, resulted in the allocation limit of 650 GL being reached and no further allocations were made.

3.4.8 Water Carryover from 2009-10 to 2010-11

The capacity to carryover unused River Murray water from one year to the next was facilitated by an annual drought related policy introduced during 2006-07 for the MDB in response to drought conditions and projected continuation of low inflows.

During the drought period, carrying over unused water from one year to the next was a useful mechanism for licensed water users to supplement heavily restricted water allocations and more effectively manage inter-seasonal risk. The total volume carried over from 2009-10 to 2010-11 was

228 GL, which was more than twice the volume carried over from 2008-09 to 2009-10. This volume of carryover meant that only 67% could be allocated against licensed water access entitlements.

The Minister for Environment and Conservation announced in December 2010 that, in light of the changed water resource conditions and the long-term water storage arrangements negotiated under the MDB Agreement, the annual drought carryover policy would end on 30 June 2011.

DFW has begun consulting with industry and stakeholder groups over a new long-term carryover system. This new carryover system will be established within the appropriate legislative, administrative and operational framework and will be underpinned by robust and transparent long-term storage rights. This will provide the opportunity for South Australian River Murray water users to store water in upstream storages, as occurs in New South Wales and Victoria.

3.4.9 Lower Lakes and River Murray Modelling and Monitoring

Modelling was an important tool for managing the River Murray and the Lower Lakes through the recent drought, including 2010-11. It was used to develop management options and strategies to manage the changing water availability conditions. Modelling enabled likely outcomes from different management strategies to be examined before they were put into practice. Modelled information was also used to determine when conditions were likely to be suitable or become unsuitable for certain activities.

For example, modelling water levels and salinities downstream of Lock 1 was regularly undertaken using the latest information on future river flow. This provided a projection into the future of how lake levels and salinities were likely to change over time. This modelling enabled both the Government and the community to plan ahead for changing situations.

A significant amount of modelling for environmental water requirements for the Lower Lakes has also been undertaken as part of the overall development of environmental water requirements for the CLLMM Ramsar site. This work has also been used to underpin South Australia's response to the *Guide to the proposed Basin Plan*.

3.4.10 River Murray Water Licensing

Low inflow conditions across the basin at the start of 2010-211 continued to severely impact on the share of water resources available to South Australian water users. Whilst inflows into South Australian improved as the 2010-2011 year progressed a major priority for 2010-11 was the continued administration of restricted allocations which included compliance and monitoring of water use.

In support of these programs, quarterly consumption advice, drought 'Top Up' water trading and administration of carryover allocations continued in 2010-11 to meet the increasing demands from managers and users of the River Murray.

3.4.11 Angas Bremer/Mallee/Marne Water Licensing

Water Allocation Plans for the Angas Bremer and Mallee Prescribed Wells Areas and the Marne-Saunders Prescribed Water Resources Area continued to be implemented in 2010-11. The primary focus for 2009-10 was on the provision of efficient water licensing and trade administration, water use monitoring and reporting, and the provision of support to the SA MDB NRM Board in their review of these plans.

The draft EMLR WAP has been prepared and consultation occurred late in 2010-11. As the Angas Bremer Prescribed Wells Area falls within the EMLR Prescribed Water Resource Area, the EMLR WAP has been prepared to cover both areas and once adopted, will replace the current Plan for the Angas Bremer Prescribed Wells Area.

3.4.12 Unbundling of water rights

Following completion of unbundling for the River Murray Prescribed Watercourse in 2009, South Australia is continuing its program to unbundle water rights across South Australia and remove barriers to trading water entitlements.

South Australia has specific commitments to implement unbundling within the following areas by the end of 2014:

- Peak, Roby and Sherlock Prescribed Wells Area;
- Mallee Prescribed Wells Area; and
- Noora Prescribed Wells Area.

During 2010-11, DFW has published a schedule for unbundling on the *Water for Good* Website (<http://www.waterforgood.sa.gov.au>). South Australia is also reviewing the feasibility of unbundling water in its unregulated surface water and groundwater systems. Where demonstrated to be feasible and of overall net-benefit, further unbundling will be implemented in consultation with stakeholders on a case by case basis.

The *Natural Resources Management (General) Variation Regulations 2011* came into effect on 1 July 2011 to support transitional arrangements to stage the process of unbundling water rights in South Australia. This will allow existing and new licences and WAPs to remain bundled until they are unbundled as part of a WAP amendment process under the *Natural Resources Management Act 2004*.

