ENVIRONMENTAL WATER PROVISION TRIALS FOR THE WESTERN MOUNT LOFTY RANGES

SUMMARY REPORT

FEBRUARY 2011

Government of South Australia
Adelaide and Mount Lofty Ranges Natural Resources Management Board
SA Water
Government of South Australia
Department of Water, Land and Biodiversity Conservation

1 INTRODUCTION

On 20 October 2005, the Minister for Environment and Conservation prescribed the surface water, watercourses and underground water of the western Mount Lofty Ranges. The area includes the catchments of the reservoirs for Adelaide's water supply within the Adelaide and Mount Lofty Ranges Natural Resources Management Board, as shown in Figure 1.

Under the *Natural Resources Management Act 2004*, once a resource has been prescribed a water allocation plan must be prepared. The water allocation plan must balance the allocation of the area's water resources, taking into account the needs of all water users, including the environment. The plan must set out the "rules" for the allocation and transfer of water, and is the basis for the issuing of water licences to water users with the region.

The process of developing water allocation plan for the Western Mount Lofty Ranges commenced in 2008, with the plan finally released for community consultation on 13 October 2010. It is anticipated that the Western Mount Lofty Ranges Water Allocation Plan (WMLR WAP) will be finalised by 30 June 1011.

As part of implementing the WMLR WAP water will be provided (released) for environmental flows downstream of SA Water metropolitan water supply reservoirs. In anticipation of the need to provide water for the environment downstream of reservoirs, an environmental water provisions trial was developed in 2006[1]. The trial commenced in late June 2006 but ceased prematurely in October 2006 with the declaration of drought conditions in the Mount Lofty Ranges.

In late 2010 with the impending release of the WMLR WAP and the onset of good rainfall in mid and late 2010, the process of re-initiating the trial first attempted in 2006 began. This report presents a summary of proposed environmental water provisions (EWP, also referred to as environmental flows) to four priority river reaches downstream of SA Water metropolitan water supply reservoirs. The river reaches were identified in 2006 on the basis of aquatic and riparian value, and good potential for improvement with increased flows. They are as follows:

- Barossa Diversion Weir to Gawler (South Para);
- Gumeracha Weir to Kangaroo Creek Reservoir (River Torrens);
- Gorge Weir to Torrens Lake (River Torrens); and
- Clarendon Weir to estuary (Onkaparinga River).

The environmental water provisions presented in this report were approved by both the SA Water Board and the Adelaide and Mount Lofty Ranges Natural Resources Management Board in 2006.

The information presented in this summary report is taken from the more detailed report entitled "Trialling environmental water provisions from SA Water Reservoirs in the western Mount Lofty Ranges". This more detailed report is in turn based on the collective work on environmental water requirements (EWR) undertaken by four Catchment Water Management Boards and the Department

1 Adelaide and Mount Lofty Ranges Natural Resources Management Board, Department for Water Land and Biodiversity and SA Water, 2006. Environmental Water Trials for the Western Mount Lofty Ranges - Summary Report

of Water (and predecessor agencies). While based on high level and significant research efforts by expert multidisciplinary teams, the environmental flow regimes recommended in this report require monitoring and evaluation in order to confirm whether intended aquatic ecosystem and water quality benefits are achieved. This report proposes a three year trial that would have the main aims of:

- testing anticipated ecological, geomorphic and biodiversity benefits resulting from the provision of environmental flows for consideration during the water allocation planning process; and
- improve ecosystem function in watercourse reaches identified as high priority on the basis of ecological value.

Reaches downstream of the Myponga and Little Para Reservoirs are not included at this time. However, environmental water provisions from these systems or other river reaches within the western Mount Lofty Ranges will need to be considered in the future.

1.1 Background to Determination of Environmental Water Requirements

A water allocation plan must include an assessment of the quantity and quality of water needed by ecosystems, and provide for the allocation of water so that an equitable balance is achieved between environmental, social and economic needs for water. The basis for the provision of water for the environment is the determination of environmental water requirements.

The former Catchment Boards have undertaken investigations into the environmental water requirements of significant river systems within their regions. This work forms the basis of the development of the environmental water provisions that are proposed in these trials.

Key studies undertaken include:

- **South Para River:** Environmental water requirements for the Gawler River catchment (including the South Para) were assessed in 1999 based on the scientific panel method, including hydrology, geomorphology and ecology. There have been two further studies relating to releases from the South Para Reservoir.
- **Onkaparinga River:** Detailed scientific studies of the Onkaparinga River were conducted over two and half years between 2001 and 2003. This included studies into hydrology, geomorphology, ecology and macroinvertebrate habitat preference.
- **River Torrens:** A detailed study of the current Torrens hydrographs illustrated the dramatic truncation of river flow downstream of both the Gumeracha Weir and the Gorge Weir by diversion to off-stream storages. This information, together with information from the Onkaparinga environmental water requirements study have been used as the basis for development of the environmental water provisions for the trials.

1.2 Environmental Water Requirements and Environmental Water Provisions

The development of environmental water requirements (EWR) uses best available science and information to determine the water regimes needed to sustain the ecological value of aquatic ecosystems at a low level of risk. EWRs are commonly expressed as a flow volume, together with the timing, frequency and duration of those flows.

In many instances, because of competing demands for available water, it is not possible to provide the full environmental water requirements. In these instances negotiation between stakeholders needs to be undertaken to determine those parts of the environmental water requirements that can be met, whilst still meeting social and economic needs. These flows are referred to as environmental water provisions.

The EWPs recommended for this trial are based on the earlier EWR investigations of the Catchment Boards. Some flow components have been reduced in duration and frequency or entirely removed in order to negotiate a lower total volume for the trial while still maintaining the ecological objectives of the EWP.

