Australian Capital Territory

Nature Conservation (Draft Reserve Management Plan—Molonglo River) Public Consultation Notice 2018

Notifiable instrument NI2018–54

made under the

Nature Conservation Act 2014, s 179 (Draft reserve management plan—public consultation)

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1 Name of instrument

This instrument is the *Nature Conservation (Draft Reserve Management Plan—Molonglo River) Public Consultation Notice 2018*.

2 Commencement

This instrument commences on the day after its notification day.

3 Draft reserve management plan

I have prepared the Draft Molonglo River Reserve Management Plan 2018 (the ***draft reserve management plan***) at schedule 1 to this instrument.

4 Details of public consultation

(1) Anyone may give a written submission about the draft reserve management plan to:

Manager, Parks and Conservations – Projects
Environment, Planning and Sustainable Development Directorate
GPO Box 158
CANBERRA ACT 2601
Email: molonglo@act.gov.au

(2) Submissions may be given on the draft reserve management plan during the public consultation period starting the notification day of this instrument and ending on 23 March 2018.

Note The draft reserve management plan is also available on the Your Say website at www.yoursay.act.gov.au.

Daniel Iglesias
Custodian

06 February 2018

ACT Government

MOLONGLO RIVER RESERVE

DRAFT RESERVE MANAGEMENT PLAN

2018

Authorised by the ACT Parliamentary Counsel—also accessible at www.legislation.act.gov.au

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- members of the local Aboriginal community
- staff of the Transport Canberra and City Services Directorate, Environment, Planning and Sustainable Development Directorate and Chief Minister, Treasury and Economic Development Directorate
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The Australian Capital Territory is Ngunnawal country. The ACT Government acknowledges the Ngunnawal people as the traditional custodians of the Canberra region. The region was also an important meeting place and significant to other Aboriginal groups.

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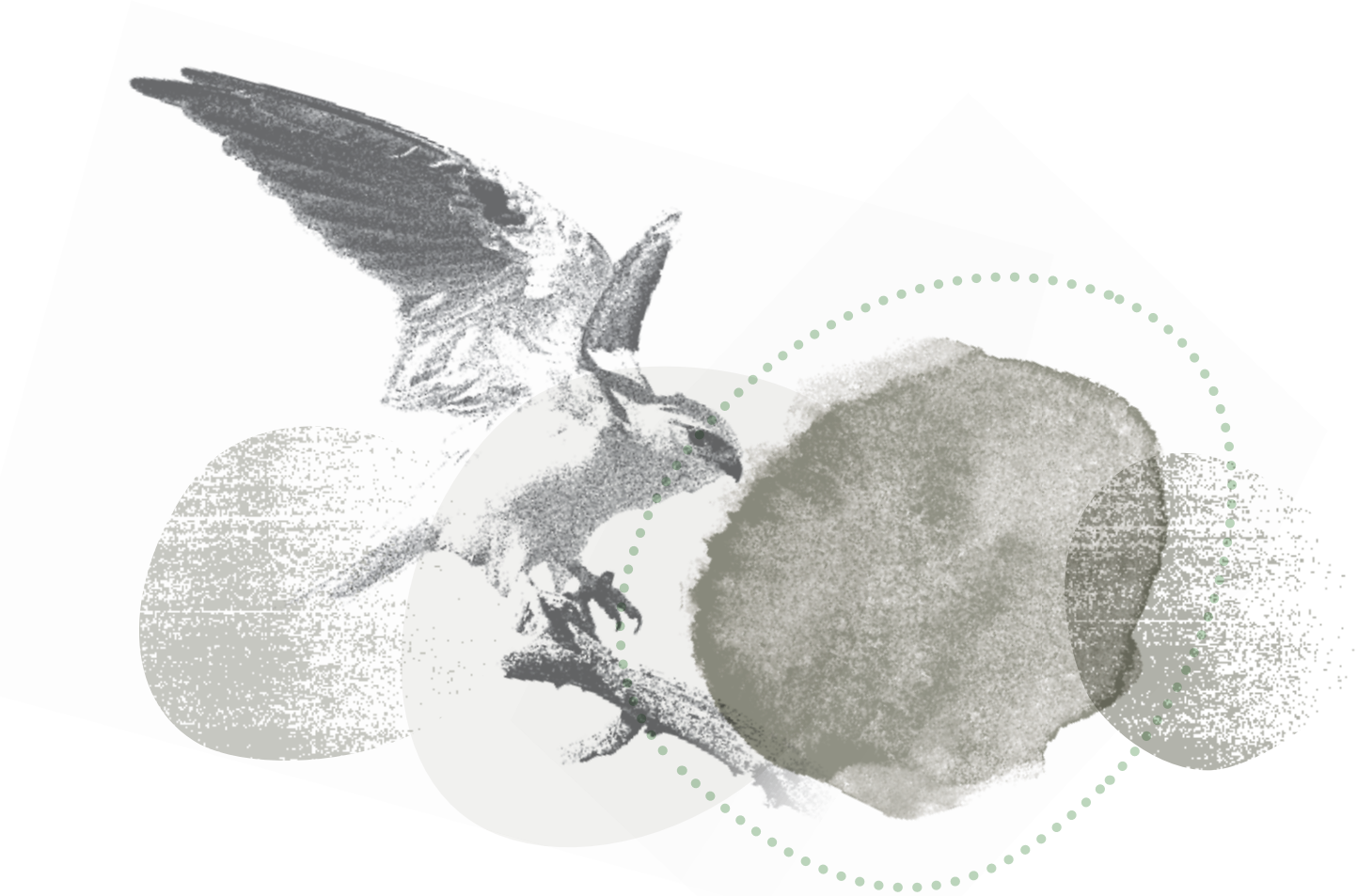

MOLONGLO RIVER RESERVE

DRAFT RESERVE MANAGEMENT PLAN

2018

ABBREVIATIONS

ACT	Australian Capital Territory
ACTPLA	ACT Planning and Land Authority
BGW	Box-Gum Grassy Woodland (equivalant to 'White Box-Yellow Box Grassy Woodland' and 'Derived Native Grassland' in the EPBC Act)
CEMP	Construction Environmental Management Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)*
EPSDD	Environment, Planning and Sustainable Development Directorate, ACT Government
LMWQCC	Lower Molonglo Water Quality Control Centre
MNES	Matters of National Environmental Significance
MoU	Memorandum of Understanding
NES	National Environmental Significance
NCA	National Capital Authority
NTG	Native Temperate Grassland (equivalant to 'Native Temperate Grassland of the South Eastern Highlands' in the EPBC Act)
OAPZ	Outer Asset Protection Zone
PAD	Potential Archaeological Deposit
PTWL	Pink-tailed worm-lizard
SBMP	Strategic Bushfire Management Plan
SFAZ	Strategic Firefighting Advantage Zone
SLA	Suburban Land Agency, ACT Government
TCCS	Transport Canberra and City Services Directorate, ACT Government
TPC	Thresholds of potential concern

GLOSSARY

Activities Declarations: A legal instrument *(a notifiable instrument)* under the *Nature Conservation Act 2014* that prohibits or restricts users activities in reserves.

Environmental flows: The flows of water in streams, rivers and impoundments that are necessary to maintain healthy aquatic ecosystems.

Kama: Formerly Kama Nature Reserve and part of Canberra Nature Park, now incorporated into the Molonglo River Reserve. It is listed on the ACT Heritage Register as Kama Woodland/Grassland, Belconnen and consists of Blocks 1419, 1386 and parts of 1596 and 181 and verge of William Hovell Drive adjacent to Blocks 1419, 1386 and 1596, Belconnen District.

Lower Molonglo River: The Molonglo River from Scrivener Dam to its intersection with the Murrumbidgee River.

(The) Management Plan: The Molonglo River Reserve Management Plan. The Plan's purpose is to give clear direction on how biodiversity, land and waters of the Molonglo River Reserve will be used and managed to satisfy both nature conservation and recreation objectives.

Molonglo River Reserve Adaptive Management Strategy (May 2013): The Adaptive Management Strategy is a key commitment arising out of the NES Plan. It forms the foundation on which the Matters of National Environmental Significance values in the Molonglo area are protected and enhanced through ongoing improvement in management practices.

Molonglo River Reserve & Offset Areas Ecological Management Guidelines (February 2015): The Ecological Management Guidelines guide management for conservation values, especially five matters of national environmental significance in land beside and near the Molonglo River, downstream of Scrivener Dam and Lake Burley Griffin, ACT.

Molonglo River Reserve Procedures Manual (September 2014): The Procedures Manual provides the core monitoring program designed to meet the monitoring requirements identified in the NES Plan.

NES Plan: The Molonglo Valley Plan for the Protection of Matters of National Environmental Significance, a plan agreed between the ACT and Commonwealth Governments to ensure that the conservation impacts of development will be offset by a range of conservation gains nearby.

Operational Plans: The day-to-day management planning tool that will provide detail about the on-ground works and activities.

Rural section: The downstream section of the Reserve that is bordered by rural land.

Trunk path: A sealed 3m wide path designed to shared path standard which is sufficiently wide to accomodate cyclists and walkers, including those with limited mobility, and slower cyclists.