4 PRIMARY INDUSTRIES AND RESOURCES SOUTH AUSTRALIA

In relation to the *River Murray Act 2003*, Primary Industries and Resources South Australia (PIRSA) through the South Australian Research and Development Institute (SARDI) undertakes significant research regarding the ecology of the river, floodplain and wetlands. SARDI also assists the irrigation industry through research and extension including irrigation modernisation and irrigation efficiency programs. It is also responsible for fisheries management and has a major biosecurity program.

4.1 RIVER HEALTH

A major focus on research during 2010-11 was on the CLLMM region, including assessing the impact of the drought.

4.1.1 Flow and Fish Ecology in the Coorong

This study provides the first comprehensive and quantitative assessment of fish assemblages of the Murray Mouth and Coorong region under prolonged drought conditions. The study examined reproductive biology of fish species in the region, assessed the relationships between flows and fisheries production, and developed salinity tolerance thresholds of juveniles for key Coorong species. The results of the study emphasised that the maintenance of a salinity gradient and connectivity between the freshwater, Coorong and marine systems are paramount to the ecological health of the Coorong fish community and the fishery.

4.1.2 Fishery Stock Assessment Report

This assessment examined the impacts of river regulation, drought and high fishing pressure in the lower Murray River system. Results indicate that the structure of fish assemblages in the lower River Murray system has changed, species diversity of fishes has declined, and the population age structures of large-bodied, late-maturing, native fish have been truncated while species with rapid growth and early maturation increasingly dominated catches. The study recommends the preservation of remnant populations of threatened fish species to support their rehabilitation, along with development of indicators to monitor changes in fish assemblages and populations in changing environments.

4.1.3 Congolli Movement Study

This project (funded by the SA MDB NRM Board) aimed to investigate the movement of Congolli in the Lower Lakes and Coorong in 2010/11 and follows work completed in 2009.

Between March and August 2010, approximately 40 adult female Congolli were captured in the Lower Lakes and Coorong and tagged with acoustic transmitters to record movement. The study noted the exploratory movements of these fish at certain times of the year including movements downstream, in the Goolwa Channel and through the Goolwa Barrage. The results of this project can be used to identify the life cycle and breeding habits of Congolli, which include movements between freshwater and estuarine water environments.

4.1.4 Coorong fish condition monitoring and barrage release intervention monitoring

Fish condition has been monitored by SARDI since 2008-09 in the Murray Estuary and Coorong. This work is to assess the population status of Black bream, Greenback flounder and Small-mouthed Hardyhead, with reference to ecological targets in the CLLMM Icon Site Condition Monitoring Plan and the Environmental Management Plan. More specifically, spawning and recruitment of these species have been assessed, and information on biological performance indicators reported and compared with previous years or upon an 'intervention' as outlined in the CLLMM Icon Site Environmental Management Plan. The project is funded by the TLM Program through DFW.

With the current barrage release, intervention monitoring has been undertaken by SARDI in 2010/11 to assess the changes in fish assemblage structure, distribution and recruitment in the Murray Estuary and Coorong. A range of hypotheses will be tested regarding fish response to the flow event. The project is funded by DENR through *Murray Futures: CLLMM Program*.

4.1.5 Coorong, Lower Lakes and Murray Mouth – Lower Lakes Small-Bodied Threatened Fish Condition Monitoring

Assessments of Murray Hardyhead, southern pygmy perch and Yarra pygmy perch populations and recruitment continued in 2010-11 through TLM CLLMM Icon Site condition monitoring program. The monitoring is undertaken by the University of Adelaide, and managed by DFW. Sites and data are shared with the DENR Drought Action Plan monitoring program, to ensure a greater coverage of the Lower Lakes can be achieved.

4.1.6 Barrage Fish way Monitoring Program

Managed by DFW and implemented by SARDI Aquatic Sciences, this targeted monitoring program continued to collect and record important information on fish passage through the barrage fishways. A key finding was that, as flows returned post drought and the barrages were opened from September 2010, fish were detected breeding, particularly diadromous species such as the iconic Congolli and common Galaxias. The monitoring took place at fishways located at Goolwa and Tauwichee barrages. Additional monitoring was also undertaken for the first time in 2010-11 at the Hunters Creek fishway on Hindmarsh Island. The project was funded by the MDBA's Living Murray Intervention Monitoring Fund and the State Drought Fund.