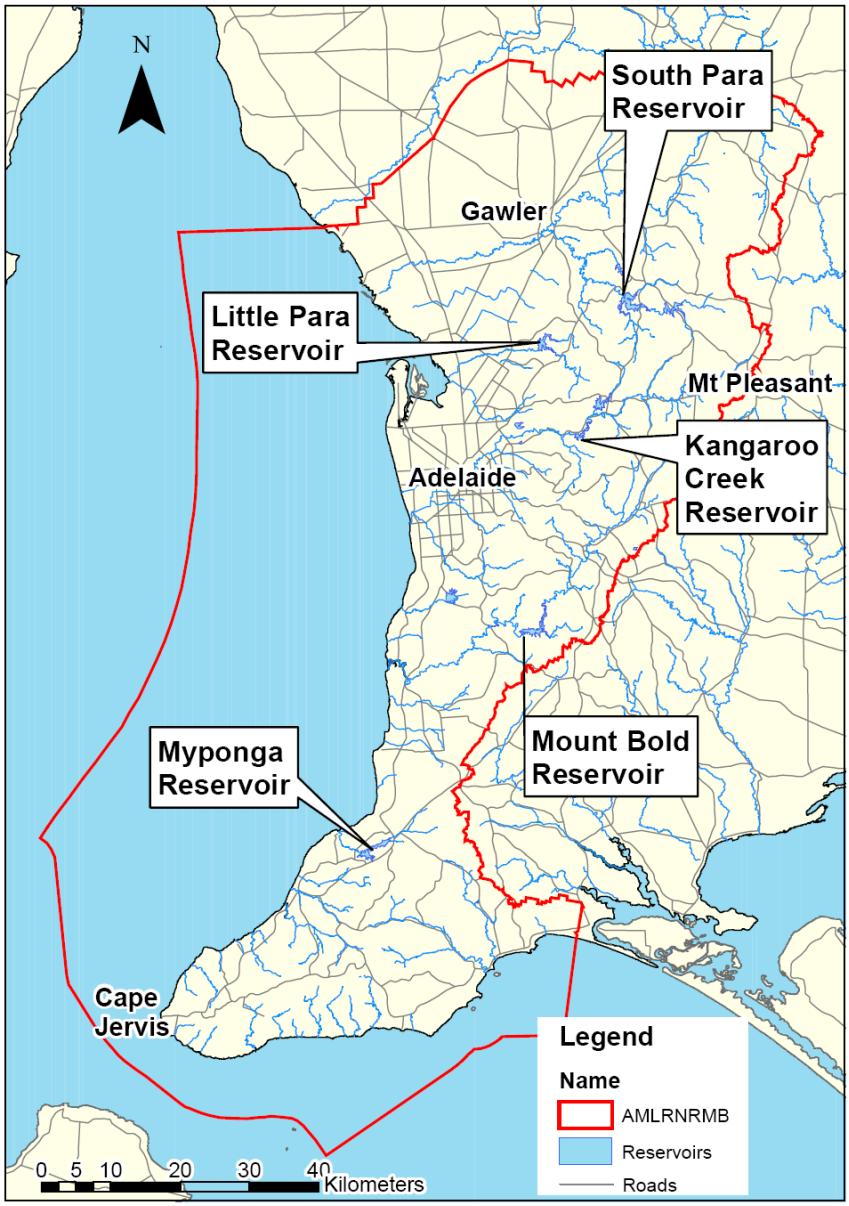

Figure 1. SA Water Reservoirs in the western Mount Lofty Ranges.

2 THE NEED FOR ENVIRONMENTAL FLOWS

2.1 River phases

Rivers of the western Mount Lofty Ranges can exist in four basic phases as summarised in Figure 2 to Figure 5. These four phases are dry, wet isolated, wet connected and flush flows and are summarised in the next sections.

The rivers of the western Mount Lofty Ranges experience a different suite of these phases under the current altered hydrological conditions than they would have experienced prior to water harvesting. There are particular ecological functions and processes associated with each of these phases and in order for rivers to be sustainable they must experience a range of these phases. The objective of EWPs is to try and return an appropriate mix of these phases so that ecological function can be returned or maintained at a low level of risk.

Dry Phase

Refer to Figure 2. While many ephemeral streams experience a dry phase on a regular basis, the extent to which the lower reaches of the MLR Rivers would have historically experienced this state is unclear. For biota that are not adapted to such dry conditions, the ecological consequences of this phase can be significant, particularly if it persists for extended periods. Consequences include, local extinction of aquatic biota [1] and encroachment of terrestrial vegetation and increased sedimentation [2].

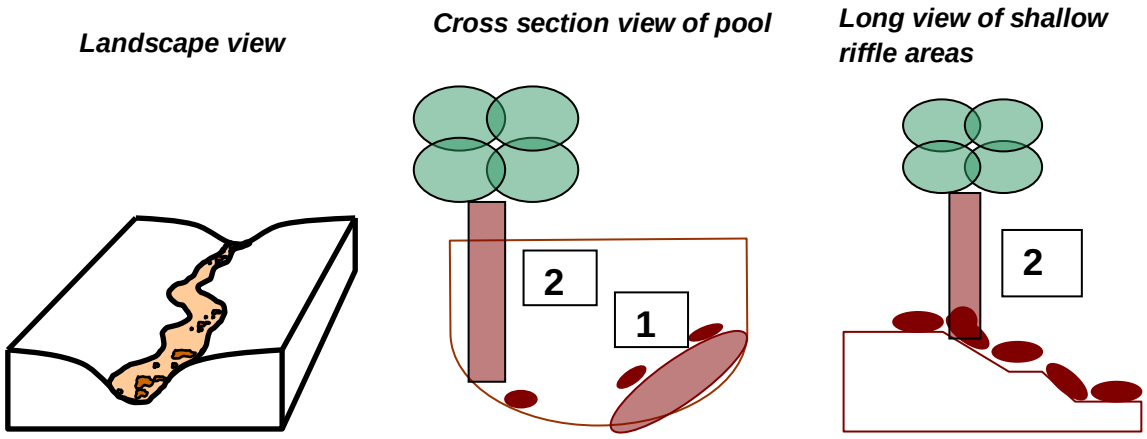

Figure 2. Dry phase.

Wet Isolated phase

Refer to Figure 3. This phase represents a 'maintenance stage' for aquatic biota, ie pools provide refuge for fish and other water dependant life, but habitat is very limited and flow is not sufficient to connect individual pools, thus disallowing migration over larger distances. Predation on small fish and aquatic bugs by birds and large fish may increase as the size of pools decreases [3]. Water quality in pools (partcularly dissolved oxygen) may become poor if conditions persist for extended periods [4]. The shallow riffle areas may only have subsurface water (ie no surface flow) [5].and may therefore be prone to encroachment by terrestrial vegetation. This may in turn reduce flow velocities leading to sediment deposition in pools and riffles.

