



5. Management objectives, actions and targets

The following tables detail proposed actions that contribute the long-term objectives of the UMDR. Many of the actions listed require the financial and in-kind assistance of existing project partners and additional stakeholders. Some of these actions are existing, and future, core business of partners that will contribute to the improvement of the Upper Murrumbidgee Demonstration Reach. Other project specific actions require targeted investment and support that will be proposed and managed by the UMDR project team (denoted ‘*’ in tables below). It will be the role of the UMDR project officer and members of the steering committee, to encourage support for priority actions to be undertaken in the Upper Murrumbidgee Demonstration Reach, whilst pursuing and encouraging linkages between the project and other related catchment initiatives.

5.1 Improving the management of surface water flows

Management objective: Flows are managed to maximise river health within the UMDR, especially for threatened native fish, other biota and ecological communities

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
1. Contribute to the review of existing ACT environmental flow guidelines	H	Improved E-flow guidelines	River flows that can support environmental values	2011	ACT Government agencies, local research institutions
2. Investigate environmental flow requirements of the UMDR to assist it meeting its vision	H	Improved E flow guidelines	E-flow guidelines that better address Murrumbidgee River needs and that are complementary between NSW and ACT	2011	Murrumbidgee CMA, ACT Government agencies, local research institutions, Industry and Investment (NSW) and other NSW Government agencies
3. Review potential impacts from the proposed ACTEW 'Murrumbidgee to Googong water transfer scheme' on the UMDR's priority 'assets'	H	Input into planning process	Impacts reduced as much as possible Identify potential offsets	2011	ACTEW, ACTPLA, Dept Industry and Investment (NSW) and other ACT and NSW government agencies
4. Environmental flow managers in NSW and the ACT establish ongoing collaboration	H	Collaborative mechanism or forum created	E-flow decisions being made collaboratively between NSW and ACT managers	2010	Murrumbidgee CMA, ACTEW, ACTPLA and other ACT and NSW government agencies
5. Collate details of licensed water extractors and their allowed take in NSW and the ACT Assess their impact on flows within the Upper Murrumbidgee River and the UMDR's priority 'assets' in particular	M	Extraction volumes and points known Real and potential impacts documented	Better knowledge of overall water 'budget' for the Upper Murrumbidgee, with opportunities for improving flows identified	2012	Murrumbidgee CMA, ACTEW, ACTPLA and other ACT and NSW government agencies
6. Document potential low-flow barriers to fish migration in NSW and the ACT portions of the Upper Murrumbidgee	H	Barriers identified, need for rectification prioritised and quantified as to when they become low flow impediments	Ability to recommend minimum flows required at critical times of the year, for example at times of native fish migration	Determined by availability of funds	Murrumbidgee CMA, relevant ACT Government agencies, research institutions, ACTEW, Industry and Investment NSW and other NSW Government agencies
7. Conduct an inventory of farm dams in the catchment and establish their role in affecting in-stream flows	M	Inventory completed	Appropriate actions taken to address impacts of farm dams on the UMDR, if required	2011	Murrumbidgee CMA, ACT and NSW Government agencies
8. Investigate groundwater-surface water interactions across the regions and for the river system especially	L	Groundwater systems across the region documented, including rates of extraction, and interactions with surface water bodies	Understanding of groundwater dynamics reflected in future UMDR planning and actions	Determined by availability of funds	Murrumbidgee CMA, CSIRO, ACT Government agencies, research institutions, ACTEW, Industry and Investment NSW and other NSW Government agencies
9. Document the expected impacts of climate change on flow patterns through the Upper Murrumbidgee over the coming 50 years	L	Broad predictions based on existing research for Australia	Predictions helping to forward plan within the context of the UMDR	Determined by availability of funds	Murrumbidgee CMA, relevant ACT Government agencies, research institutions, ACTEW, Industry and Investment NSW and other NSW Government agencies

5.2 Improving water quality

Management objective: Water quality 'hot spots' are addressed and broader, non-point source pollution reduced through behavioural changes by the community and stakeholders