(The) Reserve: Molonglo River Reserve, the reserve that is the subject of this Reserve Management Plan.

Urban section: The upstream section of the Reserve that is bordered by urban land.

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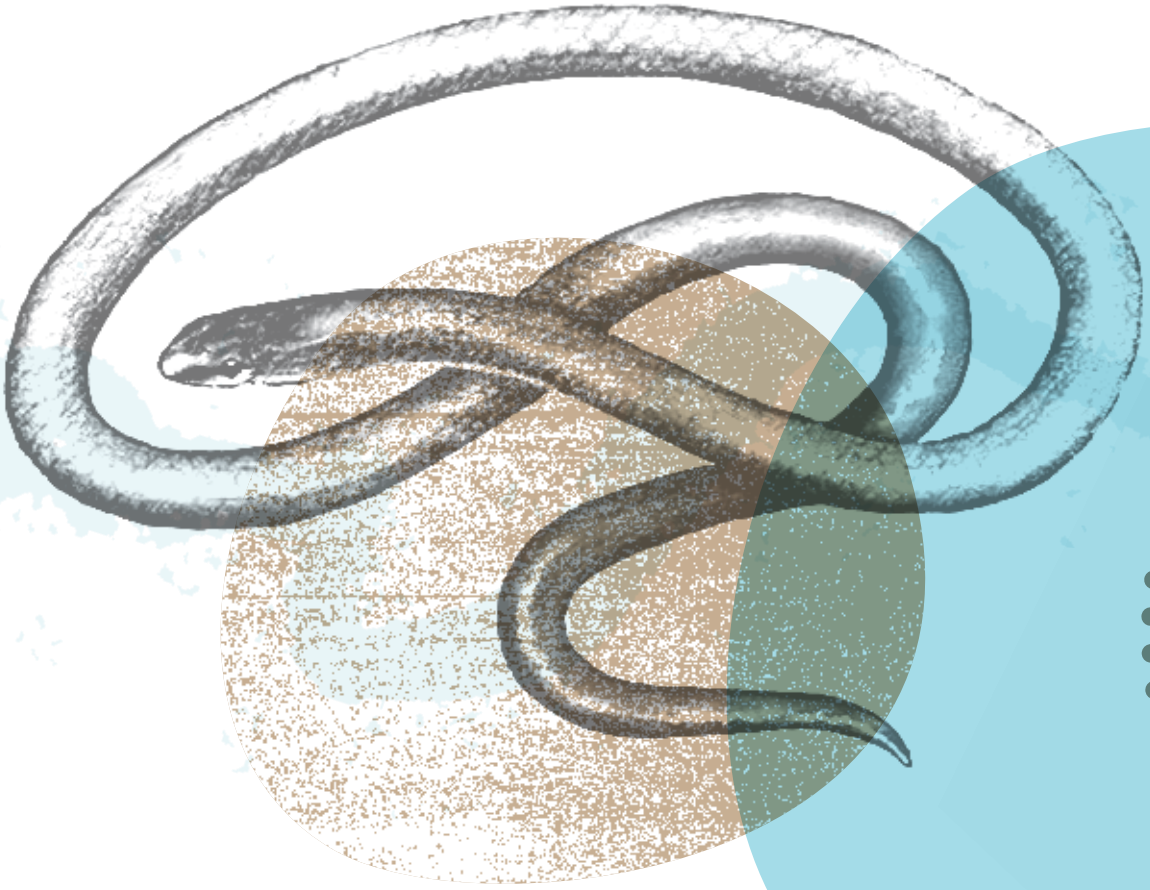
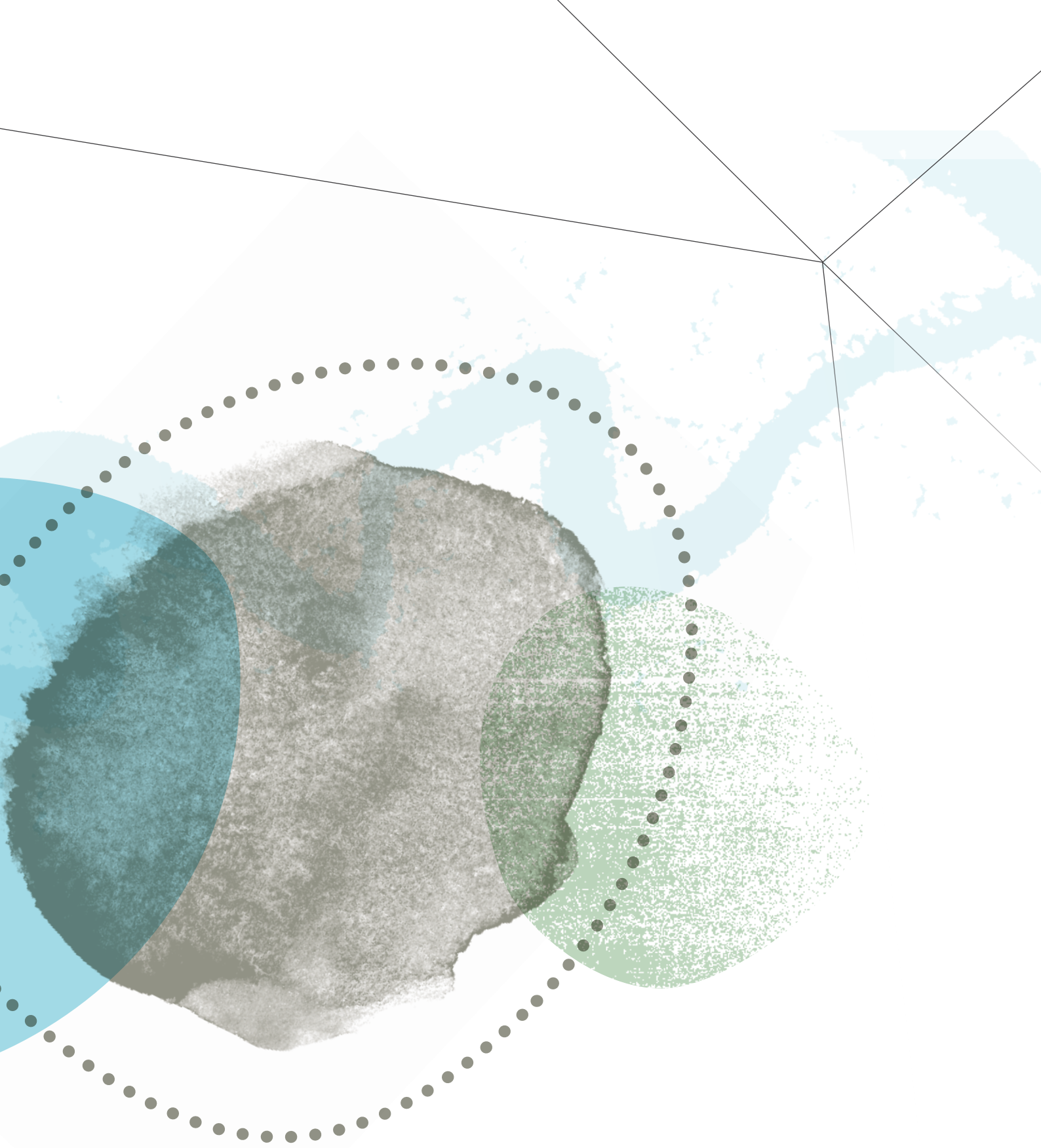




MOLONGLO RIVER RESERVE

SUMMARY

The Molonglo River Reserve ("the Reserve") is a new reserve comprising approximately 1280 hectares that follows the Molonglo River from Scrivener Dam downstream to the intersection with the Murrumbidgee River Corridor Reserve. It includes three current reserves – Molonglo River Special Purpose Reserve, Lower Molonglo River Corridor Nature Reserve and Kama Nature Reserve ("Kama"), and brings them together with some new areas to create river corridor that has high conservation value and will be a central landscape feature and recreation destination of the new Molonglo Valley urban development.

The Reserve is most significant for its river landscapes and nationally threatened species and communities. In particular, the habitat for pink-tailed worm-lizard is amongst the best remaining in Australia, and the box-gum grassy woodland in Kama is one of the best representations of that vegetation community in the ACT. As well as being consistent with Commonwealth and ACT legislation about the protection of threatened habitat and aquatic ecosystems, a specific set of agreements between the Commonwealth and ACT governments about Molonglo Valley development apply to the Reserve. These agreements are spelt out in the National Environmental Significance (NES) Plan (ACT Planning and Land Authority 2011).

Other key factors that were considered in developing this Management Plan were: the location of the Reserve to the northwest of Canberra, which is the direction of highest risk for bushfires entering urban Canberra; and prior work on a conceptual design for a river park, a central feature of the Molonglo Valley development (Molonglo River Park Concept Plan, Hassell 2012). The needs of communities and rural neighbours living on the Reserve doorsteps; of Aboriginal people with connections to the river, past and present; of those interested in the European cultural history, and of people who will come for its recreation opportunities were also important considerations.