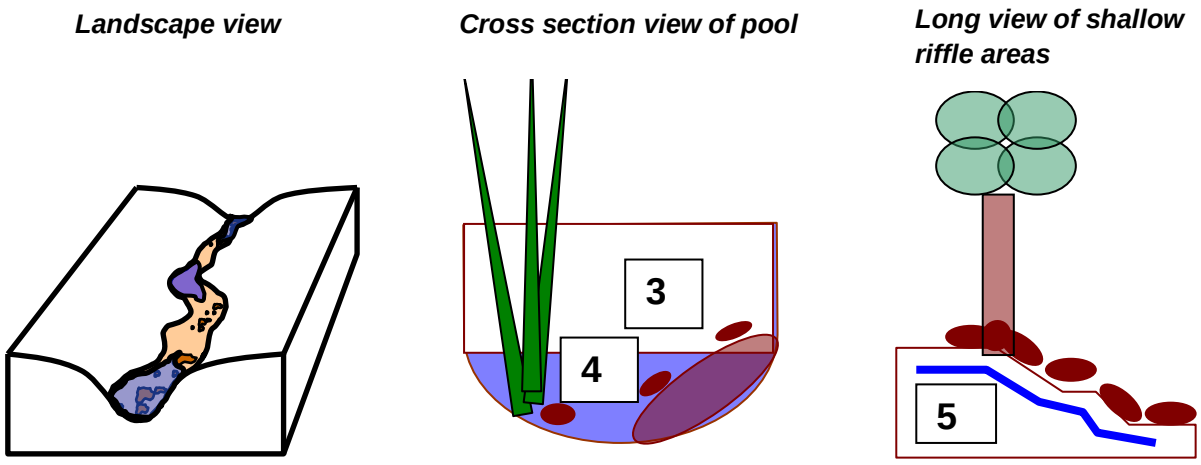

Figure 3. Wet Isolated phase.

Wet Connected phase

Refer to Figure 4. This phase creates highly favourable conditions for most aquatic biota. The extra wetted area (shallow sections of pools as well as the wetting of the shallow riffle areas) provides additional habitat for a variety of aquatic biota [6]. This will include biota with general habitat requirements as well as biota with specific habitat requirements (such as flowing water in which to collect food). Water quality will generally improve as water begins to flow between pools and flow over the turbulent shallow riffle areas [7]. The greater volume of water provides connection between pools and allows for migration of fish and other aquatic biota [8].

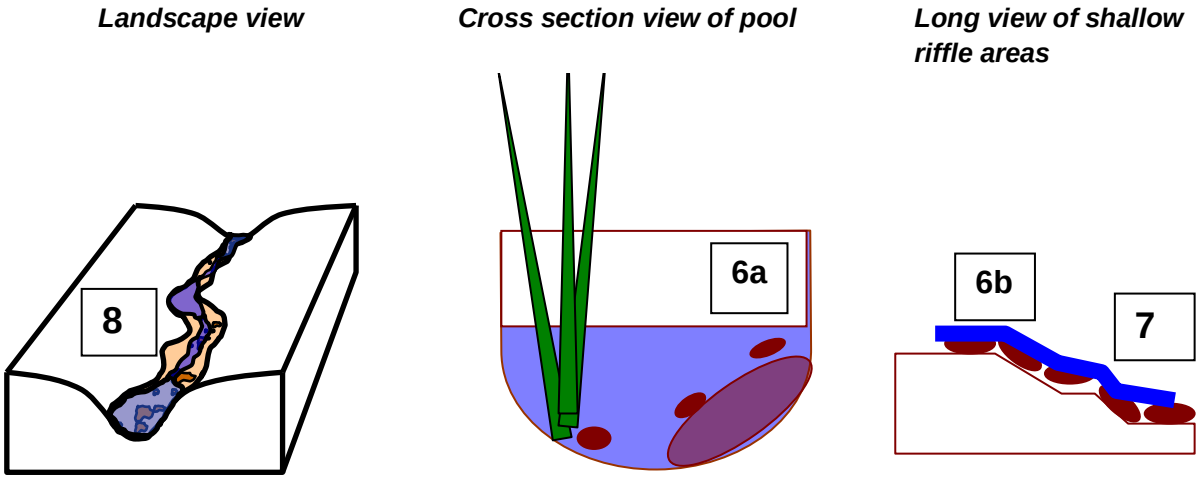

Figure 4. Wet Connected phase.

Flush flows phase

Refer to Figure 5. This is a phase that need only occur on a sporadic basis. As the magnitude or total volume of these flush flows varies, the influence or degree of impact from the event will also vary. Medium sized flows will allow for migration of fish and can provide important passage during breeding events. However, migration opportunities may decrease as the velocity of flow increases, with flow eventually becoming so great it may become unfavourable for some biota. However, these high volume, high velocity events are important for physical condition of rivers, as they cause major

geomorphic shifts by scouring sediment and vegetation [9]. The geomorphological benefits of this phase are essential in maintaining the ecological integrity of the other phases.

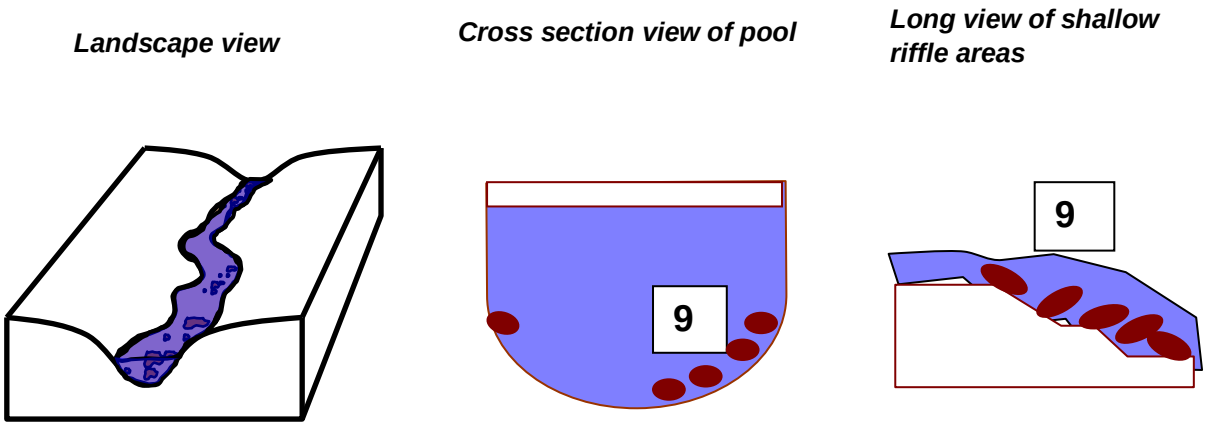

Figure 5. Flush flow phase.

2.2 Current and target hydrological state for rivers

Figure 6 represents the current and target hydrological states for the rivers of the western Mount Lofty Ranges. The columns represent the relative time spent in each of the four phases. Each column encompasses both spatial (ie along the entire river reach) and temporal (ie seasonal and annual variability) aspects to produce an overall (generalised) representation of the rivers (e.g. "frequently" implies at frequent time intervals and across a large proportion of the river channel).

In general, the rivers of the western Mount Lofty Ranges are currently over represented by the dry phase and the wet isolated phase (represented by the left hand (red) columns in Figure 6). In order to achieve long term sustainability, it is critical that the wetter phases (wet connected and flush flows) become the norm. This is represented visually on Figure 6 as a shift to the right from the current state to the target state.