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
1. Review and map major sediment and pollution input sources within the catchment of the Upper Murrumbidgee (where feasible) Collaborate with CSIRO (Sednet program) where appropriate	H	Ongoing monitoring at key sites along the UMDR and its tributaries	Improved understanding and targeting of sediment input sites	Ongoing	Waterwatch, Industry and Investment NSW and other NSW Government agencies, ACTEW
2. Identify sites in the catchment where remediation actions to address long-term sediment inputs are likely to be effective	H	Ongoing monitoring at key sites along the UMDR and its tributaries Prioritisation of sites for remediation	Targeted and strategic remediation of sedimentation input site	Ongoing	Murrumbidgee CMA, NSW DII, Waterwatch, ACTEW, ACT Government
3. Develop and implement a plan to address high impact pollution sources	M	Production of plan documenting alleviation of high impact pollution sources	Reduced pollution input to the UMDR	2015	ACTEW, ACT and NSW Government agencies, WaterWatch, ACTEW
4. Identify and rehabilitate high priority riparian sites in the UMDR and tributaries to protect water quality as well as conferring other benefits	H	Establishment of riparian assessment sites and photo points	Better understanding of the effectiveness of remediation works and areas of high value Prioritisation of sites for remediation	Ongoing	Waterwatch, Greening Australia, MCMA, Industry and Investment NSW and other NSW and ACT Government agencies
5. Continue to monitor water quality and flow levels through existing initiatives being taken by ACTEW, ACT and NSW governments, Waterwatch.		See separate M&E Plan			



5.3 Improving fish passage

Management objective: To allow native fish passage along the whole length of the demonstration reach

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
1. Review effectiveness of existing fishways (Casuarina Sands and Lower Cotter River) and modify as required. Consider the feasibility of carp trapping as part of these designs if recommended by the Carp Management Plan (see below)	H	Modification of existing fishways and incorporation of carp trapping capacity, where indicated	Fishways functional Improved fish passage Potential actions related to Carp Management Plan	2013	ACT Government agencies, ACTEW, MDBA, fishway designer, Industry and Investment NSW and other NSW Government agencies
2. Document, and prioritise for attention, other in-stream structures and other impediments to native fish passage	H	Prioritisation report	Reach-wide plan for fish passage	2010-11	MDBA, Industry and Investment NSW
3. Design appropriate fish passage remediation solutions for high priority barriers. Consider the inclusion of carp trapping as part of these designs if recommended by the Carp Management Plan (see below)	H	5-6 concept designs, including carp separation technology, if appropriate	Construction of 5-6 priority fishways, with carp traps as appropriate	2011 for concept designs	MDBA, Industry and Investment NSW and other NSW Government agencies, ACT Government
4. Liaise with relevant management authorities to facilitate the incorporation of fish passage considerations into maintenance or upgrade programs for existing instream infrastructure such as road crossings and weirs (Already done in the ACT)	M	Potential sites for amelioration identified Education of management authorities for use of fish-friendly river crossings when infrastructure is updated	Improved knowledge of fish passage issues by management authorities Fish-friendly river crossings used as standard within the reach	2011	MDBA, Industry and Investment NSW, Cooma Shire, ACT Govt
5. Determine the swimming ability of high priority native fish species within the project area to pass existing barriers at a range of water depths and velocities	M	Report on swimming capacities for priority native species, and barrier characterisation at priority barriers	Identification of priority barriers for remediation	Mid-2012	ANU, ACTEW and Industry and Investment NSW
6. Recommend flow regimes to overcome low-flow impediments to native fish passage – see flows objective above	M	Low-flow impediments identified Hydrological and geomorphic modelling conducted Swimming abilities of fish known (see above)	Flow targets recommended for all barriers	2015	Universities, research funding bodies, ACTEW, Industry and Investment NSW, ACT Govt
7. Monitor effectiveness of improved passage opportunities once installed or provided (See separate Monitoring and Evaluation Plan)	H	Fishway effectiveness monitored	Information for adaptive management available	As barriers are addressed	Australian National University, University of Canberra, Industry and Investment NSW, ACT TAMS

5.4 Improving the condition of in-stream habitats

Management objectives: To gain an understanding of where high value habitats for native fish and other aquatic fauna are located and maintain these and improve other sites to extend habitat availability

