

# **Lake Burley Griffin Action Plan**

*A Healthier, Better Functioning Lake by 2030*

## **Lake Burley Griffin Task Force**

ACT Government | National Capital Authority | Queanbeyan City Council | Palerang Council | ACTEW  
Water

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## Introduction

The Griffin plan for Canberra saw the Lake as the key unifying element, with a lakeside becoming less formal and more naturalistic as it progresses from the city centre. Griffin originally envisaged three formal basins with more natural areas forming the eastern and western extent of the Lake. The Lake continues to act as the central stage of Griffin's 'amphitheatre' of hills, designed to display national monuments reflected in its ornamental waters. Its location in the centre of the city offered Griffin the opportunity to create one of the world's great central parks – 'playground of the city' as Griffin described it. Griffin's plan saw large stretches of natural parkland alternated with judiciously sited urban waterfront developments.

Much of the original design conception of the Lake has been realised in the landscape setting of the Lake for the National Capital. However, many of the more formal aspects of the original design have been relaxed.

The *Lake Burley Griffin Management Plan 2011* identifies a number of additional values that the Lake now has in terms of natural heritage values – the Lake is a living freshwater system, providing habitat for a variety of species and for water resource management – the Lake plays a role in managing stormwater and for irrigation. These values have come under pressure from increases in the Canberra population and seasonal fluctuations in rainfall and climate.

In April 2012, the Commissioner for Sustainability and the Environment released the report of his inquiry into "*the State of the Watercourses and Catchments for Lake Burley Griffin*". The Commissioner's report can be found at [http://www.envcomm.act.gov.au/investigations/lake\\_burley\\_griffin\\_investigation](http://www.envcomm.act.gov.au/investigations/lake_burley_griffin_investigation).

## Current State of the Lake

The Commissioner's inquiry found that the key water quality issues for Lake Burley Griffin (assessed from 1978 to 2010) were:

- low dissolved oxygen levels caused by the decomposition of organic matter in urban stormwater flowing into the Lake;
- blue-green algae blooms caused by the release of phosphorous from sediments, when dissolved oxygen is low with a poor mixing of the water column, especially during dry periods; and
- the loss of submerged and fringing water plants caused by increasingly turbid Lake water which contributes to low dissolved oxygen levels.

The Commissioner also found that the main sources of faecal pollution in the Lake were urban run-off, wildlife, re-growth of bacteria already in the Lake and possible leakages from sewer pipes. The Commissioner further concluded that the Queanbeyan City Council Sewerage Treatment Plant is not a consistently significant source of faecal pollution except when infrastructure fails or overflows occur, such as during the floods of 2010.

Similarly, rural catchments were not of themselves a significant source of nutrients or turbidity in the Lake. However, the condition of these catchments needs to continue to be improved as during periods of high rainfall they continue to contribute to water quality issues in the Lake.

## The Task Force

Following the tabling in the ACT Legislative Assembly of the Commissioner's Report, in June 2012 the ACT Chief Minister, Katy Gallagher MLA, met with senior representatives from the National Capital Authority, Queanbeyan City Council, Palerang Council and Cooma-Monaro Shire. Arising from that meeting the Chief Minister directed that the ACT Environment and Sustainable Development Directorate convene a Senior Officials Task Force with the aim of developing an Action Plan to improve water quality in Lake Burley Griffin, with this Report to be submitted by the end of August 2012.

The Terms of Reference developed by the Task Force (**Attachment A**) were to:

- identify short, medium and long term actions that can be undertaken to improve overall lake water quality, highlighting the benefits that each action can provide;
- identify the contribution of participating jurisdictions and their responsibilities for undertaking identified actions; and
- outline a program of works to undertake these actions and identify budget constraints and opportunities associated with each action.

The Members of the Task Force were:

- Environment and Sustainable Development Directorate (ESDD): Mr David Papps (Chair) Mr Alan Traves (alternate Chair), Executive Director, Policy; Mr Daniel Walters, Director, Environment Protection and Water Regulation (Environment Protection Authority); David Butt, Executive Manager, Water Policy
- Territory and Municipal Services Directorate (TAMSD): Ms Jane Carder, Manager, Place Management
- Chief Minister and Cabinet Directorate (CMCD): Mr Brook Dixon and Mr Richard Bontjer, Director, Economic, Regional and Planning
- Health Directorate (HD), Mr John Woollard, Director, Health Protection Service
- National Capital Authority (NCA): Mr Gary Rake, Chief Executive
- Queanbeyan City Council (QCC): Mr Phil Hansen, Group Manager, City Infrastructure
- Palerang Council (PC): Mr Simon Holloway, Environmental Services Coordinator
- ACTEW Water, Mr Ross Knee, Executive Manager, Water Strategy.

Cooma-Monaro Shire declined to participate in the Task Force on the grounds that their Shire boundary fell largely outside the Lake catchment.

While the primary responsibility for the overall management of the Lake and the immediate foreshore rests with the Commonwealth through the NCA, the composition of the Task Force reflects the multi-jurisdictional nature of contributions to the management of the Lake's catchment both within the ACT and in the Molonglo and Queanbeyan Rivers and Jerrabomberra Creek catchments into New South Wales. TAMSD has responsibility for management of public land, the stormwater system and for road sweeping in the ACT. QCC and PC have similar roles in their shire boundaries in NSW as well as responsibility for sewerage. ACTEW Water is responsible for management of the ACT sewerage system. HD is responsible for health protection issues relating to the Lake.

The Task Force was supported by a Secretariat supplied by the ESDD.

The Task Force also sought the input of an Expert Panel to provide specific technical advice on any of the proposed remedial actions for the Lake. The members of this Panel (Dr Steven Skinner, Dr Bill Phillips and Dr Ralph Ogden) were chosen to compliment the technical advice already provided to the Commissioner in the preparation of his report by contributing additional perspectives on the issues raised. A short biography of Expert Panel members is at **Attachment B**.

Additionally, the views of key community stakeholders and Catchment Groups were sought through a workshop held on 25 July 2012. These groups included the:

- Molonglo Catchment Group;
- Upper Murrumbidgee Catchment Coordinating Committee;
- Queanbeyan Landcare;
- Lake Users' Group;
- Ginninderra Catchment Group;
- Southern ACT Catchment Group; and
- Tuggeranong Community Council.

Community organisations concerned with Lake Tuggeranong and Lake Ginninderra were invited to the workshop given the similarity of issues also affecting these lakes. The workshop provided a constructive contribution to the development of the Action Plan.

## **A Healthier, Better Functioning Lake by 2030**

The Task Force reviewed and examined the recommendations made by the Commissioner for Sustainability and the Environment in his report and accepted them, in-principle, as a basis for developing the Action Plan (**Attachment C**). The Action Plan also incorporates a range of additional actions contributed by Task Force members, the Expert Panel and stakeholders that serve to further emphasise the role of evidence based management decisions.

The Taskforce concluded that many of the pressures now placed on the Lake have developed over a period of years and that a significant (but not exclusive) driver has been the consequences of population growth and its resulting development and construction activities. All parties, including those community groups consulted, agreed that easy, quick-fix remedies were not scientifically or practically possible. A concerted and planned response, over time, was collectively acknowledged as representing the most viable way forward to ensure a sustainably healthy lake into the future.

The remedial actions outlined in the Action Plan are, accordingly, provide a diverse but inter-related mix of recommendations that are considered appropriate for the current level of knowledge about the causes of blue-green algal blooms and the recognition of the current health status of Lake Burley Griffin.

While budget constraints are acknowledged through the prioritisation of management and remedial actions, the approach adopted in this Plan is based on a mix of expert advice and scientifically sound adaptive management, which is considered most likely to lead to efficient sustainable outcomes.

There is no single causative factor for blue-green algal blooms. While organic matter in urban run-off is recognised as a primary driver, other factors also contribute and may, themselves, also be primary

drivers at particular times of the year or season (e.g. temperature stratification (layering) in the water column). Consequently, the Action Plan adopts the approach of treating holistically the diverse mix of factors identified as possible environmental drivers, namely nutrients, mixing of the water column, detention times of Lake water, temperature and light conditions.

The Action Plan also addresses faecal contamination as a cause of poor water quality through a series of systematic actions addressing the contamination at its source – both rural and urban.

The proposed actions recognise that improving the condition of the Lake will not happen quickly, nor should the expectation be to achieve a future Lake with pristine environmental qualities. Lake Burley Griffin was designed and constructed to:

- provide a central symbolic element to the National Capital;
- provide for aquatic recreational activities;
- provide for limited water abstraction; and
- manage stormwater discharge from surrounding suburbs.

The Action Plan proposes a coordinated program of short, medium and long term actions in and around the Lake itself as well as in the ACT and adjoining NSW catchments. These actions are designed to address the health of the Lake in the context of continuing urban growth and climate variability, with the aspiration of achieving progressive and measurable improvements. Short-term actions are proposed to have an impact in less than two years, medium-term actions to 5 years and long-term actions longer than 5 years. Annual reporting on implementation is envisaged.

The Task Force recommends a number of key actions that are intended to have a high impact on improving the health of the Lake and its management. While they are not in priority order, they are arranged in a logical structure to ensure a coordinated and comprehensive response.

It is important to note, that all Taskforce jurisdictions and stakeholder groups attached high importance to the creation of a single acknowledged coordinating body to ensure that the Actions outlined in this Plan are delivered and effectively reported upon.