The Management Plan is a statutory plan, required under the *Planning and Development Act 2007* and defined as a 'reserve management plan' in the *Nature Conservation Act 2014*. Its purpose is to give clear direction on how the biodiversity, land and waters of the Molonglo River Reserve will be used and managed to satisfy both nature conservation and recreation objectives. The plan is structured by topic, each with a nested set of management objectives, policies are listed in the following summary table. Recreation uses of the Reserve that are prohibited are in Table 9.1 and those that are permitted in Table 9.2.

Summary of long term objectives for the reserve, the policy approaches that will be taken for each objetive and actions in the first 10 years

#	Objectives	#	Policy	#	Action	Timing*	Priority**
LAND DESIGNATIONS, MANAGEMENT ZONES AND BOUNDARIES (CHAPTER 3)							
1	Reserve boundaries, management zones and buffers adequately protect its threatened species and communities.	1.1	Future changes in boundaries and management zones must be consistent with the objectives of the Management Plan, and in particular not compromise the capacity to protect threatened species and communities.	1.1.1	Monitor urban edge development, its impacts and policy changes that might impact on the capacity to effectively protect threatened species and communities; and propose appropriate actions if that capacity is threatened.	Ongoing	Medium
		1.2	The design and management of the Kama buffer must meet the functional criteria at Table 3.1, designed to protect its conservation value.	1.2.1	Monitor Kama annually for edge effect impacts (Table 3.1) as part of the Adaptive Management Strategy (ACT Government 2013d).	Ongoing	High
GEOLOGY, LANDFORMS, SCENERY AND SOILS (CHAPTER 5)							
2	Conserve the condition of the heritage geological site.	2.1	Protect the site from disturbance.	2.1.1	Avoid significant infrastructure development at the heritage geological site but if unavoidable, a statement of heritage effects must be developed that outlines impacts, proposed mitigation strategies, and a mid to long term management strategy.	Ongoing	High
				2.1.2	Avoid disturbing outcrops or sub-surface limestone when designing infrastructure such as trails, trenches and fences.	Ongoing	High
		2.2	Raise awareness of the value of the site.	2.2.1	Consider building a short trail through a selected part of the heritage geological site and provide interpretation.	Short term	Medium
3	Maintain and enhance landscape function in the long term.	3.1	Soil disturbance in the Reserve will be minimised by avoiding disturbance in the first place or planning for its mitigation or remediation when disturbed.	3.1.1	Design routes and trails to minimise the risk of people trampling or riding off path.	Ongoing	High
				3.1.2	Apply the design and construction approach used in new sections of the Centenary Trail (CBRE 2014) to new trails in the Nature Reserve, where appropriate.	Ongoing	High
				3.1.3	Promote a culture of people staying on trails (especially in the urban section), vehicles remaining on roads and tree litter and rocks remaining in place.	Ongoing	High
				3.1.4	Works Plans for all significant park management activities will include the mitigation of soil and habitat disturbance.	Ongoing	High
		3.2	Monitor, manage and remediate soil disturbance and erosion.	3.2.1	Remediate eroding areas that are near or have crossed their landscape function threshold.	Ongoing	High
				3.2.2	Monitor the impact of grazing, especially from cattle, kangaroos and rabbits and take action to modify the grazing pressure if soil surface condition is likely to approach thresholds.	Ongoing	Medium

#	Objectives	#	Policy	#	Action	Timing*	Priority**
4	People are able to access, view and enjoy a diversity of scenery that is dominated within the Reserve by natural features.	4.1	The 'naturalness' of the Reserve will be protected.	4.1.1	Design structural elements within the reserve to ensure integration with landscape character and ecological objectives.	Ongoing	High
		4.2	Identify and provide access to a diverse set of views, and protect their 'naturalness'.	4.2.1	Select a set of views that reflect the diversity of natural features, and identify and map them to give them status and aid in wayfinding.	Short term	Medium
ECOLOGICAL CONSERVATION (CHAPTER 6)							
5	The population size of threatened species is at least maintained; the condition of listed threatened communities are at least maintained or condition improved; and the diversity of all other native species is conserved; and the ecological condition of the dryland matrix is improved.	5.1	On-ground activities will be designed and implemented through a suite of plans informed by ecological management guidelines for the Reserve and an adaptive management approach. (Applies to all Objectives 5-9.)	5.1.1	Develop a set of scientifically-based ecological management guidelines that incorporate the NES agreements (Sharp et al. 2015) (Table 6.2), bushfire protection, action plans (Table 6.3, Table 6.4, Table 6.6) and threat abatement plans (Table 6.5) and provide integrated guidance to designing the on-ground activities for achieving the goals.	Short term	High
				5.1.2	Develop 3-year Operational Plans for discrete areas that prioritise the on-ground actions for each area.	Ongoing	High
				5.1.3	Annually develop and implement a Work Plan for each Operational Plan.	Annually	High
				5.1.4	Implement the adaptive management strategy for the NES areas (ACT Government 2013d) to track progress and adjust management as learning grows; and review other objectives in Years 5 and 10 (see Chapter 11).	Ongoing	High
6	Raise the ecological condition in the river and riparian zone to support the recovery of native fish in the river.	6.1	A long term river habitat restoration plan will guide recovery of ecological values in the river and riparian zone.	6.1.1	Monitor water quality and flows upstream (above Yarralumla Creek) and downstream of the urban section and develop a quantitative understanding of the impact of new retention basins in the catchment on the quantity and quality of flows into the river.	Ongoing	Medium
				6.1.2	Review the environmental flow recommendations developed during earlier Molonglo Valley development planning and seek mechanisms for their implementation.	Short term	Medium
				6.1.3	Investigate the extent to which outflows from LMWQCC deter some fish species from entering the Molonglo River from the Murrumbidgee and if required, investigate options for changing the point or pattern of discharge.	Short term	Medium
				6.1.4	Review the impact of the release of cold water from Scrivener Dam and explore options for improving the quality of water released from the Dam in consultation with the NCA.	Short term	Medium
				6.1.5	Combine these actions with other appropriate measures from the Aquatic Species and Riparian Zone Conservation Strategy in a Lower Molonglo River Restoration Plan.	Short term	Medium

#	Objectives	#	Policy	#	Action	Timing*	Priority**
7	Achieve fire protection for people and property in ways that also effectively protect threatened habitat and other ecological conservation values.	7.1	Requirements of the Strategic Bushfire Management Plan will be met in ways that minimise loss of threatened habitat and ecological function.	7.1.1	Complete the PTWL rehabilitation trial in Patch K and progressively apply the results to PTWL buffers and moderate and high quality PTWL habitat patches in Outer Asset Protection Zones in the urban section.	Ongoing	High
				7.1.2	Incorporate requirements into the Molonglo Development Fire Management Strategy and the three Regional Fire Management Plans that apply to the rural section, and implement them in Operational Plans.	Ongoing	High
				7.1.3	Prohibit the use of open fires in the Reserve (Chapter 8).	Ongoing	High
8	Connectivity within and outside the Reserve is addressed and improved.	8.1	Connectivity within and outside the Reserve will be imnproved.	8.1.1	Analyse connectivity, identify gaps and target the gaps for habitat rehabilitation.	Short term	Medium
ABORIGINAL CONNECTIONS (CHAPTER 7)							
9	Respect, promote and protect Aboriginal use, past and current, of the land and waters of the Molonglo River Reserve.	9.1	Aboriginal connection with Country, past and present, will be visibly promoted.	9.1.1	With Aboriginal involvement, seek government approval to name the Reserve with an Aboriginal name.	Short term	High
				9.1.2	Include Aboriginal perspectives in all major promotion and interpretation material.	Ongoing	High
		9.2	Aboriginal people will be involved in the management and interpretation of the Reserve.	9.2.1	The right of the Ngunnawal community to be consulted and involved in issues that affect their interests will be respected and protocol for how consultation should occur will be developed.	Ongoing	High
				9.2.2	Establish a site that interprets how Ngunnawal people used the river, its food and its plants.	Short term	High
				9.2.3	Identify and document traditional Aboriginal cultural knowledge and, where appropriate, use it in reserve management through partnerships with Aboriginal people.	Ongoing	Medium
		9.3	Aboriginal heritage sites and objects will be protected.	9.3.1	Aboriginal cultural heritage will be managed in accordance with statutory requirements, National Heritage principles, and guidelines for Aboriginal cultural heritage places.	Ongoing	High
				9.3.2	Develop and implement Conservation Management Plans for the following sites and areas: MRC14, MRC15, MRC17, PAD1, PAD5 and the Special Cultural place.	Short term	High
				9.3.3	Monitor the effectiveness of the conservation actions and adapt the management plans if required.	Ongoing	Medium
				9.3.4	Return agreed salvaged artefacts to Country.	Short term	Medium
				9.3.5	Develop and apply a protocol for action in the event of new sites being found.	Short term	Medium
				9.3.6	Review and if required, resurvey the rural section of the Reserve for Aboriginal sites and apply the same mechanisms to their protection as in the urban section.	Short term	Medium