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
* 1. Survey and map the distribution and condition of in-stream habitats, identifying those of greatest importance to native fish and other aquatic fauna (see Action 5.5.2 also)	H	Inventory of habitat extent and condition Determination of what habitats are most important	Knowledge of where to focus protection or remediation efforts	2015	ACT TAMS, Industry and Investment NSW, MDBA, universities
* 2. Investigate status and effectiveness of existing habitat rehabilitation measures (groynes) at Tharwa	M	Report on status and effectiveness of groynes	Knowledge on whether to expand existing measures or to use at other sites	Mid-2011	ACT TAMS, University of Canberra, consultant engaged to recommend sand slug mitigation measures, Industry and Investment NSW
* 3. Investigate the cost-benefit and feasibility of installing in-stream structures (jams and groynes) to restore deep pools	M	Report identifying potential sites and feasibility	Information for targeted interventions at high priority sites	Mid-2011	ACT TAMS, Industry and Investment NSW, consultant
* 4. Investigate cost-benefit and feasibility of ecological mitigation to improve native fish habitat at sediment deposition sites	H	Feasibility investigated	Knowledge of whether mitigation for conservation purposes is feasible	End 2010/11	MDBA, ACT TAMS
* 5. Investigate potential for income generated from ecological mitigation to be returned to aquatic habitat restoration activities	H	Feasibility investigated	Funding generated	Late-2010	ACT TAMS, Industry and Investment NSW
* 6. Establish monitoring of identified key habitats and locations where interventions are undertaken to help improve habitat availability and connectivity		See separate M&E Plan			ACT TAMS, Industry and Investment NSW

* Project specific actions, refer page 67



5.5 Supporting the recovery of threatened native fish and 'icon' species

Management objectives: Threatened native fish species and selected 'icon' species (see Asset 5 in Section 4) of this reach are secure and provided with opportunities to increase and expand their geographical coverage

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
* 1. Contribute to the collection of baseline and ongoing data on fish communities in the ACT portion of the UMDR, and seek to see this undertaken in the adjoining NSW portions	H	Ongoing fish monitoring	Information available for management of fish populations	Ongoing	ACT TAMS, ACTEW, Industry and Investment NSW, Murrumbidgee CMA
* 2. Compile an inventory of critical habitats for threatened species and their locations, and prioritise for management actions (see Action 5.4.1 also)	H	Inventory of critical habitats	Information for priority instigation of management action	2012	ACT TAMS, Industry and Investment NSW, University of Canberra
3. Undertake targeted threatened species recovery actions, including monitoring and stocking, according to national and jurisdictional guidelines and recovery plans, and inventory of critical habitats below Actions here to be considered in terms of native fish populations above and below Gigerline Gorge	H	Specific recovery actions completed for priority species	Improved conservation status for threatened native fish species	As resources can be allocated	ACT TAMS, ACTEW, Industry and Investment NSW, Murrumbidgee CMA
4. Protect and/or help restore critical fish habitats associated with threatened species (for example riffles or critical pools for Macquarie perch)	H	Plans for site remediation or protection	Priority habitats protected or restored	As resources can be allocated	ACT TAMS, Industry and Investment NSW
* 5. Ecological mitigation to improve native fish habitat at high priority sites (see 5.3 also)	M	Ecological mitigation at priority sites	Improved availability and stability of aquatic habitats	As resources can be allocated	ACT TAMS, Industry and Investment NSW, private industry
* 6. Promote actions designed to increase and secure populations of the selected 'icon' species	M	Specific actions completed for 'icon' species	Improved conservation status for 'icon' species	As resources can be allocated	ACT TAMS, ACTEW, Industry and Investment NSW, Murrumbidgee CMA, non-government organisations and community groups

* Project specific actions, refer page 67

5.6 Improving riparian habitat condition and connectivity

Management objective: Riparian health and habitat connectivity are returned along the river corridor and laterally into surrounding landscapes