## ***Governance and Community Engagement***

### **Key Actions**

#### **A Statutory Catchment Office (Task Force Recommendation)**

Consideration should be given to establishing a statutory office responsible for the coordination of actions in relation to catchment management across the ACT and interstate catchments relevant to the ACT. The proposed office would be responsible for the actions outlined in this Plan that are endorsed by Task Force member Governments and for the development and monitoring of programs to deliver those outcomes. Facilitating legislation would be required to provide sufficient authority for the effective undertaking of this role. This role should specifically include working collaboratively with the Australian Government, and NSW State and local governments in catchments relevant to the ACT.

#### **An Intergovernmental Catchment Management Agreement (Inquiry Recommendation)**

It is proposed that a formal agreement between the ACT, Australian Government and NSW State and local governments that reflects shared aspirations and an enduring commitment to improving the condition of the Lake and its catchment be entered into. The role, function and priority setting of the

proposed Statutory Catchment Office in cross border catchment management issues would be addressed in this Agreement.

**A Lake Burley Griffin Catchment Management Strategy (Task Force Recommendation)**

A Strategy would be developed by the proposed statutory catchment office as an Action Plan and structured work plan with clearly developed targets in the short, medium and long term. The Strategy will need to continue to evolve as new approaches are trialled and assessed. The Strategy would address stakeholder aspirations and provide a framework for monitoring and reporting progress to stakeholders as well as identifying priority investment opportunities.

**An Ongoing Catchment Management Expert Panel (Task Force Recommendation)**

The proposed statutory catchment office adopt science-based adaptive management approach to addressing the health of the Lake offers the most efficient long-term solution. An expert panel of catchment water quality experts, algal ecologists and ecological modellers should be established to work with Governments and the community to guide future actions. Initial priorities would be a rigorous examination of current scientific evidence. This Panel would operate on an as-needs basis along similar lines to the existing Environment Flows Technical Advisory Group.

***Community Awareness Raising and Education***

**Key Actions**

**A comprehensive catchment education, awareness and community behaviour change program (Inquiry Recommendation)**

The Task Force sees a pressing need for improved community education, awareness and behaviour change to reduce the impact of urban residential inflow into the Lake of nutrients from organics and sediment. A targeted program in urban areas of Canberra and Queanbeyan would focus on promoting the collection and composting of leaves, lawn clippings and other garden waste as well as appropriate use of fertilisers.

**A volunteer-driven Lakecare program (Task Force Recommendation)**

In a coordinated and strategic approach, community catchment and Landcare groups would work with Government to remove woody weeds, rehabilitate water plant beds, remove litter, and raise awareness of the issues affecting Lake health. Riversmart Australia and Conservation Volunteers Australia have already established a Lakecare program on Lake Burley Griffin which could serve as a model for other urban lakes.

## ***In-Lake Management***

### **Key Actions**

#### **Enhanced water quality and lake and river vegetation monitoring data to inform future action (Task Force Recommendation)**

Comprehensive and systematic collection and analysis of data on the environment of the Lake and its catchments is key to understanding the drivers affecting water quality and events like algal blooms. Monitoring both remote and physical for real time data from key locations will assist in the management of day to day issues and act as an early warning of changed conditions that may lead to algal or contamination events.

The NCA, ACT Government, ACTEW Water and the Molonglo Catchment Group all currently monitor water in the Lake and its catchments. The Taskforce sees merit in better coordination of these existing activities, identifying overlaps and gaps and acting to improve the overall effectiveness of the program. This would enable more accurate and timely management responses as well as better capacity to model future events, including algal blooms. Improved Lake and river vegetation monitoring would also inform ongoing Lake and riverbank rehabilitation works as well as sources of turbidity (cloudiness) and other pollution.

The Task Force also recognises the importance of communicating effectively information about the condition of the Lake. This requires the translation of technical monitoring data into readily accessible formats. Options for 'plain –English' forms of reporting will be explored, including scope for improving the current annual ACT Water Quality Report.

#### **Improved algal bloom prediction capability (Task Force Recommendation)**

Enhancing algal bloom modelling capability would improve understanding of the impact of interventions in the Lake water column and the catchment as a whole.

#### **Trials of submerged and fringing water plant restoration (Inquiry Recommendation)**

Plants in the Lake play a critical role in oxygenating and taking up nutrients in the water making it less susceptible to algal blooms. The NCA is trialing, with the assistance of Greening Australia Capital Region, the re-establishment of fringing and submerged water plants at a number of test sites around the Lake. A detailed assessment of a range of options to increase plant life in the Lake, including floating water plant beds, is proposed.

#### **Lake sediment treatment (Inquiry Recommendation)**

Sediments entering the Lake carry nutrients that effect biological activity. Sediments also affect the clarity of the lake water and the growth of water plants. Excessive nutrients attached to sediment particles, like phosphorous, encourage algal blooms. Reducing the flow of phosphorous into the Lake as well as 'locking up' phosphorous in sediments is a priority. Phosphorous also re-activates (re-enters) the water column from sediments when the Lake water is low in oxygen and is then available to blue-green algae.

It is proposed that a comprehensive assessment be undertaken of the use of chemical treatments such as 'Phoslock', that have been demonstrated in other lakes to remove phosphorous from the water as well as binding it in lake sediments inhibiting the reactivation of phosphorous.

#### **Water column manipulation (Inquiry Recommendation)**

Stratification of lake water by temperature at different depths in the Lake leads to anaerobic (low or no-dissolved oxygen conditions) at different times of the year. This lack of mixing promotes algal blooms.

The NCA proposes to continue trials of solar powered water column mixers at several locations in the Lake to establish the feasibility and effectiveness of this method, in terms of costs and environmental impact.

#### **Carp management (Task Force Recommendation)**

European carp are a pest animal in the Lake and the wider catchment. Carp have significant effects on native aquatic plants both through direct grazing and through uprooting plants while feeding, leading to a reduction in plant density and biomass. Soft-leaved, shallow-rooted and submerged plants are most likely to be affected. Their disturbance of the Lake bottom whilst feeding reduces light penetration, which can make it difficult for native fish that rely on sight to feed. Reduced light can also decrease plant growth, and suspended sediments can smother plants and clog fishes' gills.

Targeted carp removal is proposed in identified hotspots where the fish congregate for spawning or where water temperatures are favourable. A watching brief will be maintained on emerging management and control measures, especially biological control options. Carp fishing competitions should continue to be promoted to maintain community awareness of the need to manage this pest.

### ***Urban Catchment Management***

#### **Key Actions**

##### **Ongoing renovation of stormwater system (Task Force Recommendation)**

Roads ACT, Queanbeyan City Council and Palerang Council routinely assess the maintenance and upgrade requirements of their stormwater networks. This data will inform upgrade proposals that can be costed to reflect the impact on the Lake for a triple bottom line assessment. This information will become increasingly important as the stormwater asset in inner Canberra near the end of their design life and options for replacement are considered.

##### **Review of the application of Water Sensitive Urban Design and its impact on water quality (Inquiry Recommendation)**

A comprehensive review of the existing regulations is proposed under a revised long term water strategy, so that its application meets national best practice standard or better and that the water quality outcomes achieved are at the most economical cost. Key issues for consideration include appropriate siting, design (including size), construction costs, co-benefits (such as for irrigation, stormwater detention and amenity) as well as maintenance.

### **Further wetlands and pollution control structures (Inquiry Recommendation)**

The review of Water Sensitive Urban Design would include a systematic assessment of catchments to test the appropriateness and cost effectiveness of interventions such as ponds and pollution control structures. Based on evidence from monitoring and research into the effectiveness of the design of structures, decisions can be taken on if or where such wetlands and pollution control structures would be beneficial to the overall catchment.

### **Enhanced compliance during construction phases of development (Inquiry Recommendation)**

The *Environment Protection Act 1997* requires proponents undertaking construction and development works on sites greater than 3000 square metres to hold an Environmental Protection Agreement with the Environment Protection Authority (EPA). A condition of the Agreement is that works must be undertaken in accordance with the *Environment Protection Guidelines for Construction and Land Development in the ACT* (EPA, March 2011). The Agreement also requires the proponent to submit a Sediment and Erosion control Plan for approval by the EPA prior to works commencing. For sites less than 3000 square metres, all development proponents must submit details of sediment and erosion controls with their development application to the ACT Planning and Land Authority.

Under the *Environment Protection Act 1997*, it is an offence for a person to allow any substance other than rainwater to enter the stormwater system. Contraventions of the Act can lead to an on-the-spot fine of up to \$200 for an individual or \$1,000 for a company. More serious offences can lead to penalties of up to \$55,000, six months in jail and a criminal record.

The EPA would continue to work closely with the development and construction industry to ensure improved compliance with the approved Sediment and Erosion Control Plans, including the adequacy and maintenance of the sediment and erosion control structures both during development and in the consolidation phase after development with the objective of minimising sediment flows into the Lake.

### **Enhanced programs to prevent leaves and other organic matter entering stormwater (Inquiry Recommendation)**

Leaves and other organic matter entering the stormwater system and then into the Lake are a key contributor to increasing nutrient levels. This is especially evident in autumn and in wetter periods when plant growth is more vigorous.

Opportunities will be investigated to increase the effectiveness of street sweeping and landscape maintenance programs to capture this material before it enters drains. Management of public land and roads needs to complement efforts to inform landholders in the Lake catchment about the potential impact of their own behaviour in managing their leased land.

The potential for market-driven mechanisms, for using this organic matter for commercial purposes, will be explored, as will community based options, including community composting.