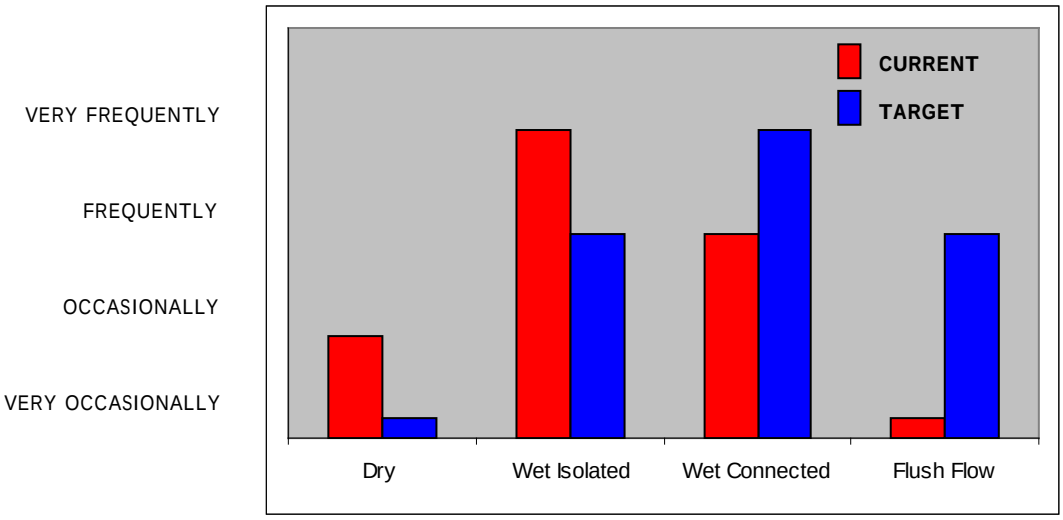

Figure 6. Generalised current and target hydrological states for western Mount Lofty Ranges rivers.

3 THE PROPOSED TRIALS

3.1 River reaches for the proposed trial

Four reaches (on three rivers) have been identified for the trials on the basis of ecological value and potential for improvement through environmental water provisions. The current values and threats that exist in these reaches are summarised below.

Despite the extended hydrological stress (prior to June 2010), many of the ecological values of these reaches are still intact. However, without provision of flows, these values will decline and ultimately may be lost. Flow restoration is more likely to be successful at sites where ecological values are still intact than at sites where ecological values have already been lost.

South Para River – Barossa Diversion Weir to Gawler

Current Values

- Physically intact - good physical and structural features.
- Low flows and fresh flows are the most severely impacted
- Section near Gawler has a good fish community,
- Upstream and middle of the reaches are currently lacking in fish, and potential for improvement with EWP is high.

Current Threats

- Lack of low flows and fresh flows mean that system spends extended periods in the dry and wet isolated phases.
- Habitat elements for aquatic biota very limited or missing (ie shallow riffle areas are only present during wet connected phase).
- Poor water quality in pools
- Potential for local extinction of aquatic biota

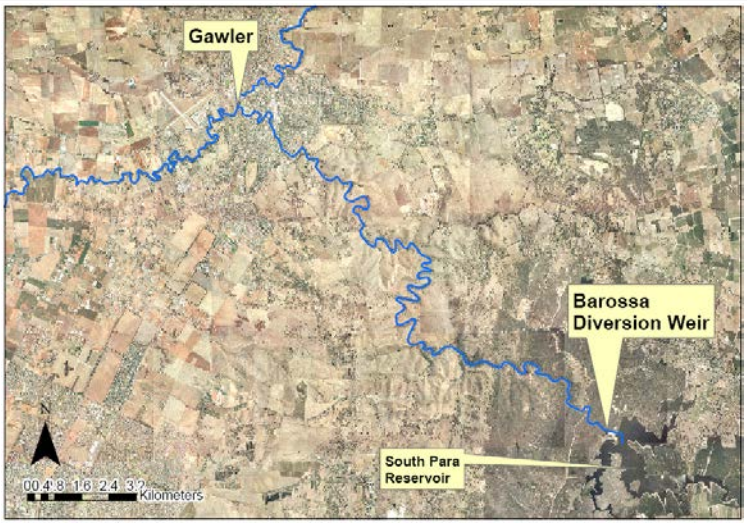

Figure 7. South Para River – Barossa Diversion Weir to Gawler.

Figure 8. Pool downstream of weir with poor quality, discoloured water resulting from reduced fresh flows.

Figure 9. Dry pool downstream of weir showing terrestrial vegetation encroaching into river bed.

Torrens River – Gumeracha Weir to Kangaroo Creek Reservoir

Current Values

- excellent riparian vegetation.
- streambed has deep pools
- macroinvertebrates and fish are diverse - when flow is present includes dwarf flat-headed gudgeon, Mountain galaxiids, flat-headed gudgeon.
- Potential to provide an important and diverse permanent habitat for a variety of vertebrates and invertebrates.

Current Threats

- Lack of flows means the system frequently experiences the wet isolated phase and will occasionally experience a dry phase.
- Habitat elements for aquatic biota very limited or missing (ie shallow riffle areas are only present during wet connected phase).
- Poor water quality in pools
- Potential for local extinction of aquatic biota

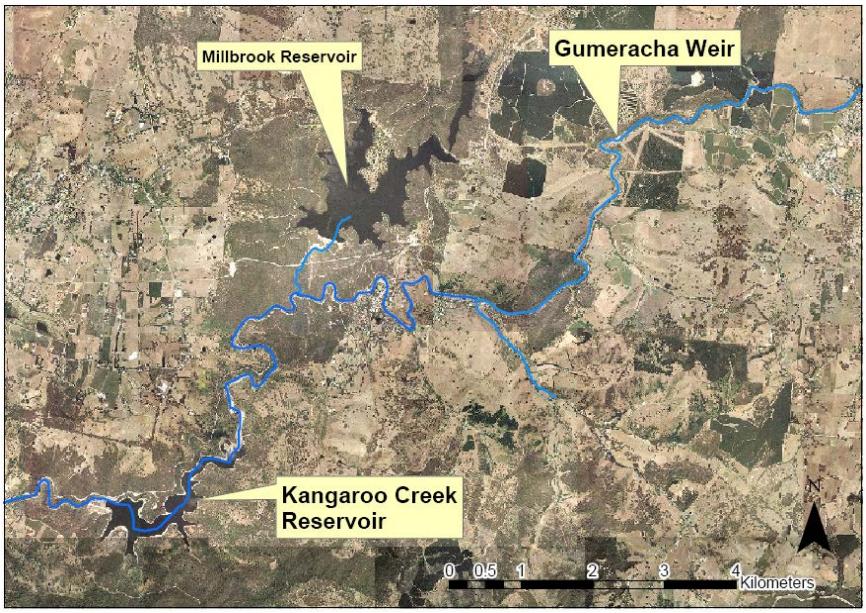

Figure 10. River Torrens – Gumeracha Weir to Kangaroo Creek Reservoir.