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
* 1. Survey and map the distribution and condition of riparian vegetation and habitat in the NSW parts of the UMDR to complement work already completed in the ACT	H	Distribution and condition maps for the full UMDR	Improved knowledge of vegetation and habitats	Funding dependant	Murrumbidgee CMA, ACT TAMS, ACTEW
* 2. Identify priority areas and opportunities to re-establish riparian corridors and vegetated links into the surrounding landscapes	M	ACT working from south to north from border to border 100,000 number of trees planted Database of species mix	Connectivity, remnant enhancements, reduced sediment and nutrient input, stabilisation	ACT section complete in five years under the One Million Trees project	ACT TAMS, Greening Australia, Parkcare, Outward Bound, CVA, Industry and Investment NSW
3. Review existing schemes that encourage landholders along the river corridor to undertake restorative works such as stock exclusions, weed control, re-plantings and seek ways to focus these, or establish new schemes (such as River Tender) to see the works undertaken	H	Improve on current schemes available Encourage landholder participation	Improved water and vegetation quality Increased knowledge among landholders	Continual	Greening Australia
* 4. Support the work of non-government organisations(NGOs) keen to assist landholders undertake riparian habitat rehabilitation	H	Wider group of NGOs involved	Increased knowledge among participants	Continual	Broad across community facilitated by UMDR project officer, GA, MCMA

* Project specific actions, refer page 67



5.7 Reducing the impacts of introduced plants

Management objective: The distribution and abundance of introduced plant species within the UMDR and surrounding areas is reduced and control measures are maintained to prevent re-invasions

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
* 1. See Action 5.6.1 above Survey and map the distribution of introduced plants species in the NSW parts of the UMDR to complement work already completed in the ACT	H	Distribution maps of weeds for the full UMDR	Plans for future coordinated control works	Depends on resource availability	Murrumbidgee CMA, ACT Research and Planning from Territory and Municipal Services (TAMS)
* 2. Support, encourage or assist targeted, ongoing willow, blackberry and poplar control efforts	H	Reduced invasive weed cover	Native plant regeneration	Ongoing due to the need for follow-up control works	Landholders, Murrumbidgee CMA, ACT Research and Planning staff from TAMS
3. Continue to monitor the impact of sawfly larvae on willow populations	M	Better understanding of impact	Localised impacts only so direct control still required	Ongoing	CSIRO
4. Where appropriate, contribute to ongoing forum and research into the control and adaptive management related to African lovegrass	M	Reduced African lovegrass cover	Native grass and wildflower regeneration	Ongoing	Upper Murrumbidgee Catchment Coordinating Committee, MCMA, NSW DII, ACT TAMS, K2C, Landcare
5. Investigate, through collaboration with existing programs, opportunities to control serrated tussock	H	Reduced serrated tussock cover	Native grass and wildflower regeneration	Ongoing	Leaseholders
6. Encourage community-based monitoring and involvement (where feasible) in the control of weed species	M	See separate M&E and CEPA Plans			

* Project specific actions, refer page 67

5.8 Reducing the impacts of introduced animals

Management objective: The impacts of introduced animals (carp and redfin perch especially) on the assets of the UMDR are reduced

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
1. Develop a carp management plan for the project area	H	See separate regional carp plan	Improved river health, including habitat for native species, following sustained carp control	Completed	MDBA, RiverSmart, ACT TAMS, UCan
* 2. Implement the carp management plan, including community engagement activities (see separate CEPA Plan also; see also 5.3 in relation to improving fish passage)	H	On-ground implementation of activities identified in regional carp plan	Improved river health, including habitat for native species, following sustained carp control	2012	MDBA, Industry and Investment NSW, Canberra & SE Region Environment Council, local fishing groups, WaterWatch, ACT TAMS
3. Develop and prioritise strategies to identify and address other priority fish pest species within the reach and adjoining regions	M	Specific actions for control of high priority species	Pest fish plan for the UMDR	2012	MDBA, Industry and Investment NSW
4. Support educational programs to raise awareness of the threats posed by live bait fishing, ill-advised fish stocking, disposal of unwanted aquarium fish and illegal fishing practices	M	See separate CEPA Plan			
5. Support ongoing pest animal control programs targeting rabbits, deer, foxes and feral cats, and where possible encourage stronger landholder uptake	M	On-ground implementation of activities designed to reduce terrestrial feral pests	Reductions in the incidence and abundance of terrestrial feral pests	Ongoing	ACT TAMS, Leaseholders/landholders
6. Promote education of urban dwellers of the threat posed to wildlife from uncontrolled domestic cats and dogs	L	See separate CEPA Plan			