4.1.7 Fish ecology and aquatic habitat in the Pike Anabranh system

This collaborative project between SARDI and the Murray-Darling Freshwater Research Centre, which assessed fish populations and aquatic habitats in the Pike Anabranh system, was completed in 2010-11.

Generally, riparian habitat within the Pike Anabranh system was in poor condition while the in-stream habitat was relatively good and dominated by native species. Generally, the system appears to provide conditions that promote the increased presence of non-native fish species. However, managing the floodplain by increasing habitat diversity, i.e. through increasing connectivity and flowing habitats, may facilitate increased fish species diversity and abundance within the Pike Anabranh system.

4.1.8 Murray Cod closure 2010

After extensive public consultation with the South Australian public on Murray Cod, PIRSA announced changes to management arrangements for Murray Cod for 2011-12. It is open to catch and release from 1 January to July 31 2011, with a seasonal closure and a trolling ban from 1 August to 31 December 2011. Chowilla is closed to fishing for Murray Cod between 2011-12.

4.1.9 Environmental Risk Assessment Feasibility Study

PIRSA is currently in the process of undertaking a review of the South Australian Policy on stock enhancement, specifically for Murray Cod. As a first step, a feasibility study is being undertaken by SARDI and the University of Adelaide through assessing environmental risks and benefits with regard to stocking Murray Cod into the South Australian waters of the River Murray and/or impoundments.

4.2 WATER QUALITY

SARDI, in its research capability, continued work on a number of research projects relating to monitoring vegetation condition in wetland and floodplain areas including the following projects:

- Chowilla Floodplain Vegetation Condition Monitoring;
- Chowilla Environmental Watering Understorey Vegetation Monitoring;
- Lower Lakes Vegetation Condition Monitoring; and
- Aquatic and littoral vegetation monitoring of Goolwa Channel 2009-11.

Many of these are ongoing monitoring programs whereby data has been collected to determine trends and opportunities to improve environmental outcomes.

5 SA WATER

In relation to the *River Murray Act 2003*, SA Water under direction of the *Waterworks Act 1932* is responsible for maintaining drinking water supplies including water sourced from the River Murray. It is also the delegated authority under the Minister for River Murray for managing a range of water infrastructure.

5.1 RIVER HEALTH

5.1.1 Incorporating Fish-ways into Engineering Structures

SA Water has incorporated Fishways to allow native fish to move through or around large engineered structures which have been integrated into construction plans in collaboration with SARDI for capital works at Chowilla and Locks 1 to 6.

A fishway is now complete and fully operational at Lock 5 (fishways at Locks 1, 3 and 6 were operational prior to 2010-11). However, due to high water levels, Locks 2 and 4 are shut down with no current planned remobilisation as this will depend on river flows.

5.2 ENVIRONMENTAL FLOWS

5.2.1 Aquifer Recharge, Storage and Recovery

Progress continues to be made with implementing stormwater recycling to reduce reliance on River Murray water and develop a diverse water supply. Construction of the Barker Inlet Stormwater Reuse Scheme commenced and planning for the Adelaide Airport Stormwater Reuse Scheme was progressed through design and documentation. Both schemes employ managed aquifer recharge to store stormwater. SA Water also manages the Lochiel Park Stormwater Reuse Scheme.

5.2.2 Wastewater Re-use

A step forward in recycling treated wastewater was the completion of the Southern Urban Reuse Project, which began supplying customers in May 2011. This will allow some new southern suburbs such as Seaford Meadows to use recycled water for watering parks and gardens and dual reticulation for toilet flushing and outside residential use.

Also in the south of Adelaide the second stage of the Aldinga Wastewater Treatment Plant was completed. In addition, the construction of the 750 ML recycled water surface storage lagoon at the Aldinga site was also completed.

Supply to additional customers from the Glenelg Adelaide Recycled Water Scheme continued, with connection of the new South Australian Police building in Angas Street and a number of other new customers obtaining SA Health approval to connect to the scheme.