#	Objectives	#	Policy	#	Action	Timing*	Priority**
EUROPEAN CULTURAL HERITAGE (CHAPTER 8)							
10	Protect, promote and respect the European cultural heritage in the Reserve.	10.1	The major European heritage sites will be protected.	10.1.1	Conforming to statutory requirements and best practice principles, implement the Conservation Management Plan for Riverview.	Year 1	High
				10.1.2	Prepare and implement a conservation management plan for the limestone quarry that aligns with measures developed to conserve the heritage listed geological site (Objective 2).	Short term	Low
				10.1.3	Monitor the effectiveness of the conservation actions and adapt the management plans if required.	Ongoing	Medium
		10.2	The history of past land uses and occupation will be reflected in named places and interpretive material.	10.2.1	Synthesise and make publically available an occupation and land use history of the Lower Molonglo Valley 1820-2014, including specific reference to historical sites within the Reserve boundaries.	Short term	Low
				10.2.2	Promote and reflect the history in the naming of local places and in interpretation material.	Ongoing	Low
		10.3	Descendants of families with a strong historical association with the places in the Reserve, and local historians, will be respected and involved.	10.3.1	Involve descendants, former users of the area and local historians in the planning, maintenance and interpretation of European cultural heritage in the Reserve.	Ongoing	High
RECREATION (CHAPTER 9)							
11	Provide a range of recreation opportunities that are valued by users and that can co-exist with other values and objectives for the Reserve.	11.1	Provide a range of recreation opportunities differentiated by their level of intensity, allowing low intensity activities in the Nature Reserve and providing for higher intensity activities into the Special Purpose Reserves.	11.1.1	Reflect the distinction between low and high intensity activities in the choice and design of recreation facilities.	Ongoing	High
				11.1.2	Incorporate the distinction between low and high intensity activities into promotion about the Reserve.	Ongoing	Medium
				11.1.3	Make permitted and non-permitted recreation activities clear (Tables 8.1 and 8.2).	Ongoing	Medium
				11.1.4	Evaluate new recreation proposals according to the criteria in Section 9.4.12.	On Demand	High
				11.1.5	Evaluate commercial proposals according to the criteria in Section 9.4.13.	On demand	High
				11.1.6	Prepare landscape plans for the Special Purpose Reserves.	Short term	High
				11.1.7	Regularly seek feedback from users and use it to guide management.	Ongoing	High
12	Residents in Molonglo Valley view, treat and protect the Reserve as their 'treasured front yard' and set a new high standard in the ACT for their behaviour in a nature reserve	12.1	Manage impact through appropriate detailed design of recreation facilities and by addressing the behaviour of users from early on in Reserve establishment.	12.1.1	Develop detailed plans for trails and facilities in successive portions of the Reserve as development proceeds.	Ongoing	High
				12.1.2	Develop and implement a program that includes working with user and community groups to codify, encourage and monitor people's behaviour in the Reserve and applying sanctions where appropriate.	Ongoing	High

#	Objectives	#	Policy	#	Action	Timing*	Priority**
13	The Reserve adds value to the ACT as a distinct recreation destination, a long-distance recreation link, and an attractive contribution to the Canberra Open Space System.	13.1	Maintain and enhance trail linkages to destinations beyond the Reserve, working with adjoining land managers to maintain or improve connectivity.	13.1.1	Maintain existing trail linkages and improve linkages in the rural section of the Reserve.	Ongoing	High
14	Visitor safety is addressed in the design of information, facilities and operations.	14.1	Minimise the risk of harm to people by designing and managing facilities to suitable safety standards and by providing community education and on-site warnings.	14.1.1	Design, build and maintain all facilities, including trails, to standards that minimise risks to visitors and natural assets.	Ongoing	High
				14.1.2	Provide clear descriptions and safety information to visitors at Reserve entrances, in published guides about the Reserve and at specific locations where danger is high.	Ongoing	High
				14.1.3	Work with schools, local community networks and recreation groups to educate users about dangers in the Reserve.	Ongoing	Medium
				14.1.4	Develop and maintain an Emergency Response Plan for Molonglo River Reserve, in conjunction with the Australian Federal Police, the Emergency Services Agency, NCA and other organisations. The Plan may include protocols for closing the Reserve or parts of it on days of high fire danger or flooding.	Short term	High
				14.1.5	Warn visitors about temporary hazards (e.g. herbicide spraying, bait laying, controlled burns).	Ongoing	High
FIRE PROTECTION, INFRASTRUCTURE AND OPERATIONS (CHAPTER 10)							
15	Suitable access and associated infrastructure is available for fire management.	15.1	An access plan for fire management will be developed that maximises the use of existing management tracks and does not impact on NES matters, except where permitted in the NES Plan.	15.1.1	Develop and implement a fire access plan, taking into account all the other objectives in the Management Plan.	Short term	High

#	Objectives	#	Policy	#	Action	Timing*	Priority**
16	Avoid or minimise the impact on Reserve values of building and maintaining infrastructure and facilities in or nearby the Reserve.	16.1	The values, objectives and relevant policies of the Management Plan will be used to guide advice and actions on the impacts of construction and maintenance works.	16.1.1	Provide advice to proponents of constructed works and facilities about how impact can be mitigated.	On demand	High
				16.1.2	Monitor and report non-compliance with legislative requirements relating to construction activities and sediment and contaminant flows from neighbouring properties.	Ongoing	High
				16.1.3	Monitor construction activities for inadvertent impact, and design and negotiate appropriate mitigation.	Ongoing	High
				16.1.4	Monitor the impact of using natural creek lines as drainage channels from stormwater ponds and rehabilitate channels or modify their design if required.	Ongoing	High
17	Minimise harm to people and the environment from Reserve operations.	17.1	Relevant legislation and ACT Government policy will be applied to all management actions that have a risk of harm to people and wildlife.	17.1.1	Ensure staff are aware of and comply with prescriptions applying to all activities in the Reserve, particularly those involving: - pesticides and weedicides - firearm use - ecological and fuel reduction burning.	Ongoing	High
				17.1.2	Apply standard ACT Government duty of care to all activities in and associated with the Reserve.	Ongoing	High
		17.2	Reserve operations will not compromise agreed objectives in the Management Plan.	17.2.1	Assess significant operational activities for their environmental impact and mitigate any significant impacts.	Ongoing	High
NEIGHBOURS AND COMMUNITIES (CHAPTER 11)							
18	Achieve productive working relationships with neighbours that contribute to maintaining Reserve values	18.1	Establish and maintain good neighbour relationships.	18.1.1	Develop and implement a Good Neighbour Plan that integrates with other relevant community and cooperative rural activities.	Short term	Medium
19	Achieve strong community support for the Reserve and active contributions towards its management.	19.1	A planned approach will be used to make good use of existing community mechanisms.	19.1.1	Develop and implement a Communication and Engagement Plan on the basis of the principles in the Management Plan.	Short term	Medium
				19.1.2	Develop a MoU with the Molonglo Catchment Group for carrying out collaborative community engagement activities in the Molonglo Valley and the Reserve.	Short term	High

#	Objectives	#	Policy	#	Action	Timing*	Priority**
GOVERNANCE, KNOWLEDGE AND IMPLEMENTATION (CHAPTER 12)							
20	Inform future decision making with a structured, evidence-based process	20.1	Strategic consultation with the community will be proactive and planned.	20.1.1	Appoint a community consultative committee and hold regular meetings to exchange feedback and develop joint, proactive responses to emerging issues.	Short term	High
		20.2	Adaptive management principles will be applied to Reserve management.	20.2.1	Implement the NES Adaptive Management Strategy that includes the NES matters applying within the Reserve.	Ongoing	High
				20.2.2	Fill gaps in the baseline data for the whole of the Reserve, including using citizen science activities where appropriate.	Ongoing	High
				20.2.3	Review progress of all objectives in the Management Plan in year 5 (for adjustment) and year 10 (to inform the subsequent plan).	Medium term	High
21 Foster the development of new knowledge and its application to management actions for achieving other Reserve objectives		21.1 Work strategically and collaboratively with key researchers.		21.1.1	Assess research proposals that require access to the Reserve on the basis of their relevance, ecological impact and management support required.	On demand	Medium
				21.1.2	With research partners, seek opportunities for funding of research projects of mutual interest.	On demand	Medium
				21.1.3	Synthesise new knowledge and ensure it reaches Reserve staff and community stakeholders.	Ongoing	Medium

* Timing is indicative of the period during the 10 year life of the Management Plan when the action is envisaged to occur (short term = Years 1-5, medium term = Years 6-10). The timing of some actions will be dependent on resource availability.

** Priority refers to the relative importance of each action in achieving the objectives of the Management Plan, including conforming with all relevant legislation and government agreements.

1. VISION, VALUES AND SIGNIFICANCE

The Molonglo River Reserve ("the Reserve") is a new reserve that follows the Molonglo River from Scrivener Dam downstream to the intersection with the Murrumbidgee River Corridor Reserve.

It includes three current reserves – Kama Nature Reserve, Lower Molonglo River Corridor Nature Reserve and Molonglo River Special Purpose Reserve, and brings them together with some new areas to create the Molonglo River Reserve. The total length of the river within the Reserve is 23 km and the area is 1,280 ha.