### **Better managed gross pollutant traps (Inquiry Recommendation)**

Gross pollutant traps (GPTs) are designed to prevent larger pollutants such as coarse sediments, bottles, cans, paper, branches and other litter entering waterways and lakes. Once these traps are full they are bypassed or water flows over them, leaving pollutants free to travel downstream. Newer, more effective gross pollutant trap designs require access to specialised equipment, currently not owned by the Territory. At present this task is (expensively) undertaken by contractors.

Importantly, the current condition and effectiveness of all existing GPTs flowing into LBG should be reviewed in terms of their location, efficiency, impact and maintenance requirements.

**Increased public awareness and compliance of illegal access and parking on public land, especially nature strips and parkland areas (Task Force Recommendation)**

Illegal vehicle parking on nature strips and other public land in key catchment areas results in soil compaction, degrading vegetation cover and leading to increased erosion and run-off.

It is proposed to increase public awareness of the legal requirements around this behaviour, including increased compliance activity.

## ***Rural Catchment Management***

### **Key Actions**

**A Lake Burley Griffin catchment protection program (Inquiry Recommendation)**

The rural catchments of the Lake include the Molonglo River, Queanbeyan River, Jerrabomberra Creek, Woolshed Creek and Reedy Creek, together with a number of other lesser streams. These catchments support a diversity of agricultural, broad acre and rural residential uses. Increasing sub-division of these catchments in NSW for rural village and small holding developments is occurring. There is a risk of significant levels of sediment and nutrients entering the Lake from these catchments through erosion and soil disturbance and inappropriate land management practices.

The proposed catchment protection program would build on the work of the Government and community (through the Molonglo Catchment Group) to identify and address erosion hotspots and promote good land management practices, especially around maintenance of vegetation cover.

## ***Sewerage***

### **Key Actions**

**Ongoing sanitary surveys of the sewer system to identify leaks and other faults to prioritise ongoing renovation of the system (Inquiry Recommendation)**

A source of faecal contamination in the Lake can be from leaks in sewer systems. ACTEW Water, Queanbeyan City Council and Palerang Council will undertake regular reviews of the condition of their sewer system in the Lakes catchments, report on these reviews and identify priorities for upgrading to reduce sewer blockages and possible leakages from the system and to reduce the risk of system failures. Annual reports will also be provided on the sewerage system refurbishment program.

## ***River Flow Management***

### **Key Actions**

**A feasibility study of water releases from Googong Dam and the Captain's Flat Reservoir to help water column manipulation in the Lake (Inquiry Recommendation)**

Such a study would investigate feasibility, costs and benefits of providing water releases to improve Lake water quality. Large increases in flow over summer months would plunge to the bottom, giving little

oxygenation but push nutrient rich water upwards. Smaller “topping up” increases in flow could reduce transfer of nutrient rich bottom water to the surface zone that normally occurs, reducing conditions favourable to algal blooms.

## ***Lake Closure Protocols and Communication***

### **Key Actions**

#### **A framework for assessing and managing risks associated with extreme water contamination events (Inquiry Recommendation)**

Lake closures are the standard response to assessed health risks for humans from contaminants in the Lake water, either cyano-bacteria (blue-green algae) or faecal bacteria. It is important that periodic reviews be undertaken of the *ACT Guidelines for Recreational Water Quality* to ensure compliance with national standards. These reviews should include consultation with relevant stakeholders.

## **Implementation Plan**

The Implementation Plan at **Attachment D** provides more details about the priority actions in terms of responsible agency, cost, lead-time and impact. Actions that are already underway are identified in blue text.

## **Resourcing the Action Plan**

Significant resources are already invested in managing water quality in the Lake and its catchments. This includes investment by the Australian Government, ACT Government, Queanbeyan City Council, and Palerang Council as well as by landholders and the community.

**Attachment E** provides information on expenditure requirements in the priority areas in the short (to 2014), medium (2015 to 2020) and long term (2020 to 2030). The costs indicated are indicative only and in no way imply a commitment by the organisations identified against the actions to commit funds. Ongoing resourcing is an intergovernmental issue with the onus falling on all levels of Government to maintain funding at a level to meet jointly shared outcomes.

Funding would need to follow normal budgetary processes in each jurisdiction. A number of actions are yet to be costed due to the need for initial work to scope out or test the feasibility of options.

The Action Plan also presents a number of opportunities to seek funding from external sources. These opportunities are identified in **Attachment E**.

## **Recommendation**

The Task Force recommends that, should this Action Plan be endorsed by the participating Governments and Councils, that this endorsement extend to a complementary commitment of appropriate resources to facilitate effective implementation.

# **Attachment A: Task Force Terms of Reference**

## **ROLE**

Lake Burley Griffin and related water quality was identified as a critical issue in the ACT Commissioner for the Environment's recent report "*Investigation into the State of Watercourses and Catchments for Lake Burley Griffin*" (The Report). The Report's 17 recommendations will be the basis for the development of an Action Plan to respond to the Report.

The Chief Minister of the ACT met with the NSW local Government Mayors, ACT representatives and the National Capital Authority to discuss the issues surrounding water quality in Lake Burley Griffin, the broad scope of potential works in the catchment and to establish a Senior Officials Taskforce to develop an Action Plan for improving the water quality of the Lake.

Facilitated by a peer review from and Expert Panel, the Taskforce will develop an Action Plan that:

- identifies short, medium and long term actions that can improve overall lake water quality, highlighting the benefits that each action can provide;
- identifies the contribution of participating jurisdictions and their responsibilities for undertaking identified actions; and
- outlines a program of works to undertake these actions and identifies budget constraints and opportunities associated with each action.

## **MEMBERSHIP**

Members of the Taskforce will be drawn from the following organisations:

- National Capital Authority;
- Environment and Sustainable Development Directorate;
- Queanbeyan City Council;
- Palerang Council;
- Cooma Council;
- Chief Minister and Cabinet Directorate;
- Territory and Municipal Services Directorate;
- Health Directorate; and
- ACTEW Water

## **TIMEFRAMES**

The Panel is to provide its advice to the Chief Minister, ACT Government in August 2012.

## **Attachment B: Expert Panel**

### **Dr Stephen Skinner**

Dr Skinner is an aquatic ecologist with expertise in algae. He is the Molonglo Waterwatch Coordinator. This followed occupying a similar role with the Southern ACT Catchment Group, a career in teaching and research related to algae. Dr Skinner also works part-time in the ACT Environment and Sustainable Development Directorate dealing with water resource issues.

### **Dr Bill Phillips**

Dr Phillips completed a Bachelor of Science and PhD in Zoology at the Australian National University in 1985. Bill then joined the Australian National Parks and Wildlife Service (ANPWS).

While employed by the ANPWS, Bill worked across a range of program areas including the National Koala Conservation Program, Ocean Rescue 2000, Save the Bush and One Billion Trees.

Bill Phillips was also a key player in the establishment of Waterwatch Australia - a community education program focused around water quality monitoring and promoting integrated catchment management.

In 1989, he led the establishment of Australia's National Wetlands Program, and then served as Deputy Secretary General of the Ramsar Convention based in Switzerland from 1997-2000.

Since 2000, Bill Phillips has worked at the 'coal face' of river management issues; facilitating a range of community-based solutions to river and wetland management challenges through the RiverSmart Australia organisation that he established.

### **Dr Ralph Ogden**

Ralph leads teams creating decision support software that will help city planners manage urban water, whether in allotments, regions or river systems. He was formerly the Director of Knowledge Exchange in the CRC for Freshwater Ecology, forerunner of eWater CRC. He has held research positions with CSIRO Land and Water and the University of Canberra and has extensive experience in translating science into a form useful for water managers.

He has studied the impacts of resource development on billabongs, influences driving physical habitat in rivers, and flooding effects on floodplains.

A special interest is how scientific knowledge becomes embedded into policy and management.

## Attachment C: Action Plan

NB Actions identified in Blue are currently underway, although current work may not be to the same extent or with the same emphasis as indicated in the Action Plan

	ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
1	<b>Coordination of Catchment Management and Governance</b>	Explore the merit of creating a statutory office responsible for coordination of actions outlined in this Plan in the ACT.	High				
		Continue the operation of the Lake Burley Griffin (LBG) Task Force as a coordination mechanism, with membership comprising the National Capital Authority, key ACT Government Directorates, key NSW government agencies, Queanbeyan City Council, Palerang Council, as well as key stakeholders - the Lake Users Group and the Molonglo Catchment Group.	High	Continue the operation of the LBG Task Force as a coordination mechanism.	High	Continue the operation of the LBG Task Force as a coordination mechanism.	High
		Develop an inter-governmental catchment management agreement between the Australian ACT, NSW and local governments.	High	Report annually on the operation of the inter-governmental catchment management agreement.	High	Review the operation of the inter-governmental catchment management agreement every 5 years.	High
		Identify gaps in legislative and planning instruments relating to the Lake and its catchment.	High	Address legislative and planning gaps.	High	Undertake review of legislative and planning arrangements as part of review of Integrated Catchment Management Framework.	High
		Develop a Lake Burley Griffin Catchment Strategy, consistent with the management agreement to guide lake restoration and protection work.	High	Report annually on the implementation of the Strategy.	High	Report annually on the implementation of the Strategy.	High

	ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
		Establish a Catchment Management Expert Panel.	High	Continue to seek advice from a Catchment Management Expert Panel.	High	Review the continuing need for a Catchment Management Expert Panel.	High
		Convene an annual forum with high-level representatives from the ACT Government, NCA, NSW Government and local government.	High	Convene an annual forum with high-level representatives from the ACT Government, NCA, NSW Government and local government.	High	Convene an annual forum with high-level representatives from the ACT Government, NCA, NSW Government and local government.	High
2	<b>Community Awareness Raising and Education</b>	Review the existing Integrated Catchment Management Framework for the ACT as it applies to the Lake catchment.	High	Report annually on implementation of a revised Framework applied to the Lake catchment as part of reporting on the inter-governmental catchment management agreement.	High	Undertake a review of the Framework every 5 years.	High
		Develop and commence implementation of a comprehensive catchment awareness and education program, as a collaboration between government and the community, to raise awareness and change behaviours across all community sectors in relation to the factors affecting the health of the Lake. The program will address ameliorating the impact of organic matter, and other household or commercial materials, including fertilizers, leaf litter, street sweepings and exposed soil.	High	Continue catchment awareness and education programs.	High	Review effectiveness of catchment awareness and education programs every 5 years.	High
		The Task Force develop an enhanced web presence for Lake information, awareness raising and education.	High				
		Build on coordination of existing catchment groups, especially the Molonglo Catchment Group to enhance outcomes for the Lake and	Medium	Consider formation of a LBG or Friends of Lake Burley Griffin Group to focus community action	Medium	Integrate LBG Lakecare or Friends of Group to focus community action to wider catchment	Medium

	ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
		its catchment.					
		Continue current volunteer environmental activities (both on-ground and awareness raising) under the existing Riversmart/Conservation Volunteers Australia Lakecare. Work with the Molonglo Catchment Group in their review of the Catchment Strategy to better address awareness, community education and behaviour change.	Medium  Medium	Continue Lakecare program environmental activities (both on-ground and awareness-raising).  Continue to work with the Molonglo Catchment Group on catchment awareness, education and behaviour change programs.	Medium  Medium	Continue Lakecare program environmental activities (both on-ground and awareness-raising).  Continue to work with the Molonglo Catchment Group on catchment awareness, education and behaviour change programs.	Medium  Medium
<b>3</b>	<b>In-lake Management</b>	Undertake modelling of potential blue-green algal blooms.	TBD		TBD		TBD
		Assess the merits of the installation of a network of water quality monitoring probes in the Lake and at inflow points to provide real time water quality information.	TBD		TBD		TBD
		Undertake feasibility studies and trials of macrophyte restoration across the Lake, including a triple-bottom-line analysis. Desktop research, physical trials and cost-benefit analyses be undertaken on options. This work will also inform approaches to in-lake management on other urban lakes and artificial water bodies in the ACT, Queanbeyan and Palerang Shire. Priorities for consideration will include: <ul style="list-style-type: none"> <li>• construction of a wetland in the Lake between Springbank Island and the mouth of Sullivans Creek;</li> <li>• construction of a wetland in the</li> </ul>	TBD	Subject to results of feasibility studies and trials, implement in-lake interventions aimed at controlling blue-green algae in Lake Burley Griffin (and other Canberra lakes).	TBD	Ongoing implementation and evaluation of successful options.	TBD

ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
	<p>Lake at East Basin;</p> <ul style="list-style-type: none"> <li>• restoration of macrophyte beds in Lotus Bay, Orana Bay, East Basin and at Weston Park East Beach.</li> <li>• floating macrophyte (water plant) beds, including their management to promote water quality;</li> <li>• treatment of lake sediments to reduce phosphorus release, including by addition of nitrates or iron chloride to the water;</li> <li>• oxygenation of Lake bottom water;</li> <li>• adsorption and removal of phosphorus from the water through the addition of clay or chemical based substances;</li> <li>• stirring the water column, e.g. water circulator trial by NCA at Molonglo Reach and Yarralumla Bay to continue for a further two years.</li> </ul> <p>Consideration will be given to varying the level of the Lake level as a contributor to encouraging macrophyte establishment.</p>					
	<p>Pursue opportunities for targeted carp removal at identified hotspots (spawning or thermal aggregations), such as the mouth of Sullivan’s Creek, Jerrabomberra Creek and wetland and the Queanbeyan River.</p> <p>Maintain a watching brief on emerging management and control</p>	High	Depending on outcome of current research into management and control measures, continue to implement targeted carp removal as well as trial new measures as available.	High	Evaluate carp control measures in Lake.	High

	<b>ACTIONS</b>	<b>SHORT TERM (&lt;2 years)</b>	<b>IMPACT</b>	<b>MEDIUM TERM (&gt;2 to 5 years)</b>	<b>IMPACT</b>	<b>LONG TERM (&gt;5 years)</b>	<b>IMPACT</b>
		measures for carp.					
		Continue to support carp fishing competitions to educate anglers about management of carp as well as obtaining data on carp populations.	High	Continue to support carp fishing competitions to educate anglers about management of carp as well as obtaining data on carp populations.	High	Continue to support carp fishing competitions to educate anglers about management of carp as well as obtaining data on carp populations.	High
		Regular fish community monitoring and stocking of native fish in Lake	Medium	Regular fish community monitoring and stocking of native fish in Lake	Medium	Regular fish community monitoring and stocking of native fish in Lake	Medium
		Undertake systematic monitoring of riparian conditions of the Molonglo and Queanbeyan Rivers and other Lake Burley Griffin catchment streams as well as the Lake edge to better inform restoration works.	TBD	Continue systematic monitoring of riparian conditions of the Molonglo and Queanbeyan Rivers and other Lake Burley Griffin catchment streams as well as the Lake edge to better inform restoration works.	TBD	Review systematic monitoring of riparian conditions every 5 years.	TBD
<b>4</b>	<b>Urban Catchment Management</b>	Ongoing program to renovate stormwater infrastructure in the catchment.	High	Ongoing program to renovate stormwater infrastructure in the catchment.	High	Ongoing program to renovate stormwater infrastructure in the catchment.	High
		Undertake review under the ACT Water Strategy to ensure ACT approaches to Water Sensitive Urban Design (WSUD) are delivering national standard or better outcomes at the most economical cost.	High	The ACT Government implements a strategic approach to WSUD under the new ACT Water Strategy. Monitor the cost and outcome effectiveness of WSUD through improved monitoring during and after urban development. The results would be used to inform improvements in WSUD practices and standards. Note: Adequate resourcing of ongoing maintenance of WSUD infrastructure is critical for its success.	High	Continue to monitor the cost and outcome effectiveness of WSUD through improved monitoring following urban developments. The results should be used to inform improvements in WSUD practices and standards.	High
		Identify the opportunities for and benefits of sites where installing catchment interventions, such as wetlands and pollution control	High	Based on the evidence from monitoring continue to install further wetlands and pollution control structures against	High	Based on the evidence from monitoring continue to install further wetlands and pollution control structures against	High

ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
	structures would improve water quality entering Lake Burley Griffin.		established priorities.		established priorities.	
	Continue to monitor the effectiveness and compliance of wetlands and pollution control structures for sediment control during construction phases of developments and subsequently to inform maintenance and effective functioning.  The NCA and ACT Government to examine options for short term remedial work at Coranderrk Pond.	High  High	Continue to monitor the effectiveness and compliance of wetlands and pollution control structures for sediment control during construction phases of developments and subsequently to inform maintenance and effective functioning.  Based on outcome of assessment, implement remedial works at the Coranderrk Pond.	High  High	Review monitor and compliance procedures for wetlands and pollution control structures.  Continue to monitor water quality and condition of Coranderrk Pond	High  High
	Identify the sources of leaf matter and potential programs to counter the sources using market-based mechanisms where appropriate including sweeping/vacuuming and composting of street verge leaf matter.  Identify opportunities to increase road sweeping programs and identify suitable composting/storage sites of bulky debris such as leaf litter.  Monitor existing new sites such as at Kingston Foreshores and in the Sullivan's Creek catchment to assess impact on stormwater management system.	High  High  Medium	Commence implementation of leaf matter reduction programs  Increased road sweeping programs, especially in Autumn.  Use evidence gained from monitoring existing new sites to refine future designs.	High  High  Medium	Continued implementation of leaf matter reduction programs.  Assess impact of increased street sweeping program on nutrient inflows to Lake.	High  High
	Review protocols for cleaning GPTs and communicate revised protocols.  Audit cleaning of GPTs to ensure compliance with the protocol standards	High	Review the efficacy of existing GPTs. The review should include: <ul style="list-style-type: none"> <li>effectiveness in pollutant reduction;</li> <li>effectiveness of current maintenance of pollution control measures;</li> <li>capital costs;</li> <li>ongoing maintenance costs</li> </ul>	High	Introduce improved GPT mechanisms	High

ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
			<p>to ensure the current drainage infrastructure remains high-standard and is in line with current best practice, protecting downstream environments;</p> <ul style="list-style-type: none"> <li>• reduction of polluted leachate water; and</li> <li>• the capacity to manage requirements of future urban growth and development;</li> <li>• Introduce revised protocols for installing GPTs if warranted by review.</li> </ul>			
	<p>Develop revised water quality monitoring strategy, consistent with national best practice, including monitoring of key inlets to Lake Burley Griffin and targeted at providing a comprehensive data set to inform on-ground actions. Monitoring data to be shared between all jurisdictions and with stakeholders.</p> <p>Public land managers to enhance re-grassing programs to addressing exposed soil in parks and other public areas.</p>	High	Integrated collection of water quality monitoring data with community data from all sources.	High	Continued monitoring to national standards.	High
		High	Continuing maintenance of playing fields, parks and other public areas to minimise erosion and application of best practice approaches to application of fertilizers.	High	Continuing maintenance of playing fields, parks and other public areas to minimise erosion and application of best practice approaches to application of fertilizers.	High
	Increase public awareness and compliance for illegal vehicle access/parking on public lands, with a focus on nature strip erosion and reserves.	Medium	Continuing compliance monitoring and enforcement for illegal vehicle access/parking on public lands and reserves.	Medium	Continuing compliance monitoring and enforcement for illegal vehicle access/parking on public lands and reserves.	Medium

	ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
5	Rural Catchment Management	Install barriers to prevent illegal access and parking on public land to prevent soil compaction and erosion.	Medium	Continue to protect public land from illegal access and parking to prevent soil compaction and erosion.	Medium	Continue to protect public land from illegal access and parking to prevent soil compaction and erosion.	Medium
		Ongoing removal of woody weeds, including pest willows, elms, silver poplars, alders, plums and blackberries guided by best available evidence in upstream catchments and the Lake edge to constrain infestation to an identified acceptable level of encroachment with associated native tree replacement program to stabilise banks and provide habitat.	Medium	Continuing woody weed removal and replacement program	Medium	Continuing woody weed removal and replacement program	Medium
		The Jerrabomberra Wetlands Board of Management, ACT Government, and NCA work to improve water quality into the Lake, including cattle exclusion zones, the role of cattle in grass management and options for macrophyte regeneration in Wetland areas.  Priority be given in the short term to a grazing plan for the Wetlands, focusing on the construction of fencing to exclude cattle from the Lake and river edge.	High	The Jerrabomberra Wetlands Board of Management investigate options to improve the functioning of the Wetlands, through alteration of watercourses, recognising their environmental, cultural, recreational scientific and educational values.	High	Continue to monitor the effect of the Jerrabomberra Wetlands on Lake water quality.	High
		Establish a Lake Burley Griffin catchment protection program, modelled on those of the Sydney Catchment Authority and ACTEW Water, with a 5 year implementation plan focused on sediment, vegetation and nutrient control to complement existing catchment management programs.	Medium	Deliver the initial Lake Burley Griffin catchment protection program including educational and financial support to relevant land managers and planning/compliance organisations.	Medium	Review the delivery of the Lake Burley Griffin catchment protection program.  Continue to deliver refined and well targeted stream protection and incentive programs in the Lake Catchment.	Medium

	ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
				Deliver refined and well targeted stream protection and incentive programs in the Lake Catchment.			
		Continue to implement on-ground actions to reduce the potential for soil erosion in the upper Queanbeyan River, upper Molonglo River and Jerrabomberra Creek.	Medium	Monitor and take preventative action on pollution from the new Googong development and other urban development zones within the water catchment of the Lake.	Medium	Continue to deliver refined and well targeted erosion control and incentive programs in the Lake catchment.	Medium
		Implement the Googong Foreshores Plan of Management.	Medium	Continue to implement the Googong Foreshores Plan of Management	Medium	Continue to implement the Googong Foreshores Plan of Management.	Medium
		Ongoing removal of woody weeds, especially pest willows, followed by revegetation using native species to stabilise banks and provide habitat.	Medium	Ongoing removal of woody weeds and replacement with native plants.	Medium	Ongoing removal of woody weeds and replacement with native plants.	Medium
6	<b>Sewerage</b>	ACTEW, Queanbeyan City Council and Palerang Council to report regularly on the condition of the sewer system in the urban areas in the Lake catchment and identify priorities for upgrading to reduce sewer blockages and possible leakages from the system, and reduce the risk of system failures.	Low	Continuing reporting on the condition of sewer system	Low	Continuing reporting on the condition of sewer system.	Low
		The ACT Environment Protection Authority to review the Environmental Authorisation 0417 for the Queanbeyan City Council Sewage Treatment Plant (QCCSTP) to ensure that the treatment process results in discharge quality that matches contemporary licence conditions for a modern, urban sewerage treatment plant. In line with this, the QCCSTP should continually review and improve its mitigating practices for inundation and washout events.	Low		Low		Low

	ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
		NCA to monitor sewage based pollution in the lake. EPA to continue regulating sewage based pollution in the catchment. ACTEW to continue to advise the EPA on events and potential direction of sources. QCC to advise the ACT EPA on events and potential direction of sources.	Low				
		ACTEW Water and the Queanbeyan City Council to report annually on their program of sewerage systems refurbishment in the catchment.	Low	ACTEW Water and the Queanbeyan City Council to report annually on their program of sewerage systems refurbishment in the catchment.	Low	ACTEW and Queanbeyan City Council to report annually on program of sewerage systems refurbishment in the catchment.	Low
		ACTEW Water, Queanbeyan City Council and Palerang Council to review and advise on leakages from the sewage system and programs for relining systems to address leaks. In line with the current Guidelines, the ACT Government and the Queanbeyan City Council identify and map sources of human faecal contamination entering urban stormwater systems, the significance of the sources, and long-term strategies for reducing loading.	Low  Low	Develop procedures for 'sanitary surveys' in the event of elevated indicator concentrations should be established.	Low		
7	<b>River Flow Management</b>	In consultation with the ACT Government's Environmental Flows Technical Advisory Group, undertake an investigation into the feasibility, costs and benefits of providing water releases from Googong Dam and the Captain's Flat reservoir.	TBD				
8	<b>Lake Closure Protocols and Communication</b>	Document a framework for assessing and managing increased levels of risk associated with extreme water contamination events (BGA, bacteria, sewerage or chemical).	N/A	The ACT Government (Health Directorate) undertake periodic reviews of the <i>ACT Guidelines for Recreational Water Quality</i> at intervals of not less than five years to ensure compliance with	N/A		

	ACTIONS	SHORT TERM (<2 years)	IMPACT	MEDIUM TERM (>2 to 5 years)	IMPACT	LONG TERM (>5 years)	IMPACT
		Develop and install consistent water quality warning signage across the ACT.		national standards and include consultation with relevant stakeholders. The reviews should consider: <ul style="list-style-type: none"> <li>• developments in use of <i>Enterococci</i> bacteria as an indicator of faecal contamination and research on the health risks associated with re-growth pathogens;</li> <li>• improvements in knowledge and technologies to determine whether toxin testing or blue-green algal concentration and algal biovolume testing is most relevant for ACT Lakes; and</li> <li>• the characteristics and re-growth challenges of the lake bays.</li> </ul>			

## Attachment D: Implementation Plan

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
<b>1. Coordination of Catchment Management and Governance</b>						
Explore the merit of creating a statutory office responsible for coordination of actions outlined in this Plan in the ACT.	ESDD	June 2013	\$60,000 From existing resources	Improved coordination and governance	TBD	Subject to agreement by Cabinet and incorporation into intergovernmental agreement.
Continue the operation of the Lake Burley Griffin Task Force as a coordination mechanism, including membership by key community stakeholders.	NCA	Ongoing	\$90,000pa From existing resources	Improved coordination of government and community effort	Ongoing	Inclusion of the Chair of the Lake Users Group and the Chair of the Molonglo Catchment Group on the Task Force will provide for more effective communication and coordination of effort.
Develop an inter-governmental catchment management agreement between the ACT, Australian, NSW and local governments.	ESDD, NCA, NSW Govt, QCC, PC	June 2014	\$180,000	Improved coordination of effort and governance	<1 year	Key document to ensuring continuity of commitment to the health of the Lake for governments.
Identify gaps in legislative and planning instruments relating to the Lake and its catchment.	NCA, ESDD, QCC, PC	Dec 2013	\$20,000 From existing resources	Ensure effective compliance	<1 year	Ensure effective operation of legislative instruments. Ongoing as an aspect of the implementation of the Action Plan. The ACT Government has commenced a review of the <i>Environment Protection Act 1997</i>
Develop a Lake Burley Griffin Catchment Strategy, consistent with the catchment management agreement, to guide Lake restoration and protection work.	ESDD, NCA, NSW Govt, QCC, PC	June 2014	\$250,000	Improved coordination of effort and governance against agreed strategic directions	2 years	Builds on the Action Plan and endorsed by parties to the inter-governmental agreement.
Convene an annual forum with high-level representatives from the ACT Government, National Capital Authority, NSW Government and local government.	NCA	Annual	\$5,000pa	Improved knowledge sharing, awareness raising	3 months	Forum to focus initially on sharing knowledge about approaches to Lake rehabilitation

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
				and improvement in Lake and catchment management approaches		and management, catchment management and community awareness and behaviour change methods.
Review Integrated Catchment Management Framework as it applies to the Lake catchment.	ESDD	June 2014	\$10,000 From existing resources		1 year	Linked to the development of the Catchment Strategy.
<b>2. Community Awareness Raising and Education</b>						
Develop catchment awareness, education and behaviour change program.	NCA to coordinate	2012-13	\$100,000 for design \$250,000pa for roll out	Increase community awareness and change behaviours.  Reduction in household or organic materials (garden and lawn fertilizers, leaf litter) as well as silt entering Lake.	<2 years	A collaboration between government and the community, to raise awareness and change behaviours across all community sectors in relation to the factors affecting the health of the Lake. The program will address ameliorating the impact of organic matter, and other household or commercial materials, including fertilizers, leaf litter, street sweepings and exposed soil
Develop an enhanced web presence for Lake information, awareness raising and education.	NCA	2012-13	\$20,000pa	Increase community awareness and influence household behaviours.	Ongoing	
Build on coordination of existing catchment groups to enhance outcomes for the Lake and its catchments.	ESDD, NCA	2012-13	From existing resources	Better coordination between government and community actions	<2 years	
Continue current volunteer environmental activities (both on-ground and awareness raising) under the existing Riversmart/Conservation Volunteers Australia Lakecare.	NCA, TAMSD	2012-13	\$12,000pa	Improved Lake shore vegetation Increased	<1 year	