5.3 WATER QUALITY

5.3.1 Water Quality Drought and Flood Event Response Monitoring

In order to respond to the severe drought and low flows, SA Water implemented a Drought Response Program in late 2007, to enable the early detection and tracking of potential impacts of drought on water quality. With the advent of floodwaters early in 2010, the initiatives under this program were used to track the progress of floodwaters and the potential effects on water quality from re-flooded wetlands.

The program involved enhanced routine monitoring for parameters such as metals, dissolved oxygen, dissolved organic carbon and nutrient levels. It also involved immediate on-the-ground assessment, tracking and early warning of potential water quality changes through focused surveys of the river.

This allows for the implementation of appropriate operational actions to address any impending water quality issues and assist in the management of those water supply systems that are likely to be affected.

5.3.2 Algal Bloom Detection

Algal blooms can potentially occur when there are available nutrients, low flows and suitable temperatures. Specific algal species can be highly toxic and in extreme cases render the water unsuitable for recreation and drinking and also be toxic to ecosystems.

In addition to SA Water's comprehensive algal monitoring program along the South Australian reaches of the River Murray, and the use of special sensors for the determination of in-situ blue-green algal biomass, high resolution digital aerial imagery was employed to enable the early detection of algal blooms in the river. The footage is also useful in identifying illegal water discharges, illegal water harvesting and understanding the connectivity of wetlands to the river, and in 2010-11 imagery was utilised by other government agencies for specific projects, and in conducting compliance monitoring.

5.3.3 Drinking Water Exclusion Zones

Approval for the establishment of exclusion zones around drinking water supply off-takes is currently being finalised. This would restrict specific activities with the potential to threaten water quality. Materials required for installation have been ordered and delivered. On the granting of approval, installation of the infrastructure and signage will commence.

5.3.4 Salt Interception Schemes

SA Water on behalf of the MDBA and the Minister for the River Murray is responsible for the construction, operation and maintenance of salt interception schemes within South Australia and has continued to administer this role during 2010-11.

5.4 HUMAN DIMENSION

5.4.1 Adelaide Desalination Project

As part of the State's *Water for Good* plan to secure water for the future, the South Australian Government, through SA Water, is building a seawater desalination plant south of Adelaide. The plant will be used in conjunction with a range of other water security measures including recycling, stormwater reuse and Water Wise Measures.

In 2010/11 a number of milestones were met on the project including completion of the transfer pipeline to take water from the plant to SA Water's Happy Valley water treatment plant, seawater intake and outfall tunnels safely flooded and water lifted up to process buildings, decommissioning of a pilot plant and revegetation on and bordering the site.

All of the power used in the desalination plant and the transfer pipeline system will be offset with 100% Green Power accredited renewable energy, generated within South Australia.

Completion of the 100GL plant is on track for the end of 2012 with customers expected to receive water from the plant through the SA Water network in Spring 2011.

5.4.2 Algal Scum Booms

Floating algal scum booms have previously been installed at Renmark, Loxton, Cobdogla, Swan Reach and Blanchetown to prevent the accumulation of blue-green algal surface scums around water treatment plant off-takes. A review of the condition and effectiveness of these booms has been completed and it is planned to install this type of boom at a further five River Murray offtakes later in 2011.

5.4.3 School Educational Programs

In 2010-11, implementation of the SA Water Brainwave Program continued. The SA Water Brainwave is a series of curriculum-based learning programs and resources accessible to all primary and secondary students and teachers in South Australia. The Brainwave Program supports a wide range of teaching and learning perspectives but has a strong focus on science, sustainability and water in the community, including the importance of the River Murray. The Program is delivered in collaboration with the Department of Education and Children's Services.

The Brainwave was expanded in 2010-11, with an increase in the number of programs offered in regional areas and additional sessions of the most popular programs added, to cater for a growing audience. All programs and resources delivered in 2010-11 were free of charge with travel reimbursements offered to rural and disadvantaged schools.

5.4.4 Community Education Program

In December 2010, Level 3 Enhanced Water Restrictions were lifted, making way for new Water Wise Measures. Restrictions had been in place since January 2007, and were lifted after receiving and reviewing advice from experts and the community. Following the introduction of the new Water Wise Measures, SA Water promoted and encouraged water wise behaviour through a new communications program. Promotion of the H₂OME Rebates scheme also continued, with a focus on water wise behaviour in the garden. The garden goods rebate was doubled to encourage water efficiency outdoors.