Figure 11. Encroachment of terrestrial weeds and other vegetation on riffle environment(a) as a result of reduced frequency of freshes and flushes. Pool environment (b) provides important refuge for aquatic biota. Hydrologic disconnection of pools such as that in (b) due to severely reduced low flows threatens biota with local extinction.

Torrens River – Gorge Weir to Torrens Lake

Current Values

- Major community asset with visual amenity
- macroinvertebrate community and fish are generally in a reasonably healthy condition

Current Threats

- Poor water quality
- Vegetation encroachment and sedimentation

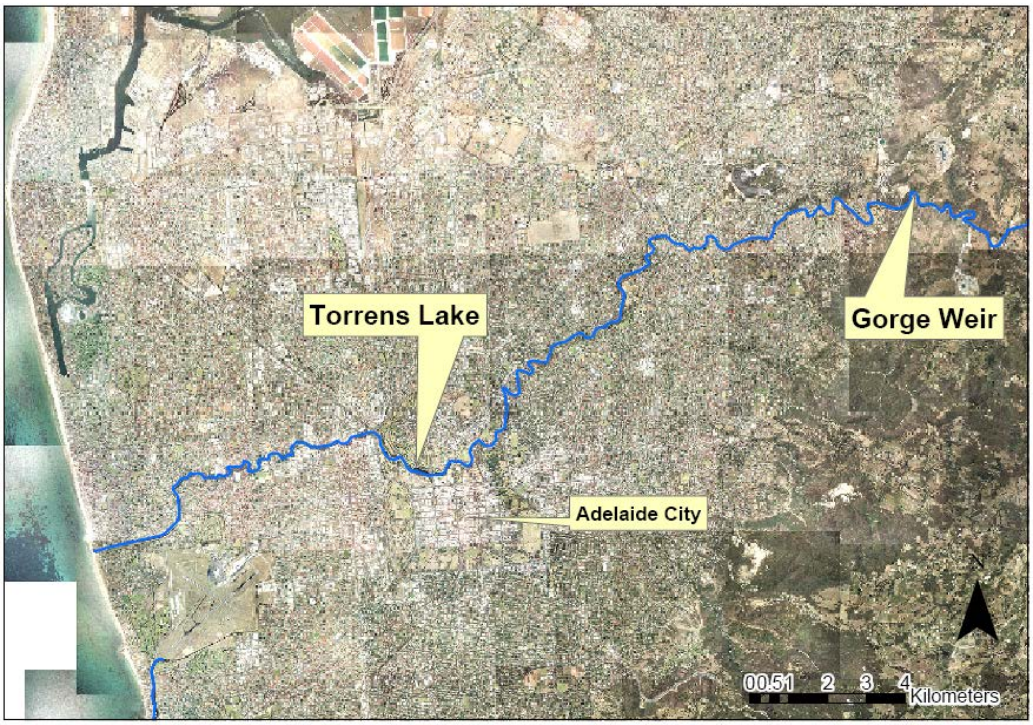

Figure 12. River Torrens – Gorge Weir to Torrens Lake.

Figure 13. Pool and community open space in Torrens Linear Park.

Onkaparinga River – Clarendon Weir to estuary

Current Values

- Physical condition is generally good.
- riparian zone remains reasonably well vegetated -, river red gums, tea tree, river bottle brush, reeds and sedges.
- healthy macroinvertebrate community.
- Good native fish populations - Climbing Galaxids, Common Jollytail, Gudgeon species, Congolli, Australian Smelt, Goby, Mullet, Whitting

Current Threats

- Lack of low flows and fresh flows mean that system spends extended periods in the wet isolated phase and sections occasionally experience a dry phase.
- Habitat elements for aquatic biota very limited or missing (ie shallow riffle areas are only present during wet connected phase).
- Subject to vegetation encroachment.
- Poor water quality

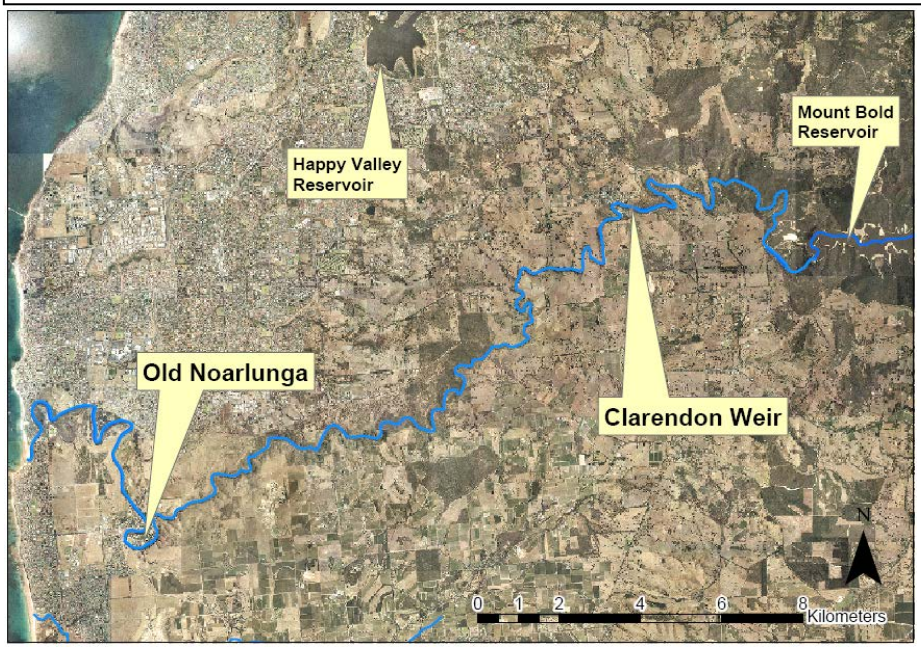

Figure 14. The Onkaparinga River - Clarendon Weir to Old Noarlunga.

Figure 15. Vegetation encroachment into riffle.

Figure 16. Reduced flows allows build up of filamentous algae and reduces habitat value.