A key characteristic of the Reserve is that the upstream section, formerly pine forests and grazing country around a river with degraded riparian vegetation, will become the central landscape feature and open space in the new suburbs of Molonglo Valley. At the same time, the nationally threatened communities and species that live in the Reserve must be protected. The downstream section will remain bordered by rural land. To simplify communication about the upstream and downstream sections, they are termed "urban" and "rural" respectively in this Plan Figure 1.1. There is no hard boundary between the two sections.

Aerial view of Molonglo River Reserve rural section

Vision

The following vision reflects the core nature and purpose of the Reserve.

A reserve that people treasure for its river and gorges, rich biodiversity and variety of experiences. For wildlife and people alike, the meandering river and its quiet spaces are sanctuaries from the city and safe passage ways for longer distance travellers. Aboriginal people commemorate how the route was once used by their ancestors and care for this land still. Canberrans respect and care for the reserve, contribute to its renewal and celebrate the revival of its native plants and wildlife.

In shorter form it has been expressed as *The river reserve is our treasured natural 'front-yard'.*

1.1 Values and Significance

The values and significance of a place elaborate on the vision and describe what is most important to enhance or protect. Values are the expressions of the esteem, desirability or usefulness of the features of the Reserve (Tidbinbilla NP ACT 2012) and the significance of each feature indicates its importance relative to other places, usually in the sense of relative scarcity. Table 1.1 documents and highlights the values of the Reserve that are most significant and that shape the directions in the Management Plan.

Issue Box 1.1 What is a value and why are values important?

In protected area planning, values have historically been separated into two categories: natural (defined as deriving from the natural environment) and cultural (deriving from human use). In fact, all the values of a place are assigned to them by people for the benefits they provide to their psychological and material wants and needs. All the values are cultural values. Applying a categorisation of values used in resource economics, the values of the Molonglo River Reserve are classified in this plan as either existence or use values.

Existence values are derived from the presence of Aboriginal or colonial cultural sites, native ecological communities, rare or endangered species, or fossil sites. Visitation is unnecessary to realise these values; they are enjoyed by anyone who knows of their existence.

Use values that involve presence in the Reserve, such as walking, cycling, fishing, meeting people, studying or just enjoying the plants, animals and scenery in the Reserve; also use of the land for infrastructure placement, fire protection, road crossings etc. People have to see or visit the Reserve, or live nearby to benefit from the other services provided, so use values decline with distance from the Reserve.

All the use and existence values of the Reserve have a **bequest value** when left in good condition for the benefit of future generations.

Most landscapes provide a mix of values (benefits) to people. Within a particular landscape, the mix can be varied by the way in which the landscape is used and managed. However, landscapes can rarely provide everything that people want from them and values need to be 'traded-off' if the landscape is to sustain a flow of benefits in the longer -term. *"All human–environment frameworks must address complements and conflicts among diverse sets of human needs because of the limited capacities of ecosystems to meet those needs sustainably"* (Daniel et al. 2012). In the case of protected areas it is characteristic that the trade-offs are asymmetrical in scale (Zia et al. 2011), that is, people who live nearby place use values most highly and people at a distance place more value on existence values. In the case of this Reserve, the need for tradeoffs means that not all the desires for access and recreation will be met within the Reserve, nor all the desires for ecological integrity. Protected areas "provide for only a limited part of the range of land uses in a region" (NSW NPWS 2000).

The significance of redefining how values are categorised in this Management Plan is that it makes transparent that all the trade-offs between different values are trade-offs between people. For example, decisions or actions that protect ecosystems, such as threatened species declarations, are agreed by people through a political process. The challenge is to protect the most significant values, find and promote those that are complementary and determine the safe trade-off points for those that conflict. The statement of values and their significance provides the foundation for doing this, within the boundaries set by the legislated objectives for land classified as nature reserve or special purpose reserve.

Because this is a new reserve encompassing land that has not previously been managed either for its ecological or urban open space values, some of the stated values are desired rather than current values. Urban parks have been noted to increase in value over time (Garvin 2010) and one of the roles of the Management Plan is to guide how this will be achieved.

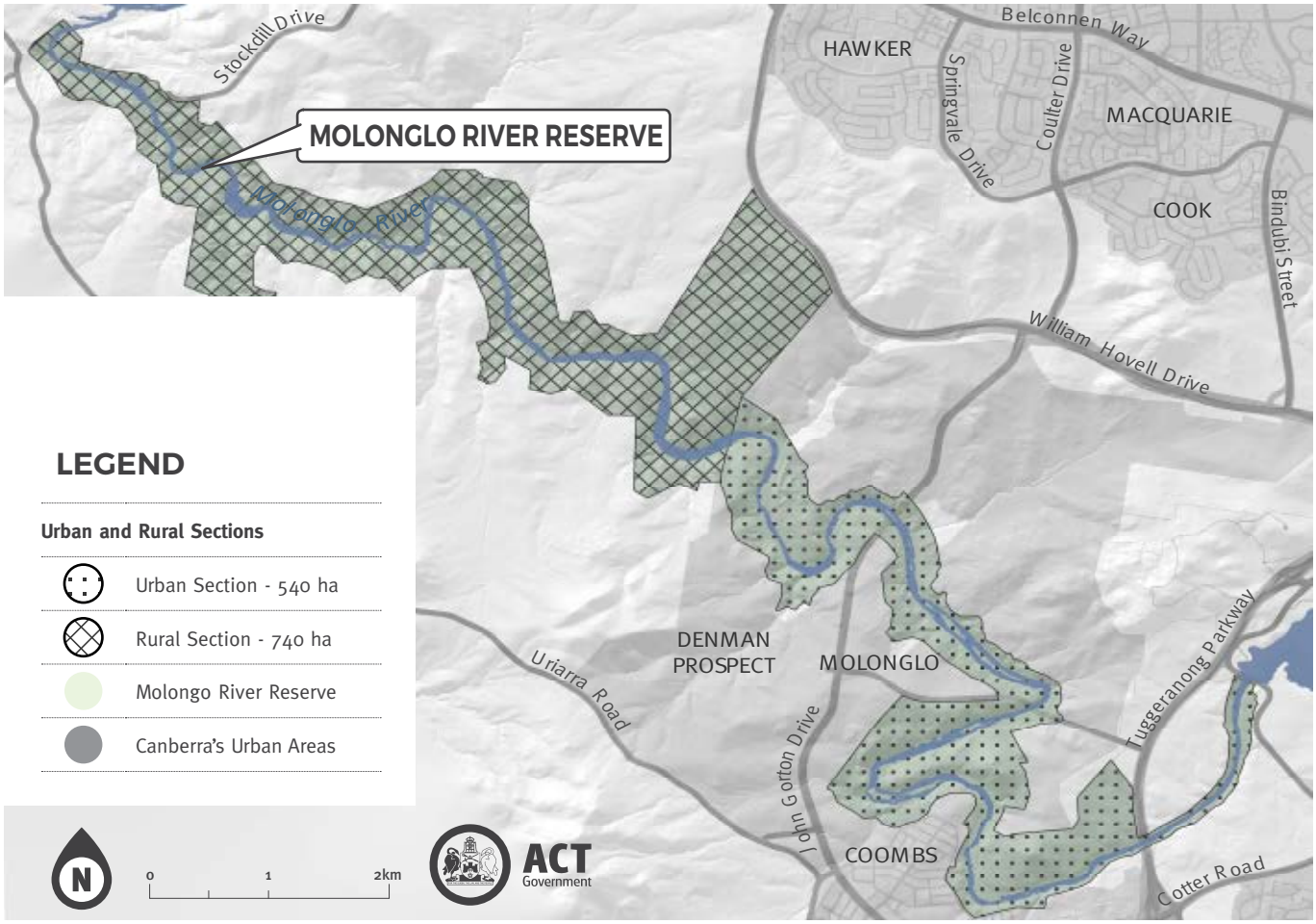
Table 1.1 Significant attributes of the Reserve