In addition, SA Water, in conjunction with the National Water Commission, launched the WaterRight Garden tool – an online resource to help gardeners determine the appropriate amount of water to use. SA Water also continued its partnership with DFW to deliver the WaterWise Communities program, including a range of kits for schools, businesses and households to promote the value of water and encourage efficient water behaviour in the community.

6 ENVIRONMENT PROTECTION AUTHORITY

In relation to the *River Murray Act 2003*, the Environment Protection Authority (EPA) is responsible for maintaining the water quality of the River Murray as directed by the *Environment Protection Act 2003* and the associated *Environment Protection (Water Quality) Policy 2003*.

6.1 WATER QUALITY

6.1.1 Implementing the National Water Quality Management Strategy

The National Water Quality Management Strategy provides a national approach to improving water quality in Australia's waterways. Part of this process is consultation with the community to set environment values across the region. EPA partners are the SA MDB NRM Board, SA Water, DFW, and the MDBA.

Works undertaken in 2010-11 included:

- Providing input into the Salinity and Water Quality Management Plan in conjunction with the development of the Basin Plan;
- confirmation of environmental values in conjunction with the development of the Basin Plan;
- assessing appropriate water quality objectives for South Australia under different flow conditions (e.g. high vs low, Darling vs Murray); and
- amending the Environment Protection (Water Quality) Policy 2003 to reflect agreed environmental values and water quality objectives as a result of the above actions.

6.1.2 Lower Murray Reclaimed Irrigation Area Compliance

The Lower Murray Reclaimed Irrigation Area restructuring and rehabilitation program was completed in December 2008. The EPA continues to monitor and enforce established environmental standards to protect River Murray Water Quality. This includes checking and ordering the erection of fencing to exclude stock from the River, and investigating sources of pollution from effluent ponds and feed lots that have resulted in elevated levels of *E. coli* in the River. The EPA is currently working with SA Water to investigate and reduce elevated levels of *E. coli* at Murray Bridge that have increased over the last three years to levels up to 20 times higher than that allowed for recreational swimming. This is a complex project affecting all River Murray users.

Also, the recent transition to feedlots which concentrate pollution has created a range of new issues that are currently being addressed. During 2010, water levels rose sufficiently to enable gravity-fed flood-irrigation to recommence. Given the degraded state of the Lower Murray Reclaimed Irrigation Area infrastructure during the drought, this has already posed, and will continue to pose, additional management challenges.

Work undertaken in 2010-11 has included:

- on site investigations to ensure compliance with best management practises and legislative requirements;
- sampling of water quality, evaluation and reporting of results;

- technical investigation into acid drainage issues;
- investigation of complaints; and
- serving of environment protection orders where required for failing to meet obligations under legislation.

6.1.3 Clean River Program

Work undertaken during 2010-11 has included:

- Development of a High Energy Action Campaign in conjunction with industry to educate and promote sustainable, environmentally friendly boating activities on the River Murray. To be implemented through a non-government campaign in partnership with EPA, Keep Australia Beautiful, SA MDB NRM Board, DFW, Department of Transport, Energy and Infrastructure, Local Government and the Boating Industry Association of South Australia, and includes:
 - Wake damage to riverbanks; and
 - Identification of “no wash” zones and “sensitive areas”.
 - Implementation of a litter reduction information campaign with enforcement as a last resort for people who continue to litter and leave rubbish at River edge camp sites.
 - Negotiation with owners of derelict vessels, with a view of safely removing abandoned and derelict vessels along the banks of the River Murray. This work is expected to escalate due to the increasing water levels and flow in the river.

6.1.4 Random Audit Program for River Boat Vessels

An audit program of wastewater discharge from private river craft continued during 2010-11. The audit addresses black-water and grey-water discharge and can result in boat facilities having to be upgraded. Letters of compliance regarding the design and proper management required for on-board black water management systems have been prepared and issued where relevant.

6.1.5 Code of Practice for Vessel and Facility Management (marine and inland waters)

The *Code of Practice for Vessel and Facility Management (marine and inland waters)* was developed in 2009-10 to encourage best environmental management practices on South Australia’s marine and inland waters. It requires the introduction of new wastewater management practices for all vessels operating on South Australia’s inland waters, including the River Murray.

In 2010-11, this initiative resulted in the EPA winning the 2010 Standards Australia Award in the category of ‘Most Outstanding Committee’.