3.2 Trial Water Requirements

Environmental water provisions have been developed for the trial based on the various scientific studies completed for each reach. Three levels of EWPs have been recommended and are based on returning a regime of flows to the river reaches that better represents the hydrological conditions which existed prior to flow modification (as far as is practicable). These flow bands and the river phase (refer to section 2.1) they are designed to replicate are summarised in Table 1. A summary of the recommended EWPs for the trial is presented in Table 2.

Table 1. Link between recommended environmental water provisions and river phases.

Flow band	River Phase	Main features
No EWP	Dry and Wet isolated	• Refuge sites for aquatic life deplete in number and size over the dry season. Water quality in pools may become poor. Limited opportunity for migration or recruitment of aqutic life.
Low Flow	Wet Isolated and Wet connected	• 'Maintenance stage' for aquatic biota between higher flow bands, ie pool levels and water quality maintained by low flows, provides good habitat for fish and other water dependant life.
Fresh Flow	Wet Connected	• Creates highly favourable conditions for most aquatic biota. The extra wetted area provides additional habitat for a variety of aquatic biota. • Water quality generally improves as water begins to flow between pools and flow over the turbulent shallow riffle areas. • The greater volume of water connection provided between pools allowing for migration of biota.
Flush Flow	Flush Flow	• Allows for migration of fish and can provide important passage during breeding events. • Higher volume, higher velocity flows cause major geomorphic shifts by scouring sediment and vegetation and are essential in maintaining the ecological integrity of the other phases.

3.3 Additional water required for trial

To maintain target storage holdings in the Kangaroo Creek, Millbrook and Mount Bold Reservoirs while at the same time meeting the recommended EWPs, additional pumping will be required from the River Murray to augment the system. The average additional volume required to be pumped is 8.1 GL but this can vary from 0.7 to 16 GL depending on seasonal conditions. Note that the average volume required is reduced due to recapture in Kangaroo Creek Reservoir of around 4GL of water released from Gumeracha Weir. Additional pumping costs (refer to section 4) for the trial has been based on the average (cost will be lower in a wet year and higher in a drought year).

Currently there is no scope under the existing Adelaide Metropolitan licence to extract any additional volumes from the River Murray. For EWP delivery, SA Water will need to access a portion of the 25 GL licence volume purchased in late 2005 to make up the additional water required for the EWP.

Not all of the current SA Water diversion weirs were capable of delivering the trial environmental releases in a controlled manner and so between 2005/06 and 2006/07 modifications were made to the following structures:

- Barossa Diversion Weir;
- Gumeracha Weir ;
- Gorge Weir; and
- Clarendon Weir.

Modifications were completed at a cost to SA Water of around $830,000.

Table 2. Summary of trial environmental water provisions *.

River Reach	Low Flows (ML)	Fresh Flows (ML)	Flush Flows (ML)	Total volume (ML)	Comment on timing of flows
South Para River - Barossa Diversion Weir to Gawler	1,806	432	0	2,238	Low flows (June – Dec) Fresh Flows (June – Oct) Flush flows not requested - met when reservoir spills.
River Torrens - Gumeracha Weir to Kangaroo Creek Reservoir	913	0	3,200	4,113	Low flows (Jan – Dec) Fresh flows - provided as natural input from tributaries. Flush flows, one in April – June and one in Aug – Oct)
River Torrens - Gorge Weir to Torrens Lake	91	0	800	891	Low flows (Jan – Dec) Fresh flows – provided as input from stormwater. Flush flows , one in April – June and one in Aug – Oct)
Onkaparinga River - Clarendon Weir to estuary	4,260	1,080	3,900	9,240	Low flows (Jan – Oct) Fresh Flows (March, May, July & Sept) Flush Flows (June, Aug, Oct).
Totals	**7,070**	**1,512**	**7,900**	**16,482**	*Includes flows from Gumeracha Weir which may be recovered in Kangaroo Creek Reservoir.*

* Optimum start time for trial flows is August to coincide with the required first “flush flow” following the winter flow period.

3.4 Providing water in drought years

Where possible, the same regime of EWPs should be implemented in all three years of the trial at the 4 reaches. Constancy in flow regimes is considered important in order to draw the best information from the trial in terms of understanding the relationship between environmental flows and ecological impacts. Such an understanding will prove highly useful in the water allocation planning process if the adopted environmental water allocation is to be both ecologically and operationally effective and sensible.

Modelling indicates that the provision of the full EWP can negatively impact on SA Water's reservoir storage levels if natural intakes are less than the 20th percentile (ie dry to drought conditions) or if there are restrictions on extractions from the River Murray. If this does occur during the trial period the EWPs will be modified to ensure the minimum reservoir storage levels are not compromised.

As an example, modifications have been made to the provision of high volume flushing flows in order to maintain control over target storage levels in SA Water reservoirs. Guidelines on the limitations of the provision of flushing flows for each river system have been developed and would be observed during the trial in order to maintain control over SA Water's target storage levels.

3.5 Monitoring the Trials

A detailed monitoring program was developed in 2006 to assist with evaluating the results of the trial. The method proposed in 2006 is still relevant for implementation in 2011. The monitoring program comprises ecological surveys linked to flow monitoring in order that ecological responses to the EWPs can be evaluated. The monitoring program will be implemented by a consortium comprising scientists from the Australian Water Quality Centre, Adelaide University, University of South Australia and the South Australian Research and Development Institute, with overview by the Board and Department for Water. The monitoring programs are summarised briefly below.

Ecological response monitoring

The ecological response monitoring program has two key components; short term response monitoring and long term response monitoring.

Short term response monitoring program

The short term response monitoring program is designed to provide rapid feedback (within 12 months) on the response of lower trophic levels[2] in the aquatic environment to environmental flows.

The program is focused on physical and habitat responses and lower trophic level parameters such as biofilms (assemblages of algae, fungi and bacteria that colonise submerged surfaces such as rocks, snags and the river bed) and diatoms, but may also include other indicators e.g. zooplankton or macroinvertebrate drift response.

These indicators are useful for monitoring environmental water provisions due to their rapid response to flow and the important role they play in providing habitat and food to higher trophic level biota such as fish and birds.

Long term response monitoring

Monitoring of long term responses to environmental water provisions will focus on the long term sustainability of native fish populations. The program is directed at linking aspects of fish populations (relative abundance, age and distribution of fish) and related fish habitat with flow over both the short and long term.

It is highly likely that measurable responses in fish populations will not be seen for some years (5 to 10 years, beyond the timeframe of this trial) after the sustained implementation of flow releases.

[2] The term trophic level can be defined as a feeding level in a food chain – low trophic level indicates an organism low in the food chain.

Surface water flow monitoring

Nine surface water flow gauging stations will collect daily flow data downstream of the EWP release points. The stations are summarised in Table 3.

Table 3. Surface water flow monitoring stations.