Feature	Attributes valued by people	Type of value*	Significance Local = ACT Regional = SE NSW National = Australia
The river and corridor in the wider landscape.	As a designated part of Canberra's National Capital Open Space System, the Reserve contributes to the designed framing of Canberra with natural bushland and the creation of a strong sense of place for the national capital. (Current and future)	Use	Locally high
Twelve kilometres of a perennial river flowing through an urban area.	A substantial natural centrepiece running through the new Molonglo Valley suburbs and past the new commercial centre. Most residents will live less than a kilometre from the river. (Future)	Use	**Locally outstanding.** The only residential area in Canberra that fronts a largely natural river.
A meandering, incised river with gorges and varied river forms, from pools to rapids. The water level can rise and fall dramatically.	The diversity of river scenery and its range of water flows increases the visual interest for people. (Current and future) The diversity of river forms supports a diversity of aquatic life and improves water quality. (Current and increase in future)	Use	Locally outstanding
The presence of running water in the landscape.	Water has symbolic meanings for people in many cultures, and a special significance in a dry continent. (Current and future)	Use	Locally high
Middle Silurian faunal fossils over a 50 ha site on the slopes above the river in the rural section.	The site is listed in the ACT for its heritage value. It is the best-known and richest deposit of Middle Silurian faunal fossils in eastern Australia. (Current and future)	Existence	Locally outstanding Regionally high
Home to two nationally threatened ecosystems and five nationally threatened species (one plant, two birds, one fish and one lizard).	The largest remaining population of Pink-tailed worm-lizard in Australia and the location of the type specimen for this species (Current and future) Kama Woodland, one of the ACT's best examples of Box-Gum Woodlands, is a nationally threatened ecosystem. (Current and future)	Existence	Nationally high
Diverse habitats and a permanent source of water.	Very species rich for its size (<1% of the area of the ACT). More than 75% of the bird species recorded in the ACT use riparian areas at some time. The Molonglo and the Murrumbidgee river corridors together have a higher diversity and abundance of raptors than any other place in the ACT region and uncommonly seen species such as platypus are found in the river. The Reserve is also home to a number of plants and birds that are special in the ACT for their rarity, endemism, being at the edge of their range or providing a key functional role in supporting other species. Some of the riparian areas are in excellent condition and five of the twelve species of native fish and crayfish found in the ACT are found in the river (Current and future)	Existence	Locally very high Regionally high
The river provides a watered and vegetated corridor through the landscape, with cross connections to other woodlands via Kama.	Important corridors for birds and other wildlife movement. Some of the riparian vegetation is in excellent condition. (Current and future). The river was formerly important for fish movement from the Murrumbidgee River to the Molonglo River upstream.	Existence	Locally outstanding Regionally high
A watered and vegetated corridor for people moving through the landscape.	In the past, a source of water, food and campsites for local Aboriginal people and a major movement corridor for Aboriginal people travelling through the region for ceremonial purposes. An important place in Aboriginal stories and cultural practices of today. (Current and future)	Use & Existence	Regionally high
In bushfire management zones, special management of the vegetation to reduce the risk of bushfires spreading into the urban area.	Contribution to the protection of people and property from bushfire. (Future)	Use	Locally very high

Feature	Attributes valued by people	Type of value*	Significance Local = ACT Regional = SE NSW National = Australia
A trail network that aims eventually to straddle the river on both sides, with several crossing points between them.	A diversity of opportunities for low intensity recreation, from short to long walks and rides to picnicking, nature watching and fishing. Locations encompass a variety of urban and wilder, more remote settings. (Current and increase in future)	Use	Locally very high
Trail connections to wider networks of walking, cycling and equestrian trails.	Contributes to a substantial network of recreational opportunities in and around Canberra. (Current and increase in future)	Use	Locally high
Two recreation parks, one at each end of the urban section.	Opportunities for higher intensity recreation and for special events. (Future)	Use	Locally very high
Remains of Riverview farm, occupied by an early settler family.	Riverview has significant heritage value. (Current and future)	Existence	Locally high
A living laboratory.	A place for scientists, land managers and landcarers to further scientific knowledge about Australia's biophysical assets and processes, and in particular to learn in a planned way about ecological rehabilitation of sites such as those that are in poor condition in the Reserve. (Current and future)	Use	Locally high
A living classroom	Doorstop opportunities for people, including school and university students, to gain individual and social satisfaction from learning about nature or engaging in its care. (Future)	Use	Locally high

* All values have a bequest value when left in good condition for future generations

Figure 1.1 The urban and rural sections of the Reserve



2. THE RESERVE MANAGEMENT PLAN

2.1 Purpose

The purpose of the Reserve Management Plan (the Management Plan) is to provide a clear and agreed set of long term objectives for the Reserve, to outline the planned pathways for achieving them and to give clear guidance on how the land and waters of the Molonglo River Reserve will be managed and used.

Section 315 of the *Planning and Development Act 2007* provides for the reservation of public land for a range of purposes and objectives for management outlined in Schedule 3. An area of public land must be managed in accordance with the management objectives applying to the area and the public land management plan for the area. Public land management plans are either Reserve Management Plans (for areas identified as 'reserves' under the *Nature Conservation Act 2014* and Nature Conservation Regulation 2015), or Plans of Management for other types of public land such as urban open space. Once approved, it will be the primary statutory document governing conservation and recreation in the Reserve, as well as other activities that might contribute to or impact on its values. Some of these are governed by other legislative tools (see Section 4.4).

A new Plan is required because the upper part of the river corridor has not previously been a nature reserve. Land use along the river in this section has changed dramatically since the fires of 2001 and 2003 destroyed the pine plantations of the Molonglo Valley. After the fires, the Canberra Spatial Plan was reviewed and land in a section of the Molonglo Valley was designated for urban development. This is bringing new pressures, especially from a closer urban population, but also new opportunities, to the management of the river corridor.

The Management Plan must also: incorporate a set of specific national conservation measures required by the Commonwealth Government as a condition on the ACT Government for converting land in the Molonglo Valley from rural to urban use (the NES Plan, see ACT Planning and Land Authority 2011); comply with and contribute to the goals of all relevant conservation legislation; and comply with any other legislation relevant to the area and its uses.

Molonglo River pools

2.1.1 Term of the Plan

The life of this Plan is 10 years. However, the past history of land use in the Reserve, which has included grazing as well as forest plantations, and alterations to river flows, means that the ecological condition of its land and waters is not as high as is usually found in a new nature reserve. Substantial rehabilitation activities will be required to meet the objectives of the Plan in the longer term. This Plan is therefore important as a **foundation** plan that sets the direction for the long-term improvement of the values of the Reserve. The Management Plan is required to be reviewed every 10 years after the plan commences, or at any other time at the Minister's request.

2.1.2 Users of the Plan

The Management Plan is designed to be used by the Reserve manager (the Custodian of the Reserve in the *Planning and Development Act 2007*) to guide decision making about activities in the Reserve, and by all others to provide information about its values and objectives and guidance on the reasoning for decisions about uses of the Reserve. Users of the plan could include people wanting to recreate in the Reserve, proponents from the private sector, other arms of government or the community wishing to carry out new activities in the Reserve, volunteers wishing to become involved in park care activities or neighbours and other stakeholders interested in the Reserve's future.

2.2 Principles

The Plan is informed by a long history of experience in park management in Australia and elsewhere, as well as contemporary experience in managing Canberra's urban recreation and nature parks. It is underpinned by research findings across a wide range of disciplines from ecology to economics, as well as trans-disciplinary studies that bring that knowledge together for application to real-world challenges.

Issue Box 2.1 Trans-disciplinary principles that underpin this Plan

Sustainable development and the precautionary principle

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Where protected area management has sometimes conceived of protection as keeping people out of such areas, taking a sustainable development approach shifts the focus to searching for ways in which a broader range of values can be delivered without compromising future options. Nevertheless there are some clear principles to uphold. In the ACT the *Planning and Development Act 2007* (Section 9) states that integration of social, economic and environmental considerations must apply the following principles: (a) the precautionary principle (b) the inter-generational equity principle (c) conservation of biological diversity and ecological integrity and (d) appropriate valuation and pricing of environmental resources.

The precautionary principle refers to using a cautious approach to actions or policies where there is a risk of serious or irreversible damage and there is no scientific consensus about the impact. It means that actions that risk foreclosing significant future opportunities be further investigated before decisions to act are made; or lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The inter-generational equity principle means that people now should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

Landscapes are coupled socio-ecological systems

This concept recognises that people and nature are not separate or independent of each other, and that the relationships within and between them are dynamic, complex and not always predictable. Understanding and managing such systems requires continuous testing and learning, and a capacity to adapt to change in both the social and the ecological system (Carpenter and Gunderson 2001). These ideas underpin the adaptive management strategy in the Plan. The concept also underpins ideas about the role of people, and importance of their attitudes, values, and understanding in achieving conservation goals. Peoples' activities, directly and indirectly, are both the cause of undesirable and desirable change in ecosystem entities (Raymond et al. 2013).

Scarlet robin
Petroica boodang

Superb parrot
Polytelis swainsonii

Resilience

Resilience is the capacity of a socio-ecological system to adjust and continue to deliver a particular bundle of ecosystem services in the face of disturbance (Resilience Alliance 2010). The capacity to adjust is not infinite, and the system state and the values that are delivered can cross thresholds (tipping points) from which it can be very difficult to recover. A local example of a threshold is the 'rule-of-thumb' 20 cm distance between clumps in a typical Canberra region grassland (Tongway pers. com.). Beyond this distance, water running down the slope builds up sufficient erosive force that it removes the topsoil and litter that are needed to promote re-establishment. Another local example in grazed native pastures is maintaining at least 60% cover of patches of native grass tussocks to maintain connectivity across the landscape for small invertebrates with limited mobility (McIntyre 2005). "Being aware of critical thresholds between system states can potentially provide advance warning of impending change as well as opportunities for preventing undesirable shifts in system states" (Resilience Alliance 2010).

An example of different system states for box-gum woodlands and what actions are required to move towards desirable threshholds or away from undesirable threshholds is in Appendix 1.

Novel ecosystems

Some of the ecosystems of the Reserve are 'novel ecosystems', in the terminology of Hobbs et al. (2009). That is, due to the clearing, grazing, forestry, weed introductions and changes in river flows over the last 180 years, the species assemblages of these ecosystems are different from those at the time of European settlement. The changes constrain the ability to restore ecosystems to a past historical state (Standish et al. 2013). In these areas, like the highly modified grassy woodlands and grasslands that do not contain threatened habitat, management and restoration can focus on achieving other ecological and perhaps recreation objectives.