* Project specific actions, refer page 67



5.9 Enhancing understanding and appreciation of Aboriginal cultural heritage assets

Management objectives: To gain a better understanding of the Aboriginal cultural heritage values of the reach and incorporate consideration of these values into management of the reach

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
1. Support documentation of the Aboriginal culture and cultural heritage values of this reach by the local Aboriginal community, in order to guide future management actions	H	A GIS map showing sites of particular importance to the Aboriginal community	Aboriginal communities are better engaged in the project and sites of value are protected	To determined by availability of funding	ACT NRM Council, TAMS, Murrumbidgee CMA, Heritage ACT
2. Incorporate Aboriginal cultural heritage sites (where appropriate) into the UMDR Plan for integration of natural and cultural heritage management	H	Sites are listed and mapped in the relevant heritage management plans/legislation are considered in future management decisions	Natural and cultural heritage values are better integrated to result in improved overall management of the demonstration reach	To determined by availability of funding	TAMS, Project Officer, ACT Heritage & DECCW, Heritage ACT
3. Actively engage Aboriginal people in the development of all aspects of the UMDR to ensure where suitable that all interest and concerns are given appropriate outlets within the initiative	H	Where possible, Aboriginal input to the development of all aspects of the UMDR	Where possible, Aboriginal input to the development of all aspects of the UMDR	Ongoing	ACT NRM Council, United Ngunawal Elders Council, Dept Housing and Community Services (ACT), Ngarigo peoples, Mogo Aboriginal Land Council, Wagonga Aboriginal Land Council
4. As part of the CEPA Plan for the UMDR ensure that Aboriginal culture (including language and art) and cultural heritage are highlighted and included in on-site signage and educational materials	H	See separate CEPA Plan			

5.10 Enhancing understanding and appreciation of European cultural heritage and recreational values

Management objective: To gain a full appreciation of European cultural heritage and recreational values of the UMDR and incorporate consideration of these values into management of the reach

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
1. Document European cultural heritage values and recreational values of the UMDR in order to include their appreciation and management into this plan	M	Report with stock-takes and updates of existing and new information	Improved understanding of current condition, management of assets, etc.	2015	Heritage ACT, Heritage Council of NSW
2. Incorporate listings of European cultural heritage sites and recreational assets into the demonstration reach plan for integration of natural and cultural heritage management	M	Definitive list of assets and their management requirements	Improved understanding of European cultural significance along the reach	Ongoing	Heritage ACT, Heritage Council of NSW
3. As part of the CEPA Plan for the UMDR ensure that European cultural heritage assets are highlighted and included in on-site signage and educational materials.	H	See separate CEPA Plan			



5.11 Ensuring sound governance and maximising funding opportunities

Management objective: The UMDR project is undertaken according to expected procedures and processes for accountability and transparency, and through an open and consultative process

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
<p>* 1. Demonstration reach plan developed to integrate and guide future investment, on-ground works, monitoring and community consultation needs of the reach</p>	H	<p>Published report available online as a downloadable PDF</p> <p>Consultative meetings with at least ten ACT and NSW community groups and organisations</p>	<p>Strategic cross-border planning approach to catchment management</p> <p>Framework from which to undertake high priority on-ground works at key sites</p> <p>Model to encourage further investment, particularly co-investment by the corporate sector</p> <p>Clear strategy for the project's connection and promotion to the broader community</p> <p>Collaborative partnerships developed and enhanced with a range of ACT and NSW government and community organisations</p>	Mid-2010	All project partners with RiverSmart Australia having a facilitation role for initial planning and community consultation
<p>* 2. Development of a rigorous M&E program to support the demonstration reach plan, aligned with the Commonwealth's NRM monitoring, evaluation, reporting and continuous improvement framework and including the recommendation of Boys et al. 2008</p>	H	<p>Establishment of an M&E committee with membership from key aquatic and terrestrial scientists</p> <p>Reviewed and published monitoring framework available online as a downloadable PDF</p>	<p>Scientifically rigorous monitoring framework to guide assessment of the effectiveness of on-ground activities</p> <p>Quantified river health improvements that can be publicised to the broader community and contribute towards national accounting and reporting targets</p>	2010	All project partners