River reach	Station	Location	Parameters monitored	Agency
South Para River -Barossa Diversion Weir to Gawler	A5050503	South Para River upstream Gawler	Flow	DfW
River Torrens - Gumeracha Weir to Kangaroo Creek Reservoir	A5040500	Torrens River at Gumeracha Weir	Flow	DfW
	A5041003	Hollands Creek	Level	DfW
River Torrens - Gorge Weir to Torrens Lake	A5040501	Torrens River at Gorge Weir	Flow	DfW
	A5040529	Torrens River at Holbrooks Rd	Flow, rainfall, water quality	AMLR NRMB
Onkaparinga River - Clarendon Weir to estuary	A5030500	Onkaparinga River at Clarendon Weir	Flow	SA Water
	A5031004	Onkaparinga River 300m downstream Clarendon Weir	Flow	AMLR NRMB
	A5031005	Onkaparinga River 1.1km upstream estuary ford, Old Noarlunga	Flow, water quality	AMLR NRMB

Flow data will be critical in the interpretation of ecological response data as it will allow confirmation of the timing, magnitude, duration and frequency of flow events, and with that the linking of those events to measured ecological responses. Monitoring flows at several points downstream of weirs will assist in better understanding flow processes so that more certainty in the assessment of ecological responses to flow can be achieved.

3.6 Governance and reporting of the trial

The governance framework for the trials is presented in Figure 17.

Implementation, monitoring, evaluation and review of the environmental flow trial is likely to require significant cooperation and coordination between the Board, SA Water and DfW. To ensure that effective communication is maintained between all parties a WMLR Environmental Flows Steering Committee has been established and includes officers from the three agencies.

Reporting on the progress and the outcomes of the trial will include submission of an operations report to the WMLR Environmental Flows Steering Committee on an 8 weekly basis, with a progress report submitted to both SA Water and the Adelaide and Mount Lofty Ranges Natural Resources Management Board every 4 months

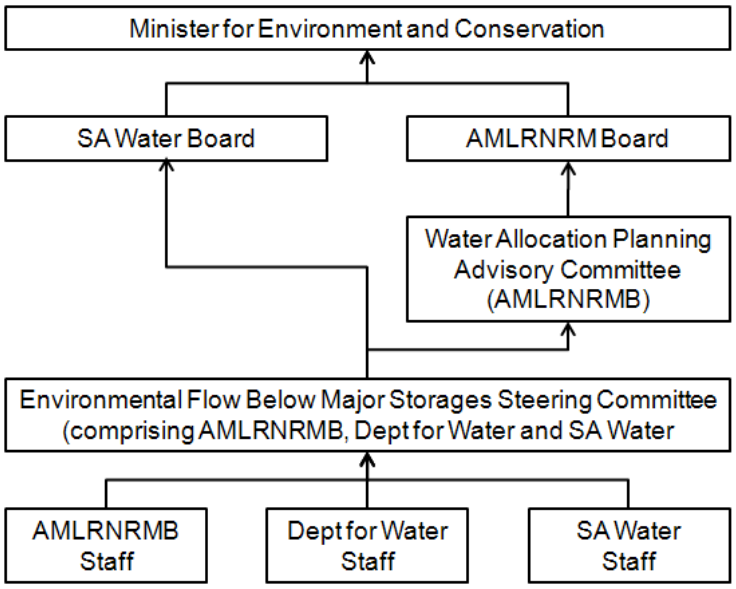

Figure 17. Governance structure for the environmental water provisions trial.

4 SUMMARY OF RESPONSIBILITIES AND COSTS OF TRIAL

A summary of the main tasks and responsibilities associated with the trial is presented in Table 4. Proposed timelines for tasks are presented in Table 5 based on the trial commencing in mid 2011. A summary of the major costs associated with the three year EWP trial is presented in Table 6. Costs associated with agency officer time are not accounted for in this estimate.

Table 4. Summary of responsibilities for EWP trial.

Task	Description	Responsibility*	Timeline
Develop EWP Trial	Develop recommended EWPs and protocols for trial.	WMLREFSC	End of March 2011
Implement EWP trial	Implement the trial according to recommendations.	WMLREFSC	Mid 2011 –Mid 2014
Develop monitoring and evaluation program	Develop detailed monitoring program to assist in evaluation of short term and long term ecological responses to flows.	AMLRNRMB, DfW and SA Water	End of March 2011
Implement ecological monitoring program	Monitor indicators of short term and long term ecological response to flow.	AMLRNRMB and DfW	Long term - April 2006. Short term - immediately prior to first flows.
Implement surface water flow monitoring program	Monitor surface water flow conditions and water releases from SA Water weirs.	AMLRNRMB, DfW and SA Water	Existing program
Trial reporting	Prepare operations, progress and annual reports.	WMLREFSC	4 monthly over period of trial
Trial evaluation	Evaluate short and long term ecological responses to flow.	WMLREFSC	12 monthly (short term) and end of trial
Final trial report	Prepare Final report on trial	WMLREFSC	December 2014 (with drafts available prior)

Table 5. Proposed timeline for trial.

Task	2011 (quarters)				2012 (quarters)				2013 (quarters)				2014 (quarters)			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Develop EWP Trial																
Implement EWP trial																
Develop monitoring / evaluation program																
Implement long term ecological mon. program													(prog continues) →			
Implement short term ecological mon. program																
Implement surface water flow monitoring program													(prog continues) →			
Trial reporting																
Trial evaluation																
Final trial report																

Table 6. Major costs associated with 3 year EWP trial (does not include in-kind costs).

Component	Item	Responsibility	Cost ($,000)					Total ($,000)
			Pre 2010/11[1]	2010/11	2011/12	2012/13	2013/14	
Pumping	South Para River EWP	SA Water	0	0	below	below	below	below
	River Torrens EWP		0	0	below	below	below	below
	Onkaparinga River EWP		0	0	below	below	below	below
		subtotals	**0**	**0**	**800**	**800**	**800**	**2,400**
Weir modification	Barossa Diversion Weir	SA Water	176	0	0	0	0	210
	Gumeracha Weir	SA Water, AMLR	310	0	0	0	0	270
	Gorge Weir	SA Water	0[3]	0	0	0	0	0[3]
	Clarendon Weir	SA Water	407	0	0	0	0	407
		subtotals	**893**	**0**	**0**	**0**	**0**	**893**
Monitoring & evaluation	Ecological monitoring	AMLRNRMB, DfW, other	216	TBA	TBA	TBA	TBA	TBA
	Surface water flow mon.[4]		Ongoing	40	42	44	46	172
		TOTALS						

1. Does not include in-kind costs or costs associated with EWR and EWP investigations by the AMLRNRM Board (and predecessors) and DfW (and predecessors).
2. Pumping costs estimated by SAW Major Systems based on representative 'average years'. They include energy cost and network charges. A breakdown for each river was not provided. Energy costs have increased slightly but network charges have decreased compared to the old electricity tariff.
3. No spend at Gorge as sufficient flow can be delivered from a valve on the transfer main.
4. Costs relate to operation and maintenance of stations, including data collation and storage. They are based on averaged costs incurred by the AMLRNRMB for station maintenance and indexed for inflation.