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
				community engagement and awareness		
Work with the Molonglo Catchment Group in their review of the Catchment Strategy to better address awareness, community education and behaviour change.	ESDD	2012-13	\$10,000	Increased community engagement and awareness and alignment of effort	1 year	Molonglo Catchment Group have commenced a review of their Plan
<b>3. In-Lake Management</b>						
Modelling of potential blue-green algal blooms	NCA	TBD	TBD	Knowledge to predict potential disruptions to Lake users or asses timing/utility of types of interventions	n/a	Related to network of water quality monitoring probes to provide real time information
Assess the merits of the installation of a network of water quality monitoring probes in the Lake and at inflow points to provide real time water quality information.	NCA	2012-13	\$30,000 - \$100,000pa	Knowledge to better target remedial actions and predict disruptions to lake users	To be scoped	Catchment wide network preferable
Feasibility study of macrophyte restoration across Lake <ul style="list-style-type: none"> <li>Construction of wetland between Springbank Island and mouth of Sullivan's Creek</li> <li>Construction of wetland in East Basin</li> <li>Restoration of macrophyte beds in Lotus Bay, Orana Bay, Weston Park East Beach</li> </ul>	NCA	2012-13	\$30,000 for trial; \$7m estimate for full restoration	The purpose of the Trial is to establish whether macrophyte restoration could be undertaken on a larger scale	To 2030	
Treating sediments to reduce phosphorous release, including addition of nitrates or iron chloride to the water.	NCA	2012-13	TBD	Reduce phosphorus in water column and bind phosphorous in Lake sediments		A desktop review of chemical treatment methods is proposed, with NCA examining costs, feasibility and logistics, EPA environmental concerns and Health Directorate human health effects. Indicative costing is based on

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
						use of Phoslock and costed in 2009.  Efficacy of Phoslock-type products may be reduced due to natural process of supply of clay and iron minerals in catchment discharge
Oxygenation of Lake bottom water	NCA	2012-13	Estimated \$1m to implement	Increase oxygen levels in Lake water	>5 years	A cost-benefit analysis of this method is proposed. To implement requires large investment. Is being applied in the Swan and Canning Rivers in WA.
Absorption and removal of phosphorous by addition of clay or other chemical based substances	NCA, EPA and Heath Directorate	2012-13	\$1.7m for Lake; \$6,000pa for retreating of small problem areas	Reduce phosphorus in water column and bind phosphorous in Lake sediments	<1 year	A desktop review of chemical treatment methods is proposed, with NCA examining costs, feasibility and logistics, EPA environmental concerns and Health Directorate human health effects. Indicative costing is based on use of Phoslock and costed in 2009.  Efficacy of Phoslock-type products may be reduced due to natural process of supply of clay and iron minerals in catchment discharge
Stirring the water column	NCA	2013-14	\$180,000 for trial. \$3.8m capital and \$700,000pa ongoing costs	Reduce stratification (layering) of the water column which is conducive to algal blooms forming		The NCA is currently undertaking a three year trial of two mechanical mixing devices (SolarBees) in Yarralumla Bay and Molonglo Reach. Lake Sediment testing underway
Pursue opportunities for targeted carp removal at	NCA,ESDD	2012-13	\$200,000	Reduce numbers of	2 years	

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
identified hotspots (spawning or thermal aggregations), such as the mouth of Sullivan's Creek, Jerrabomberra Creek and wetland and the Queanbeyan River.			for hotspots study  \$200,000 - \$500,000 per site plus \$10,000 to \$50,000 for running costs	carp in lake at key spots		
Maintain a watching brief on emerging management and control measures for carp.	ESDD	Ongoing	From existing budgets	Increase capacity to address carp management.	Ongoing	Membership of established pest management groups and networks
Continue to support carp fishing competitions to educate anglers about management of carp as well as obtaining data on carp populations.	NCA, ESDD	Ongoing	Up to \$50,000pa to support research	Better information on Lake carp populations to aid management.	Ongoing	Research would look at sex ratios, age as well as undertake supplementary sampling.
Regular fish community monitoring and stocking of native fish in Lake	NCA, ESDD	Ongoing	\$20,000 to \$30,000pa	Predate on juvenile carp	Ongoing	Stocking of 30,000 to 60,000 fingerlings a year with 2-3 yearly monitoring.
Undertake systematic monitoring of riparian conditions of the Molonglo and Queanbeyan Rivers and other Lake Burley Griffin catchment streams as well as the Lake edge to better inform restoration works.	ESDD, NCA, QCC, PC		\$50,000 for a riparian condition snapshot \$30,000 for ongoing monitoring	Better understanding of riparian conditions to guide restoration efforts	1 year for snapshot	Molonglo River riparian corridor subject of riparian condition snapshot in 2009-10
<b>4. Urban Catchment Management</b>						
Ongoing program to renovate stormwater infrastructure in the catchment.	TAMSD, QCC, PC	Ongoing	TBD	Better control of sediments and other pollutants entering waterways and the Lake.	Ongoing	TAMSD (ACT Roads) monitors the condition of the ACT stormwater network. This information is contained in the Integrated Asset Management System for TAMSD. The system contains condition and maintenance history information for the entire stormwater network. The current

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
						Asset Management Plan for Roads ACT details how the stormwater network will be maintained.  Stormwater systems in Queanbeyan and Palerang are managed in a similar way
In conjunction with the revision of the ACT long term Water Strategy, ensure the current ACT regulations for Water Sensitive Urban Design (WSUD) are delivering national standards (or better) at the most economical cost to the community.	ESDD, EDD	2012-13	TBD	Revised policy will lead to a greatly improved balance for water quality management from developments and more efficient, cost effective catchment management practices.	9-12 months	Revised policy leading to revised general code on WSUD and revised rules and criteria for all developments to meet with the new policy & general code
Identify the opportunities for and benefits of sites where installing catchment interventions, such as wetlands and pollution control structures would improve water quality entering Lake Burley Griffin.	ESDD, TAMSD, EDD, LDA	2013-14	\$70,000 for site identification	Improve quality of water entering the Lake by removing sediments and nutrients	3 months	
Continue to monitor the effectiveness and compliance of wetlands and pollution control structures for sediment control during construction phases of developments and subsequently to inform maintenance and effective functioning.	ESDD, TAMSD, EDD, LDA		\$60,000 for evaluation	Determine cost required to maintain WSUD initiatives; determine maintenance budgets necessary to maintain WSUD initiatives; Determine feasibility/cost effectiveness of each type of WSUD initiative	Ongoing	Assess costs effectiveness at DA (design stage); Monitor at 2, 5, 10 and 15 years after installation (depending on type of infrastructure)

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
The NCA and ACT Government to examine options for short term remedial work at Coranderrk Pond.	NCA, TAMSD, ESSD	TBD	Likely to be significant	Reduce nutrients and sediment entering the Lake	TBD	The NCA has commissioned AECOM to report on short-term remediation strategies
Identify sources of leaf matter and programs to counter the sources using market based mechanisms where appropriate including sweeping/vacuuming and composting of street verge leaf matter. Identify opportunities to increase road sweeping programs and identify suitable composting/storage sites of bulky debris such as leaf litter.	TAMSD	Dec 13	\$50,000 for consultancy \$200,000 per truck for additional sweeping (\$1m pa currently spent on sweeping)	Reduce nutrients and sediment entering the Lake	6-8 months	All streets are swept at least twice time per year. Suburbs with deciduous street trees where there is a heavy leaf fall receive additional services during autumn. Major arterial roads are swept on a monthly basis, and minor arterials, three monthly. Consultant to identify optimum cleaning frequency and schedule. Two extra sweeping trucks (one each for inner north and south Canberra) would increase capacity.
Monitor existing new sites such as at Kingston Foreshores and in the Sullivan's Creek catchment to assess impact on stormwater management system	ESDD, EPA			Reduce nutrients and sediment entering the Lake		Linked to proposed revised water quality monitoring strategy below.
Review protocols for cleaning GPTs and communicate revised protocols.	TAMSD	Dec 13	GPT cleaning \$630,000 pa	More effective GPT's reducing pollutants entering the Lake		Funding directed to cleaning of GPTs over the past three years: <ul style="list-style-type: none"> <li>• \$451,000 in 2009-10</li> <li>• \$701,000 in 2010-11</li> <li>• \$947,000 in 2011-12</li> <li>• \$450,000 is budgeted for 2012-13 but this may be adjusted due to weather conditions (rain, flooding etc) as in previous years.</li> </ul>
Audit cleaning of GPTs to ensure compliance with protocol standards.	TAMSD	July-Aug 2015	\$30,000 for audit	More effective GPT's reducing pollutants entering		