Work undertaken during 2010-11 included:

- Engaging with all private and commercial vessels owners operating on the River Murray on a case by case basis to ensure a commitment (and firm timeframe) to comply with the code.
- Development and implementation of an interactive vessel management database to manage the compliance of the 2000 vessels operating on the River Murray.
- Provision of timely advice to industry and the community as to the requirements of the Code, including development of extensive supporting information.
- Monitoring and testing of greywater treatment systems installed on vessels in the River Murray and working with potential and existing treatment system manufacturers to provide technical support to assist in the successful development and commercialisation of these systems.

- Promotion of the EPA's Code of Practice for Vessel and Facility Management (marine and inland waters) and the Australian Standard for Greywater Treatment on Inland Waters (sponsored by the EPA) interstate to encourage NSW and Victorian vessels to reduce pollution before it gets to South Australia.
- Licensing of slipways and marinas along River Murray and facilitation of the Clean Marina program, in conjunction with the Boating Industry Association of South Australia, to encourage and inform all marina manager's as to their legislative responsibilities.
- Implementation of a 12 month trial (in conjunction with Vessel Insurers, Boating Industry Association of South Australia, Greenings Landing Marina and Slipway, and The Marina Hindmarsh Island), at the Hindmarsh Island and Mannum slipways, to inspect and assess private vessels operating on inland waters for compliance with the blackwater and greywater requirements as per the Code of Practice for Vessel and Facility Management (marine and inland waters). The program had considerable success in promoting compliance with the Code and the scheme is set to be extended and expanded to other sites and inspectors in 2011-12.
- Assessment of local and regional impacts of greywater pollution from river vessels through monitoring and modelling.

6.1.6 Sand Dumping & Bank Stabilisation

Sand dumping was a significant concern during the drought as river residents attempted to shore up riverbanks, cover the smell of ASS and create artificial beaches as many metres of river bed became exposed due to low water levels. EPA officers, supported by DFW officers, led a program to inform and educate river residents against this practice and warn of potential penalties as the practice had the potential to cause harm to the River and breach the *Environment Protection (Water Quality) Policy 2003*. With river levels returning to pre drought levels, the focus is shifting to bank stabilisation and restoration.

Work undertaken in 2010-11 has included:

- undertaking media and enforcement campaign to increase awareness and reduce the instance of importing and dumping sand along the banks of the River Murray for amenity;
- conducting audits and send out letters of compliance;
- timely advice to sand dumping and bank stabilisation questions and alternatives; and
- working closely with local community groups, commercial product developers and the SA MDB NRM Board to deliver a test site that can be used to promote alternatives to sand and rock bank stabilisation.

6.1.7 Evaluation of Proposals for Development

The EPA, by virtue of the *Development Act 1993* (through the declaration of the River Murray Water Protection Area under the *Environment Protection Act 1993*) and more recently through the provisions of the *River Murray Act 2003*, has been offering advice or providing direction to planning authorities for consideration or attachment to development approvals to avoid or minimise potential impacts of such developments upon water quality and other environmental values. This includes applications for jetties, boat ramps, retaining walls, dwellings, land divisions, intensive animal keeping, dredging and wastewater treatment plants. This work is increasing due to the transition from an extended period of drought to a sudden period of high flows, creating an increasing requirement for more bank works, and an increasing population seeking to live next to the River.

Work undertaken in 2010-11 has included:

- On site meetings with developers, residents and local councils to discuss proposed plans that can affect River Murray water quality.
- Written advice to Councils and Department of Planning and Local Government (DPLG) outlining consistency with existing legislation and EPA conditions for development.
- Development of a response matrix for development applications to simplify and maintain consistency in the response process.

6.1.8 Audit Compliance and Enforcement

The EPA has a comprehensive audit compliance and enforcement program and is also responsible for certain referrals under the *River Murray Act 2003*. The EPA routinely undertakes random audits and inspections on a range of industries that have the potential to impact on water quality. Compliance is enforced through a range of instruments including letters, fines, environment protection orders, clean up orders and prosecution.

Major issues requiring enforcement in 2010-11 included sand dumping, illegal development (affecting water quality of the river), pesticide mismanagement and clean up, abandoned vessels, sewage spills and (to a lesser extent) diesel spills into the river. All of these issues were dealt with using a range of approaches, including verbal advice, letters, environment protection orders and emergency response.