For readability, background explanatory material and additional guidance for decision makers have been set out in seperate 'Issues Boxes' and 'Guidance Boxes' in the Plan. Their role is to assist decision makers when judgements need to be made that were not foreseen by policies and actions in the Plan. As part of the Plan they carry the authority of the Plan and decisions that depart from their guidance would need to be supported by alternative evidence.

2.3 Structure

The Plan is structured so that each level in the hierarchy takes its direction from the one above.

The objectives are arranged so that they are clustered around recognisable topics such as Ecological Conservation, Aboriginal Connections, Recreation etc.

Objectives: the long term, sustainable outcomes desired that will endure past the term of this Plan. These are identified by number and there are 21 objectives for the Reserve in this Plan.

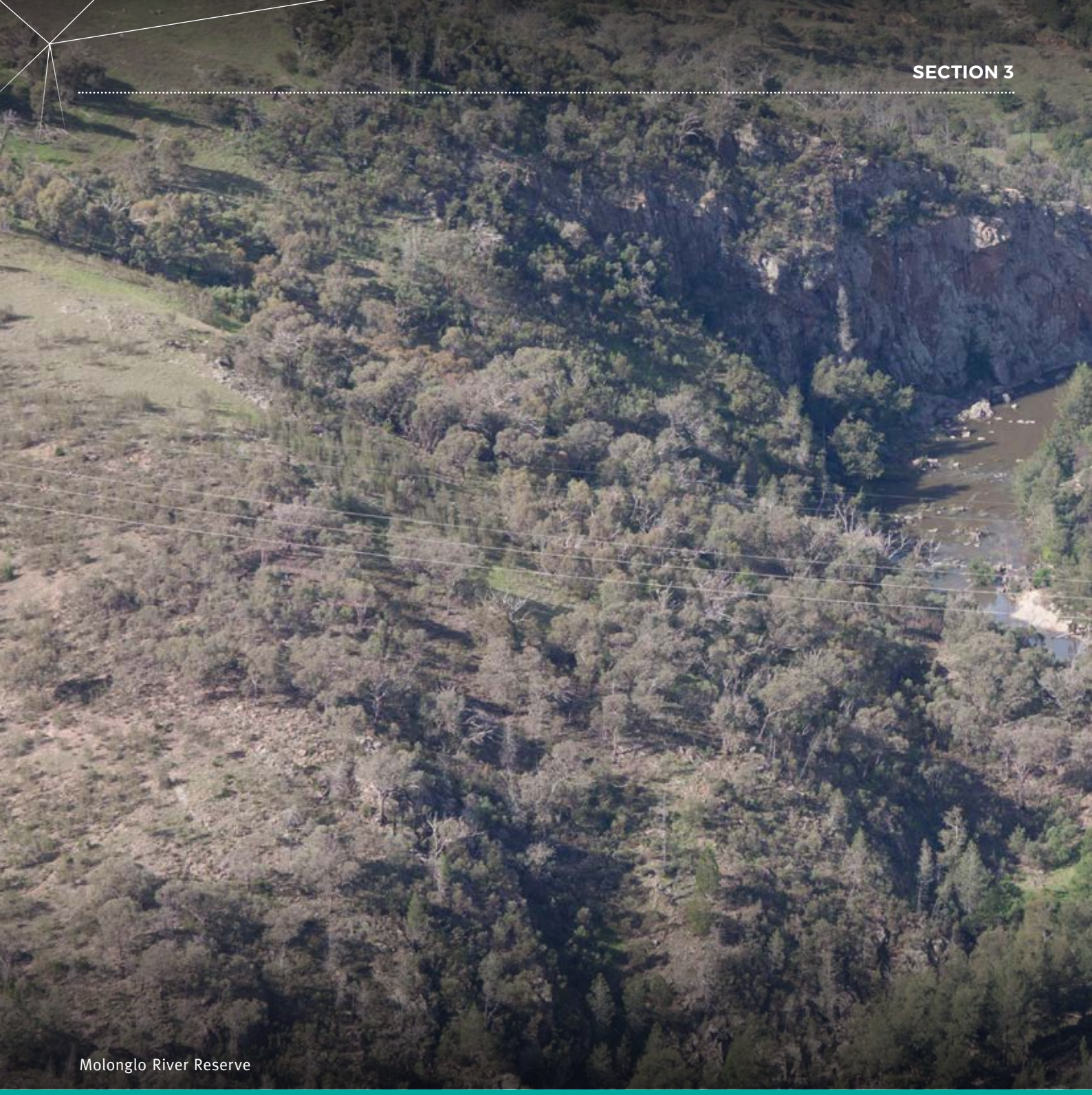
Policies: the general approaches that will be taken to achieve the objective. These are identified by number. Some objectives might require a combination of policies.

Actions: specific activities required to implement the policies. They might be a one-off 'action' or the application of an on-going policy and are identified by number. Policies and actions are not highly detailed as such detail lives in operational plans or in other existing plans e.g. the NES Plan (ACT Planning and Land Authority, 2011a).

Each policy or action therefore has a unique identifier e.g. Action 1.1.1 can be tracked back up the hierarchy, in this case to Policy 1 of Objective 1. The Plan is structured like this so that monitoring, adaptive management and reporting will be transparent and efficient (see Chapter 12), and so that the objectives, policies and actions can transparently flow into the Ecological Management Guidelines.

The objectives, strategic directions and major policies and actions in the Plan set the framework for detailed operational planning for the Reserve. These details are not included in the plan, but a commitment to develop and implement them is incorporated into a number of the actions in the plan. These will then become incorporated into the operational plans for the Reserve. Supporting guidelines and plans include:

- Molonglo Adaptive Management Strategy (ACT Government 2013d)
- Procedures Manual for Monitoring Vegetation and Habitat Condition in Molonglo River Reserve (Sharp and Milner 2014)
- Ecological Management Guidelines for Molonglo River Reserve (Sharp et al. 2015)



Molonglo River Reserve

3. LAND DESIGNATIONS, BOUNDARIES, MANAGEMENT ZONES AND BUFFERS

Objective 1:

Reserve boundaries, management zones and buffers adequately protect its threatened species and communities.

3.1 Land designations, boundaries and management zones

The Molonglo River Reserve is public land designated as Nature Reserve and Special Purpose Reserve under the ACT *Planning and Development Act 2007*. The management objectives for these are:

- **Nature Reserve**:
  1. to conserve the natural environment and
  2. provide for public use of the area for recreation, education and research.
- **Special Purpose Reserve**:

  to provide for public and community use of the area for recreation and education.

Currently the lower corridor and Kama are classified as Nature Reserve and the upper corridor as Special Purpose Reserve and Urban Open Space (Figure 3.1). However the upper corridor contains significant areas of habitat that are either listed as threatened or dedicated for restoration in the NES Plan. These areas require protection from disturbance and need to be managed under a designation where the conservation objective has primacy, that is, as Nature Reserve. More detailed justification for this general recommendation can be found in the remainder of this Management Plan, and particularly in Chapter 6 and Chapter 9. This pattern of designation was recommended in the Molonglo River Park Concept Plan (Hassell 2012): "The reclassification of a significant portion of the park site from special purpose reserve to nature reserve will better reflect the ecological values of the site and the management emphasis in the future". The proposal was supported in consultation about the Concept Plan. Consistent with the definition of Nature Reserve, opportunities for low impact recreation will be provided in the Nature Reserve in ways that do not jeopardise the primary conservation objective.

Two areas in the urban section are suitable for development as more intensive recreation spaces because they have relatively low conservation values, contain land of suitable slope and are in appropriate locations, one at each end of the urban development. It is therefore proposed that these be classified as Special Purpose Reserves and the remainder of the Reserve as Nature Reserve.

In addition, there are a number of relatively small changes to the boundary proposed in order to be consistent with refinement in the urban boundary that has already been agreed, and to appropriately protect conservation assets and streamline Reserve management. These are indicated in the map at Figure 3.1 and spelt out in the sections below. Generally the proposed boundaries between Nature Reserve and Special Purpose Reserve have taken into account the need for them to be clearly defined by roads, trails, fences or other markers so that along with good signage, it is clear to people where there is a change in the activities that are permitted. Further but minor boundary changes are expected to be required for practical reasons as development proceeds. Any changes must be in accordance with the objectives of the Management Plan and the NES Plan which identifies 488 ha as the River Park offset area and 155 ha as the Kama Nature Reserve offset area (*ACT Planning and Land Authority 2011*).

Specific details that underpin the proposed changes are described here.

3.1.1 Special Purpose Reserves

The Sludge Ponds area will remain as Special Purpose Reserve to facilitate a node of recreation facilities for the Reserve, minimising impact on conservation areas. This area is defined by the existing flat terraces above the river. The boundary with the Nature Reserve has been drawn to encompass PTWL habitat and a 20 m buffer around it, and a river frontage will be zoned as Nature Reserve. People will be able to access the river, but the riparian zone should remain free of built recreation infrastructure.