5 LINKS WITH PLANNING AND COMMUNITY ENGAGEMENT

5.1 Planning

The Western Mount Lofty Ranges was prescribed on 20 October 2005. Following prescription a water allocation plan must be prepared for the resource. The process to prepare the water allocation plan is clearly defined in the *Natural Resources Management Act 2004.* Under the Act, a water allocation plan must include an assessment of the quantity and quality of water needed by ecosystems, and allocate water so that there is an equitable balance between environmental, social and economic needs for water.

The environmental water provisions trial will provide important feedback to the water allocation planning process in relation to the above requirements.

The Act requires that in providing for environmental water requirements, an equitable balance is found between environmental, social and economic needs. Reaching agreement on the balance and therefore final agreement on the environmental water provisions (in terms of volume and timing of flows) is a complex process.

The negotiation of final environmental water provisions will form a part of the consultation to develop the water allocation plan, and the final provisions will be linked to SA Water's licensed allocation. However, the environmental flow trials will also need a comprehensive consultation and engagement process to inform key stakeholders and the community about the objectives and nature of the trials and its outcomes (in terms of ecological benefits achieved by the flows, and potential social and economic costs of providing the flows). It will also need to provide the community with the necessary information to be able to contribute to the determination of an equitable balance between environmental, social and economic needs for water.

The key stakeholders for this process, and therefore those that need to be involved in the consultation and engagement process are broad, and include both water users within the Western Mount Lofty Ranges, and water users in areas supplied by the SA Water reticulated water system (i.e. urban population).

5.2 Community engagement

A detailed consultation strategy is currently being developed for the development of the Western Mount Lofty Ranges Water Allocation Plan. The consultation program for the environmental flow trials will link to this consultation program.

Broadly the consultation program will need to address:

- The purpose of the trials;
- The role of flow in improved ecological outcomes; and
- Ongoing monitoring, and what the outcomes are showing about the success of the trials

The consultation program will need to include the key messages and issues that have become part of the national water resource industry landscape since reform of Australia's water management regulation began in 1994 with a strategic framework encompassing economic, environmental and social objectives. The framework was developed and agreed by the Council of Australian Governments (COAG) and includes the following key environmental water issues.

- Allocation of water for the environment.
- Ecological sustainability of new developments.
- The incorporation of environmental costs in water pricing.
- Ecologically sustainable water trading.

A range of methods could be used in the consultation process including:

- Wide media strategy – e.g. articles in local papers;
- Information and fact sheets available on websites; and
- Information sessions and meetings.

It is likely that a number of these activities can be linked to existing communication and engagement programs undertaken by the Adelaide and Mount Lofty Ranges Natural Resources Management Board, SA Water and the Department for Water, Land and Biodiversity Conservation.

The nature of the links to existing programs and the additional consultation activities required will be further defined once consultation strategies for the WMLR WAP and the AMLR NRM Board are completed.

6 COMPLEMENTARY WORKS

Watercourses may be strongly influenced (or dominated) by environmental factors other than reduced stream flows. Sites for this trial were, in part, selected on the basis that flow was the major environmental stressor, thus increasing the likelihood of achieving benefits by returning some flow. However, environmental water provisions may have limited benefits to the ecosystem without complementary actions to address the associated issues. By addressing these issues, the potential benefits of environmental flows may be both increased and accelerated. Complementary actions that may require some consideration are summarised in Table 7 together with recommendations for action and responsibilities in relation to those actions. Suggested timelines are presented in Table 8.

Table 7. Summary of complementary works.

Issue	Description	Recommendations	Responsibility
Barriers to movement of fauna	• instream storages, culverts, road crossings, gauging weirs.	1. Identify barriers, & prioritise works. 2. Identify works required to remove barrier. 3. Identify funds for works. 4. Implement works.	DfW/AMLRNRMB AMLRNRMB/landholder AMLRNRMB/landholder AMLRNRMB/landholder
Thermal pollution	• Water released from dams with low level outlets can be substantially colder than the ambient water temperature. • Low water temperatures favour exotic fish over natives.	1. Investigate influence of releases on temperature levels downstream. 2. Monitor potential impacts on native fauna and identify whether modifications are necessary. 3. Identify funds for works. 4. Implement works.	DfW/AMLRNRMB/SAW DfW/AMLRNRMB/SAW SAW SAW
Vegetation Management	• Current flow regime has produced conditions suited to invasion of riparian areas by terrestrial vegetation, and in some circumstances exotic weed species dominate the river channel. • May lead to loss of aquatic habitat, geomorphological change, reductions in water quality and biodiversity loss.	1. Develop prioritised work plans for weed management and revegetation. 2. Identify and secure budgets on three year rolling basis. 3. Implement works according to priority and budget availability.	AMLRNRMB/landholder AMLRNRMB/landholder AMLRNRMB/landholder
Exotic fish management	• Reduced water quality resulting from lack of fresh flows may favour exotic fish. • Declining pool size intensifies competition between exotic and native fish. • EWPs may inadvertently favour exotic fish over native fish	1. Identify contingency actions for managing exotic fish in the event that EWPs support exotic fish recruitment and distribution. 2. Monitor fish distribution, abundance and habitat condition. 3. Implement exotic fish management actions as indicated necessary by monitoring	AMLRNRMB DFW/AMLRNRMB AMLRNRMB/landholder

Table 8. Timeline for complementary works.

Issue	Recommendations	2011 (quarters)				2012 (quarters)				2013 (quarters)				2014 (quarters)			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Barriers to movement of fauna	1. Identify barriers to movement and prioritise for works.			EWP Trial Begins													
	2. Identify works required to remove barrier.																
	3. Develop investment strategy for works.																
	4. Implement works.																
Thermal pollution	1. Investigate influence of releases on temperature/DO.																
	2. Monitor potential impacts on native fauna.																
	3. Develop work plan and costings.																
	4. Implement works.																
Vegetation Management	1. Prioritised work plans for weed management/reveg.																
	2. Secure budgets on three year rolling basis.																
	3. Implement works.																
Exotic fish management	1. Identify contingency actions for managing exotic fish.																
	2. Monitor fish.																
	3. Implement exotic fish management actions.																