7 DEPARTMENT FOR TRADE AND ECONOMIC DEVELOPMENT

In relation to the *River Murray Act 2003*, the Department of Trade and Economic Development (DTED) supports economic growth and wealth creation through policy development and project initiatives. It is guided by *South Australia's Strategic Plan 2007*.

7.1 HUMAN DIMENSION

7.1.1 Riverland Futures Taskforce

This taskforce was established to diversify industry, promote industry growth within the Riverland and ensure a more sustainable approach in line with the Regional NRM Plan. The work of the Riverland Futures Taskforce has now been completed and the Taskforce ceased operations on 30 June 2011.

Implementation of the opportunities identified in the Riverland Regional Prospectus, developed by the Taskforce, is now being undertaken by RDA Murraylands and Riverland.

7.1.2 The Riverland Regional Prospectus Project

The Riverland Regional Prospectus, coordinated by the Riverland Futures Taskforce, was released on 10 September 2010 and funded by DTED. It aims to deliver outcomes that establish sustainable and economically productive industries, while seeking to protect and enhance the biological diversity and social values of the area.

The government's \$20 million Riverland Sustainable Futures Fund will support the implementation of opportunities identified through the Prospectus.

Alignment of the development plans and policy for the three Riverland councils as part of the prospectus project was completed in 2010-11.

7.1.3 Regional Development Australia Murraylands and Riverland

Regional Development Australia is a national policy initiative to engage with regional communities. RDA committees were established throughout South Australia during 2009-10 as a means of promoting alignment of activities and greater regional input to regional matters. DTED finalised the establishment of the RDA network in South Australia in 2010-11 and local RDAs have been established across all regions.

RDA bodies provide the shop front for business development services offered by the state government across regional South Australia. This facilitates the provision of information and support services to business as well as state and local governments in the regions.

7.1.4 Riverland Sustainable Futures Fund

The Riverland Sustainable Futures Fund was announced by the Government in February 2010 to assist the region to diversify its economic base and facilitate recovery of the local economy.

The \$20 million Riverland Sustainable Futures Fund is available over four years and is accessible by organisations, industry and businesses to fund projects that will make a major and sustainable impact in the region.

The Fund aims to facilitate projects that improve infrastructure, attract industry and help grow existing businesses. It is expected that over time this initiative will deliver structural change, population growth and enhanced employment outcomes for the Riverland.

As at 30 June 2011, the Minister for Regional Development had announced approximately \$1.35 million in successful grants from the Fund.

7.1.5 Regional Development Infrastructure Fund

The purpose of the Regional Development Infrastructure Fund is to increase the prosperity of regional communities by facilitating infrastructure that supports sustainable economic development.

The State Government through DTED, in conjunction with Federal and local governments, provides funding of more than \$900,000 a year to the RDA Murraylands and Riverland. This funding is to support projects that address the issues, challenges and opportunities affecting, or likely to affect the region. Eligible infrastructure includes reusable and water efficiency projects.

8 DEPARTMENT OF PREMIER AND CABINET

In relation to the *River Murray Act 2003*, the Aboriginal Heritage Branch of the Aboriginal Affairs and Reconciliation Division (AARD), in the Department of Premier and Cabinet (DPC) administers the *Aboriginal Heritage Act 1988* on behalf of the Minister for Aboriginal Affairs and Reconciliation.

The *Aboriginal Heritage Act 1988* covers all areas of South Australia, providing blanket protection for Aboriginal remains and Aboriginal sites and objects of significance to Aboriginal archaeology, anthropology, history and tradition.

8.1 HUMAN DIMENSION

8.1.1 Conservation of Aboriginal sites

Owing to the heavy rains this season, Aboriginal burial sites have become eroded and exposed in several locations along the River Murray. The Department has responded to each of these cases and has worked with the Local Council, the local Aboriginal people and land owners to draw up and implement management plans which address the issue of access for local people and the need for the burials to be conserved and protected into the future. Local Councils have been very cooperative in assisting DPC to determine the engineering requirements of the conservation works.

8.1.2 Funding Interpretations of Aboriginal Heritage

The Department contributed funding to the Ngaut Ngaut Interpretation Project managed by Flinders University and the Mannum Aboriginal Community Association.