ACTIONS	PRIORITY	KEY OUTPUTS ANTICIPATED	ANTICIPATED OUTCOMES	TIMEFRAME FOR COMPLETION	POTENTIAL LEAD ORGANISATIONS
* 3. Establish a project officer (or other arrangement) to effectively link project partners, with an active role in communicating and consulting with the community	H	Actively linking and communicating with the project partners, demonstration reach plan, monitoring program, community field days, community meetings, development of project extension material, and project media releases	Facilitate strengthened collaborations between ACT and NSW organisations, community groups and individuals	Ongoing	ACT TAMS will host and supervise this position
* 4. Undertake all aspects of contract management, funds administration and accountability for the project to high standards	H	A steering committee made up of all project partners	Project accountability and clearly identified means of liaising with the Commonwealth Government on behalf of the project and its partners Coordination of project delivery and communication of project outcomes Project well linked with other regional NRM projects and meeting the targets of ACT and Murrumbidgee's NRM plans		ACT NRM Council (CFOC grant), ACT TAMS (MDBA grant)
* 5. Continually investigate investment and partnership opportunities in the demonstration reach and implement strategies to encourage ongoing investment in the project	H	A strategy developed to target partnership investment opportunities with governments; industry and corporations	A demonstration reach project with high profile and financial stability		ACT NRM Council; Project Officer, RiverSmart and Industry and Investment NSW

* Project specific actions, refer page 67

6. Monitoring asset condition and impact of actions

A technical reference group will be formed under this project (see Section 3.3.2) to develop and guide the implementation of a monitoring and evaluation (M&E) plan.

A fundamental requirement of a demonstration reach is the need to measure ecosystem condition before and after interventions, in order to demonstrate changes to river health as a result of works carried out (MDBC 2004). Consequently a robust M&E plan will be developed to underpin the on-ground activities carried out as part of the Upper Murrumbidgee Demonstration Reach that will align with the national natural resource management Monitoring, Evaluation, Reporting and Improvement (MERI) framework. The proposed M&E plan will also incorporate recommendations from a report on the monitoring and evaluation of demonstration reaches, recently compiled for the Murray–Darling Basin Commission (Boys et al. 2008).

The reach is fortunate to possess almost thirty years of long-term monitoring data for ACT fish communities (Lintermans 2002). This is probably unique in Australia and provides a benchmark of condition against which to measure the success of rehabilitation measures. ACT Research and Planning (TAMS) have in-house capability to undertake aquatic ecology monitoring and links are being established with the academics and students at Canberra's universities.

The proposed technical reference group will comprise members with expertise in scientific and community based aquatic research and monitoring in order to design a monitoring program that includes both targeted and surveillance monitoring components. Targeted monitoring will evaluate the success of particular interventions such as the removal of barriers to fish passage, and surveillance monitoring will measure changes in overall ecosystem condition and resilience. Components of the monitoring program will include:

- fish passage monitoring (pre- and post-monitoring of barrier remediation works to determine the success of fish passage works)
- a commitment to ongoing fish community monitoring at long-term sites, in order to benchmark changes in overall condition
- contributions to the determination of environmental flow effectiveness through monitoring of targeted ecological processes such as native fish recruitment, maintenance of drought refuge integrity (habitat and water quality)
- river flow monitoring to assist with determination of environmental flows, including their timing and delivery (by ACTEW flow monitoring stations)
- riparian condition assessment and monitoring to link terrestrial with aquatic health indicators
- sand slug monitoring (fish passage, habitat diversity, water quality impacts, and sand deposition)
- water quality monitoring by EcoWise, Water Watch and Frogwatch. This data will be used to engage the Canberra community in monitoring the effects of urban stormwater impacts.