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
				the Lake		
<p>Review the efficacy of existing GPTs. The review should include:</p> <ul style="list-style-type: none"> <li>effectiveness in pollutant reduction;</li> <li>effectiveness of current maintenance of pollution control measures;</li> <li>capital costs;</li> <li>ongoing maintenance costs to ensure the current drainage infrastructure remains high-standard and is in line with current best practice, protecting downstream environments;</li> <li>reduction of polluted leachate water;</li> <li>the capacity to manage requirements of future urban growth and development; and</li> <li>Introduce revised protocols for installing GPTs if warranted by review.</li> </ul>	TAMSD, ESDD, EPA	2014-15	\$50,000 for review	More effective GPT's reducing pollutants entering the Lake		
Develop revised water quality monitoring strategy, consistent with national best practice, including monitoring of key inlets to Lake Burley Griffin and targeted at providing a comprehensive data set to inform on-ground actions. Monitoring data to be shared between all jurisdictions and with stakeholders.	ESDD, NCA, QCC, PC	TBD	TBD	Better knowledge on which to base catchment management actions	TBD	Funding to undertake this action to be sought as part of catchment management bid for funding from Murray Darling Basin State Priority Projects allocation.
Public land managers to enhance re-grassing programs to addressing exposed soil in parks and other public areas.	TAMSD	July 2014	\$60,000pa for re-grassing  \$80,000pa for stabilising steep sloped beside underpasses	Reduce sediment entering watercourses and the Lake	Ongoing	
Increase public awareness and compliance for illegal vehicle access/parking on public lands, with a focus on nature strip erosion and parkland areas.	TAMSD	July 2014	\$220,000pa	Reduce sediment entering watercourses and	Ongoing	Develop and implement community engagement plan. Installation and maintenance of

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
				the Lake		no parking signage in parks. Provides two additional parking inspectors and vehicles - one each for north and south Canberra with a focus on damage to parkland assets.
Install barriers to prevent illegal access and parking on public land to prevent soil compaction and erosion.	TAMSD	July 2014	\$100,000pa	Reduce sediment entering watercourses and the Lake	Ongoing	Installation of vehicle barriers to prevent access Compliments capital works projects to install barriers in 2011/12 and 2012/13.
Ongoing removal of woody weeds, including pest willows, elms, silver poplars, alders, plums and blackberries guided by best available evidence in upstream catchments and the Lake edge, consistent with Willow Management Plan for Lake Burley Griffin, to constrain infestation to an identified acceptable level of encroachment with associated native tree replacement program to stabilise banks and provide habitat.	TAMSD, NCA, QCC, PC	Ongoing	\$300,000pa	Reduce organic matter from entering Lake and enhance dissolved oxygen levels	Ongoing	Costs will vary from site to site depending on the nature of the remediation. TAMSD has allocated funding as part of Restoration of Waterways project to address Willow removal and blackberry control in Molonglo Reach and the Molonglo River at Oaks Estate.
<b>5. Rural Catchment Management</b>						
The Jerrabomberra Wetlands Board of Management, ACT Government, and NCA work to improve water quality into the Lake, including cattle exclusion zones, the role of cattle in grass management and options for macrophyte regeneration in Wetland areas.  Priority be given in the short term to a grazing plan for the Wetlands, focusing on the construction of fencing to exclude cattle from the Lake and river edge.	TAMSD	2012-13	\$5,000 - \$10,000 for the grazing plan consultancy	Clearer directions about managing cattle adjacent to the Lake	6 months	The ACT Government has released the Draft Jerrabomberra Wetlands Reserve Master Plan for public comment. Consultation closes on 28 September 2012. The draft Master Plan includes proposals for management of cattle in the Reserve. To further inform the finalisation of the Master Plan, the Jerrabomberra Wetlands Board of Management will let a consultancy shortly to provide

PRIORITY ACTIONS						
ACTION	RESPONSIBLE AGENCY	TIMING	COST	TYPE OF IMPACT/ OUTCOME	LEAD TIME	OTHER COMMENTS
						advice on a grazing plan for the Reserve.
The Jerrabomberra Wetlands Board of Management investigate options to improve the functioning of the Wetlands, through alteration of watercourses, recognising their environmental, cultural, recreational scientific and educational values.	TAMSD	TBD	TBD	TBD	TBD	Options for improving the functioning of the Wetlands are contained in the Draft Master Plan which is open for public comment as detailed above.
Establish a Lake Burley Griffin catchment protection program modelled on those of the Sydney Catchment Authority and ACTEW Water, with a 5 year implementation plan focused on sediment, vegetation and nutrient control to complement existing catchment management programs.	NCA, TAMSD, QCC, PC	2012-13	TBD	Reduce sediments and nutrients entering catchments and Lake	Ongoing	Works to include grants and incentives to landholders to address erosion hotspots, groundcover, road stream crossings and stock access to riparian areas.
Implement the Googong Foreshores Plan of Management	TAMSD	Ongoing	TBD	TBD	Ongoing	The final Plan is being prepared for consideration for final approval by the Minister for TAMSD. The Plan proposes additional monitoring of recreational use and grazing pressure to protect water quality.
<b>6. Sewerage</b>						
ACTW Water, Queanbeyan City Council and Palerang Council to report regularly on condition of sewer system.	ACT Water, QCC, PC	Ongoing	From existing resources	Reduce faecal contamination of Lake	Ongoing	
The ACT EPA review and update Environmental Authorisation 0417 for the Queanbeyan Sewerage Treatment Plant to ensure compliance with licence conditions.	ESDD/EPA	Current/ongoing	From existing resources	Maintain consistency of the quality of the treated effluent discharged from the treatment plant to the Molonglo River	Current	All authorisations including this one are reviewed annually as required by the <i>Environment Protection Act</i> . Authorisations are routinely updated based changes to facility operations, changes to standards and in response to incidents.
The Queanbeyan Sewerage Treatment Plant to continually review and improve its mitigating practices for inundation and washout events	QCC	Ongoing	From existing resources	Reduce faecal contamination of Lake	Ongoing	
NCA and ACT Health to continue to monitor sewage-based	NCA, ESDD,	Ongoing	From	Reduce faecal	Ongoing	ACT Health monitors bacteria

<b>PRIORITY ACTIONS</b>						
<b>ACTION</b>	<b>RESPONSIBLE AGENCY</b>	<b>TIMING</b>	<b>COST</b>	<b>TYPE OF IMPACT/ OUTCOME</b>	<b>LEAD TIME</b>	<b>OTHER COMMENTS</b>
pollution in the Lake. EPA to continue regulating sewage based pollution in the catchment. ACTEW to continue to advise the EPA on events and potential direction of sources. QCC to advise the ACT EPA on events and potential direction of sources.	EPA.		existing resources	contamination of Lake		levels in lake which is a surrogate for sewage related pollution and unsanitary conditions
ACTEW Water and Queanbeyan City Council to report annually on program of sewerage system refurbishment in the Lake catchment.	ACTEW Water, QCC	Ongoing	From existing resources	Reduce faecal contamination of Lake	Ongoing	
ACTEW Water, Queanbeyan City Council and Palerang Council to review and advise on leakages from the sewerage system and programs for relining systems to address leaks.	ACTEW,QCC, PC	Ongoing	From existing resources	Reduce faecal contamination of Lake	Ongoing	
In line with the current Guidelines, the ACT Government and Queanbeyan City Council identify and map sources of human faecal contamination entering urban stormwater systems, the significance of the sources, and long-term strategies for reducing loading.	ACTEW Water QCC	Ongoing	From existing resources	Reduce faecal contamination of Lake	Ongoing	
Develop procedures for 'sanitary surveys' in the event of elevated indicator concentrations should be established.	ACTEW Water QCC	2012-13	From existing resources	Reduce faecal contamination of Lake	< 1 year	
<b>7. River Flow Management</b>						
In consultation with the Environmental Flows Technical Advisory Group, undertake an investigation into the feasibility, costs and benefits of providing water releases from Googong Dam and the Captain's Flat reservoir.	NCA, ACTEW Water, ESDD	TBD	TBD	Pulsed flows would help mix Lake waters and inhibit algal blooms	<5 years	The NCA has commenced discussions the feasibility of one-off water releases with ACTEW Water
<b>8. Lake Closure Protocols and Communications</b>						
Document a framework for assessing and managing increased levels of risk associated with extreme water contamination events (BGA, bacteria, sewerage or chemical).	NCA to lead Health Directorate and EPA to advise	Sept 12	From existing resources			
Develop and install consistent water quality warning signage across the ACT.	NCA, TAMSD	2012-13	TBD			

## Attachment E Resourcing the Plan – Estimated Costs

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
<b>Coordination of Catchment Management and Governance</b>								
<i>Explore merit of statutory office</i>	0	60	Existing resources ACT Govt	0		0		Policy officer SOG B for 6 months
<i>Continue operation of Lake Burley Griffin Task Force</i>	0	180	Existing resources ACT Govt	450	Existing resources ACT Govt	900	Existing resources ACT Govt	Secretariat support SOG B 0.5 FTE SOG C 0.2 FTE
<i>Identify gaps in legislative and planning instruments</i>	0	20	Existing resources ACT Govt	0		0		Policy officer SOG B for 2 months
<i>Develop an Inter-governmental agreement</i>	0	180	Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	0		0		Policy team SOG B 0.5 FTE, SOG C 0.2 FTE
<i>Continuing operation of an inter-governmental agreement, including annual reporting on achievements</i>	0		Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	100	Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	200	Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	\$20,000 pa for reporting by agreement signatories
<i>LBG Catchment Strategy</i>		250	Proposed Water for	0		0		\$200,000 catchment study and resource assessment