8.1.3 Lake Bonney Cultural Heritage Management Plan

On request of the First Peoples of the River Murray, the Lake Bonney Cultural Heritage Management Plan was redrafted and sent to stakeholders for comment. When comment has been received, the final Management Plan will be prepared, and, following endorsement, the site can be nominated for registration under the *Aboriginal Heritage Act 1988*. The Management Plan should enable the Berri Barmera Council to better manage the cultural values of Lake Bonney in consultation with the First Peoples of the River Murray and Mallee and DPC AARD.

9 DEPARTMENT OF PLANNING AND LOCAL GOVERNMENT

In relation to the *River Murray Act 2003*, the Department of Planning and Local Government (DPLG) is responsible for the implementation of the *Development Act 1993* and the *30 Year Plan for Greater Adelaide*. DPLG's work is further influenced by *Water for Good* and *South Australia's Strategic Plan 2007*.

9.1 RIVER HEALTH

9.1.1 Open Space Program

The Department is working with interested Local Councils along the River Murray to increase and improve opportunities for open space. In addition, DPLG has an on-going grant program for conservation and/or recreation projects on public land, including land located within townships.

9.1.2 Development Referrals

The Development Assessment Commission is required, under the *Development Act 1993*, to refer various applications to the Minister for the River Murray and take into account any comments and directions of the Minister in determining these applications.

In addition, where the Development Assessment Commission is the approval authority, it undertakes a compliance and enforcement function to ensure development is undertaken in accordance with approvals and to take action where development is undertaken without approval.

9.1.3 Marina Strategy

The *Guide for Marina and Moorings Structure Development Along the River Murray in South Australia* was finalised and released in June 2011. It has been distributed to River Murray Councils and industry stakeholders and is available on South Australia's new cross government web portal (www.sa.gov.au).

The guide will assist to improve infrastructure and facilities for the houseboat industry and houseboat users by providing advice for developers, councils and the community regarding where and how marinas and other mooring structures should be built and used, whilst ensuring the amenity values of the river are protected.

9.2 WATER QUALITY

9.2.1 Water Sensitive Urban Design

The Murray and Mallee Region Plan was adopted as a volume of the South Australian Planning Strategy on 20 January 2011. The Murray and Mallee Region Plan offers an integrated and coordinated vision for future land use and development in the Murray and Mallee region, responding to changes in the agriculture and horticulture industries, as well as growth in the tourism industries. It includes guidelines related to water sensitive urban design (WSUD) to protect the quality and function of water ecosystems from the impacts of land use and development, including that all new developments (residential, retail, commercial, institutional, industrial and transport) in the region should apply the principles of WSUD.

While the responsibility for implementing WSUD is now with the DFW, DPLG will incorporate WSUD principles into the South Australian Planning Policy Library as a resource for local government in developing Development Plan policy.

APPENDIX 1: LIST OF ACRONYMS

AARD	Aboriginal Affairs and Reconciliation Division, Department of Premier and Cabinet (Government of South Australia)
ASS	Acid Sulfate Soils
BSMS	Basin Salinity Management Strategy
CHWN	Critical Human Water Needs
CLLMM	Coorong, Lower Lakes and Murray Mouth
DENR	Department of Environment and Natural Resources (Government of South Australia)
DPC	Department of Premier and Cabinet (Government of South Australia)
DFW	Department for Water (Government of South Australia)
DPLG	Department of Planning and Local Government (Government of South Australia)
DTED	Department of Trade and Economic Development (Government of South Australia)
EPA	Environment Protection Authority (Government of South Australia)
GL	Gigalitre
IIEP	Improving Irrigation Efficiency Project
LAP	Local Action Planning
LWMP	Land and Water Management Plan
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
ML	Megalitre
NRM	Natural resources management
OFIEP	On Farm Irrigation Efficiency Program

ORM	Objective(s) for a Healthy River Murray
PIRSA	Primary Industries and Resources South Australia (Government of South Australia)
RDA	Regional Development Australia
RMDWADF	River Murray Drought Water Allocation Decision Framework
RRP	Riverine Recovery Project
SA	South Australia
SA MDB NRM	South Australian Murray-Darling Basin Natural Resources Management
SARDI	South Australian Research and Development Institute
SDL	Sustainable Diversion Limit(s)
SIS	Salt Interception Scheme
TLM	The Living Murray
WAP	Water Allocation Plan
WFTF	Water for the Future
WSUD	Water Sensitive Urban Design