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
			the Future State Priority Project					\$150,000 consultancy for drafting strategy \$50,000 community engagement and consultation
<i>Annual High Level Forum</i>	0	30	Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	25	Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	50	Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	\$5,000 pa (Coordination, venue hire, key note speakers, publication of proceedings)
<i>Review Integrated Catchment Management Framework as it applies to the Lake Catchment</i>	0	10	Existing resources ACT Govt	0		0		Policy officer SOG B for 1 month
<b>Monitoring and Knowledge Management</b>								
<i>An enhanced web presence for Lake and catchment information and monitoring data</i>	5	20	Proposed Water for the Future State Priority Project	25	Proposed Water for the Future State Priority Project	50	Proposed Water for the Future State Priority Project	Current: ~\$5,000 NCA website Short: \$20,000 to build \$5,000 site hosting and improvement pa Developed to complement catchment awareness program, with complementary content on agreement signatory websites
<i>A new water quality monitoring strategy for the Lake and its catchments</i>			Proposed Water for the Future State Priority Project					Cost to be determined following detailed scoping
<i>A network of water quality monitoring probes in the Lake</i>	200	100	Proposed Water for the Future State Priority					Current: NCA monitoring in Lake \$200,000 including monitoring of Solar Bee \$100,000 consultancy fee to

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
			Project					advise on monitoring system Installation and running costs to be determined following detailed scoping
<i>Native fish monitoring</i>	10	20	Proposed Water for the Future State Priority Project	100		200		Estimate based on current practice.
<i>Riparian monitoring</i>		50		30		60		Estimate based on previous rapid assessment plus analysis of aerial and satellite imagery work
<i>Continue to monitor the effectiveness and compliance of wetlands and pollution control structures during construction phases of development and subsequently to inform maintenance and effective functioning</i>	0	60	Proposed Water for the Future State Priority Project					Estimate provided by EPA \$60,000 for evaluation
<i>Monitor existing new sites such as at Kingston Foreshores and in the Sullivan's Creek catchment to assess impact on stormwater management</i>								To be determined
<b>Community Awareness Raising and Education</b>								

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
<i>Develop catchment awareness and behaviour change program</i>	408	350	Proposed Water for the Future State Priority Project	1,250	Proposed Water for the Future State Priority Project	2,500	Proposed Water for the Future State Priority Project	Current: \$158,000pa Aust Govt Caring for our Country program - Molonglo Catchment Group coordination and Waterwatch; \$250,000 pa ACT Govt GardenSmart Program; ACTEW Annual Water Saving Campaigns, Canberra Discovery Garden (National Arboretum), Education presentations and programs Short: \$100,000 Consultancy to research, design and pilot program Medium: Roll out \$250,000 pa based on ActewAGL Source Water Protection Program
<i>Build on coordination of existing catchment groups to enhance outcomes for the Lake and its catchments</i>	0	0		0		0		Current: \$158,000pa Aust Govt Caring for our Country program - Molonglo Catchment Group coordination and Waterwatch
<i>Volunteer Program</i>	2	30	Proposed Water for the Future State Priority Project	75	Proposed Water for the Future State Priority Project	150	Proposed Water for the Future State Priority Project	Current: ~\$2,000 for one-off events (plants, equipment) Short, Medium and Long: 4-6 events per year CVA coordination, promotion etc \$3,000pa; materials \$12,000pa
<i>Work with the Molonglo Catchment Group to review their Catchment Strategy</i>	0	10	Existing resources ACT Govt, NCA, NSW Govt, QQC, PC	0		0		Estimate for time contributed by agencies to review process
<b>In-Lake Management</b>								

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
<i>Modelling of potential algal blooms</i>	0		Proposed Water for the Future State Priority Project					Cost to be determined following detailed scoping
<i>Feasibility of macrophyte restoration</i>	30	30	NCA					\$30,000 for trial by Greening Australia
<i>Subject to feasibility, full restoration of macrophytes including construction of wetlands and macrophyte beds</i>	0		Proposed Water for the Future State Priority Project	2,300	Proposed Water for the Future State Priority Project	4,700		\$7 million estimated for full restoration by Commissioner for Sustainability and Environment as part of Inquiry
<i>Feasibility of treating sediments</i>								Cost to be determined subject to feasibility assessment
<i>Feasibility of oxygenation of water column</i>	0	0		1,000		1,000		Costs to be determined subject to feasibility assessment – e.g. \$1 million to establish and \$100,000 pa operating costs for Swan and Canning River, WA project
<i>Feasibility of absorption and removal of phosphorous</i>	0			1,724		60		Cost to be determined subject to feasibility assessment - Inquiry estimated \$1.7m to treat entire Lake; \$6,000pa to treat small hotspots each year
<i>Feasibility of stirring the water column</i>	0	180		6,800		7,000		Inquiry estimated \$3.8m capital cost and \$0.7m annual operating.
<i>Carp hotspots study</i>	0	200						Estimate based on current practice in other areas
<i>Targeted carp removal</i>	0	0		200		500		Estimate based on current practice in other areas

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
<i>Native fish re-stocking</i>	30	60		150		300		Est \$30,000 current NCA annual expenditure Estimate based on 50,000 fingerlings a year
<i>Carp populations research</i>	0	50						Estimated cost subject to detailed scoping
<b>Urban Catchment Management</b>								
<i>Ongoing program to renovate stormwater infrastructure</i>	1,600							To be determined TAMSD annual budget for stormwater maintenance \$3.2 to 4.0m, which addresses maintenance issues as they arise - difficult to apportion budget for LBG catchments (est 40%) 2012-13 budget committed \$360,000 in Capital Works funding for Fyshwick Stormwater Augmentation Stage 3 (Design)
<i>In conjunction with the revision of the ACT long term Water Strategy, ensure the current regulations for Water Sensitive Urban Design are delivering national standards or better.</i>	0	250	Proposed Water for the Future State Priority Project					To be determined Revised policy leading to revised general code on WSUD and revised rules and criteria for all developments to meet with the new policy and general code. This will lead to a greatly improved balance for water quality management from developments & more efficient, cost effective catchment management practices associated with this. ESDD (Water Policy) and EDD have already had preliminary discussions on a way forward for this review. Combination of

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
								internal and external providers/inputs.
<i>Identify the opportunities for infrastructure to be installed for pollution control</i>	0	70	Proposed Water for the Future State Priority Project					Estimate for advice on opportunities
<i>Examine options for short term remediation at Coranderrk Pond</i>								NCA obtaining advice on options
<i>Identify sources of leaf litter and programs to counter the sources using market based mechanisms where appropriate including seeping/vacuuming and, where possible, composting of street verge leaf matter</i>	0	50	Proposed Water for the Future State Priority Project					Short: \$50,000 for consultancy to explore options, including markets for street verge leaf matter
<i>Identify opportunities to increase the effectiveness of road sweeping programs</i>	500	400	Proposed Water for the Future State Priority Project					Current: Annual road sweeping program budget \$1m; 4 road sweeper vehicles for ACT; new vehicles \$300,000 each plus \$100,000 annual operating cost Short: TAMSD suggest 2 additional sweepers @ 400,000 would be effective response to reducing leaf litter in inner north and south Canberra

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
<i>Review protocols for cleaning GPTs and communicate revised protocols</i>	450	1,290	ACT Govt Budget consideration	3,150	ACT Govt Budget consideration	6,300	ACT Govt Budget consideration	Current: \$450,000 in ACT budget for GPT cleaning - adjusted depending on weather conditions (2011-12 \$947,000; 2010-11 \$710,000, \$2009-10 \$451,000) Short: \$30,000 for GPT cleaning audit Short, Medium and Long Term: TAMSD identified a need for an additional \$630,000pa to effectively clean GPTs (justification needs to come from review of maintenance arrangements)
<i>Review the effectiveness of existing GPTs</i>		50	Proposed Water for the Future State Priority Project					Estimate for consultancy advice
<i>Public land re-grassing and stabilisation</i>		280	ACT Govt Budget consideration	700	ACT Govt Budget consideration	1,400	ACT Govt Budget consideration	\$60,000pa for re-grassing and \$80,000pa for restabilising steep slopes beside underpasses
<i>Public land access compliance education and enforcement</i>		440	ACT Govt Budget consideration	1,100	ACT Govt Budget consideration	2,200	ACT Govt Budget consideration	Estimate based on current practice
<i>Additional barriers to protect public land</i>		100	ACT Govt Budget consideration	100	ACT Govt Budget consideration	200	ACT Govt Budget consideration	Estimate based on current practice

Action	Current Funding \$'000	Short Term (2012-14) \$'000	Source of Funding	Medium Term (2015-20) \$'000	Source of Funding	Long Term (2020-30) \$'000	Source of Funding	Comments/Basis of Costing
<i>Removal of woody weeds</i>		600	Proposed Water for the Future State Priority Project	1,500	Proposed Water for the Future State Priority Project	3,000	Proposed Water for the Future State Priority Project	Estimate based on current practice
<b>Rural Catchment Management</b>								
<i>Rural Catchment Protection Program</i>								To be determined following detailed scoping
<i>Grazing Plan for Jerrabomberra Wetlands</i>		10	ACT Govt					
<i>Better functioning of Jerrabomberra Wetlands</i>								To be determined following finalisation of Master Plan
<i>Implementation of Googong Foreshore Plan of Management</i>								To be determined following release of Plan of Management
<b>Sewerage</b>								
<b>Lake Closure Protocols and Communications</b>								
<i>Document a framework managing risk from extreme contamination events</i>								To be determined following detailed scoping
<i>Develop and install consistent water quality signage</i>								To be determined following detailed scoping
<b>TOTAL</b>	<b>3,433</b>	<b>5,430</b>		<b>20,779</b>		<b>30,770</b>		