Ryans Hill Park is proposed to constitute a second Special Purpose Reserve. The boundary on the river side is designed to edge an existing management road and provide for a contiguous strip of Nature Reserve along the river.

3.1.2 Below Scrivener Dam

It is also proposed that the corridor of public land along the river below Scrivener Dam be changed from Urban Open Space to Nature Reserve in the Territory Plan as this will be an important entrance to the Reserve and more appropriately developed with plantings that reflect the conservation objectives of the Reserve.

3.1.3 Future boundary changes

As development proceeds and practical issues in determining the urban edge arise, there may be a need to review the Reserve boundary again. Where the land is unleased territory land and the change is consistent with both the apparent intent of the original boundary line and the objective for the zone, this can be acheived by making a technical amendment to the Territory Plan, under Section 96A of the *Planning and Development Act 2007*. Such changes in boundaries must be consistent with the objectives of the Management Plan, and in particular not compromise the capacity to protect threatened species and communities.

3.1.4 Management zoning

Internal zoning is an additional tool commonly used in protected area management as a measure for clearly delineating the activities that can occur in various parts of the reserve in relation to conservation priorities. To be useful, practical and clear to managers and visitors alike, zoning must reflect substantially different management combinations between the zones (Worboys et al. 2005). Management zone boundaries can, but are not obliged to, follow land classification boundaries and for clarity, should have readily identifiable boundaries. For example, Tidbinbilla has three management zones: core conservation, conservation and rehabilitation, and developed recreation and education, superimposed on two public land classifications, Nature Reserve and Special Purpose Reserve (ACT Government 2012a). The Murrumbidgee River Corridor also contains Nature Reserve and Special Purpose Reserves (ACT Government 1998).

In this relatively small, long and narrow Reserve, however, where high priority conservation areas are intertwined with medium priority conservation areas across the Reserve, no additional value would be provided by further management zoning beyond that already provided by the two public land designations. An alternative approach for describing areas with differing conservation requirements has been developed and is described in Chapter 6.2.

3.2 Kama buffer

The NES Plan makes a commitment to provide a buffer between the eastern edge of Kama and urban development to protect its high conservation value from the impacts of an urban edge. The commitment is to *Establish a buffer outside the Kama Nature Reserve between the reserve and the proposed development area, and allow for appropriate uses consistent with nature conservation uses of the reserve. The buffer will be developed to ensure that fire management is undertaken outside of the Kama Nature Reserve and will provide protection against urban edge effects* (see Actions 7, 27 and 34, Appendix 5).

3.2.1 Fire management in the buffer

The buffer will be managed as an Asset Protection Zone, consistent with the commitment in the NES Plan. It is proposed that Kama be managed as a Strategic Firefighting Advantage Zone (SFAZ) and appropriate management actions are dealt with in Sections 6.7.2, 6.7.3 and 6.7.5. However, in the context of the restoration work underway in Kama it is especially critical that fuel reduction is carried out in a manner that considers restoration outcomes.

3.2.2 Protection against urban edge effects

Gradients of urban impact frequently extend beyond the edge of urban developments that border nature reserves. The nature and significance of the impact on conservation outcomes depends on the context and a number of different mechanisms have been identified (Issue Box 3.1). Buffers are frequently used to absorb or reduce impact, especially for small nature reserves like Kama (155 ha).

Pedestrian trail through Reserve

Issue Box 3.1 Urban edge effects on nature reserves

These edge effects have been scientifically established in Australia and are relevant to Kama. See also Chapter 11 for discussion of edge effects elsewhere in the Reserve.

1. For **woodland bird** communities in Canberra, increased proximity to the urban boundary can have a strong negative impact on the occurrence and abundance of specialist woodland-dependent bird species, including some that are migratory and some that are listed as threatened in the ACT, such as the brown treecreeper (*Climacteris picumnus*) and scarlet robin (*Petroica multicolour*) (Ikin et al. 2014; Rayner et al. 2014).
2. For **native flora**, exotic weeds are commonly found inside reserves, as the physical disturbance that occurs at the urban edge provides openings for invasion, while garden plantings and established urban weeds create a high exotic seed load. Impacts commonly extend further into reserves as the housing development ages, and spread faster along drainage lines and tracks or roads into the reserve (Smith and Smith 2010).
3. For **insectivorous bat** communities in Canberra, significantly reduced echolocation activity and species richness have been recorded in built-up urban environments compared to habitats such as nature reserves and urban greenspace areas (open space and parklands). These findings suggest that some animal groups may be especially sensitive to indirect human disturbances associated with urban infrastructure (e.g. houses and roads), including artificial noise and light that may pose barriers to movement and dispersal (Le Roux et al. 2015).
4. For **marsupial** communities, some species have been shown to be adversely affected by urban encroachment. For example, the yellow-bellied glider (*Petaurus australis*) avoids forest that edges urban development in coastal New South Wales. Establishing lower impact broad-acre peri-urban areas adjacent to the urban fringe can benefit more sensitive species (Villaseñor et al. 2014).
5. Some **invasive pests** such as the common myna (*Acridotheres tristis*) are known to increase in abundance in urban areas in Canberra. Species like the common myna compete with native bird species over limiting nesting sites such as tree hollows, which may be exacerbated at the urban boundary (Grarock et al. 2014).
6. **Hyper aggressive native species** such as the noisy miner (*Manorina melanocephala*), red wattlebird (*Anthochaera carunculata*) and common hollow-nesting species such as the crimson rosella (*Platycercus elegans*) become increasingly prevalent within urban edge environments outcompeting other species, including superb parrots (*Polytelis swainsonii*) and swift parrots (*Lathamus discolor*), from using limited resources (e.g. nectar producing shrubs and tree hollows) (Maron et al. 2013).
7. The incursion of **domestic cats** (*Felis catus*) into nature reserves in Western Australia revealed that the linear roaming distance of a single cat can exceed 300m. Predation by pet cats can have considerable impacts on native fauna at the urban boundary and buffer zones can minimise risks of incursion (Lilith et al. 2008).
8. Similarly, the impact of **domestic dogs** (*Canis familiaris*) on wildlife communities at the urban-reserve boundary is of high concern. For example, in Tasmania predation of native wildlife in nature reserves by dogs was comparable to that of cats (Holderness-Roddam and McQuillan 2014).

3.2.3 Functional criteria governing buffer design and management

Determination of the width of the urban edge buffer zone will be included as part of the planning for Molonglo Stage 3 to be developed by the Environment, Planning and Sustainable Development Directorate. In order to minimise both direct and indirect edge effects on Kama, the width – and its management during development and beyond – must meet the key functional criteria in Table 3.1. The criteria are in decreasing order of their potential deleterious impact on conservation outcomes for Kama. The decision about width must be able to clearly demonstrate the evidence for the decision, and a future management regime must also be specified.

Opportunities for mitigation of edge effects can also be provided for in Estate Development Plans.

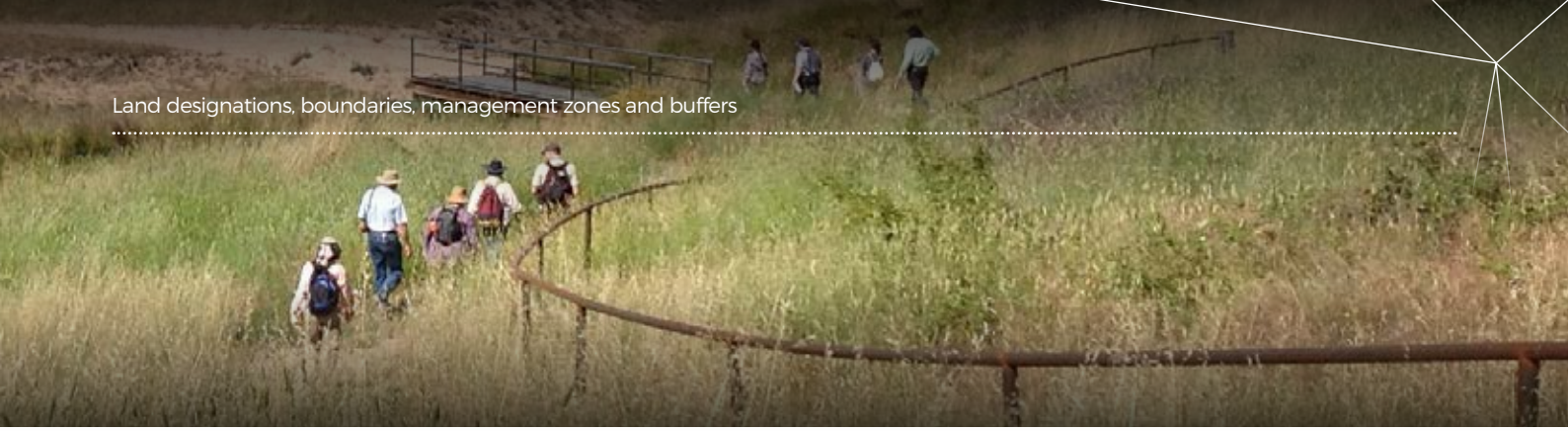


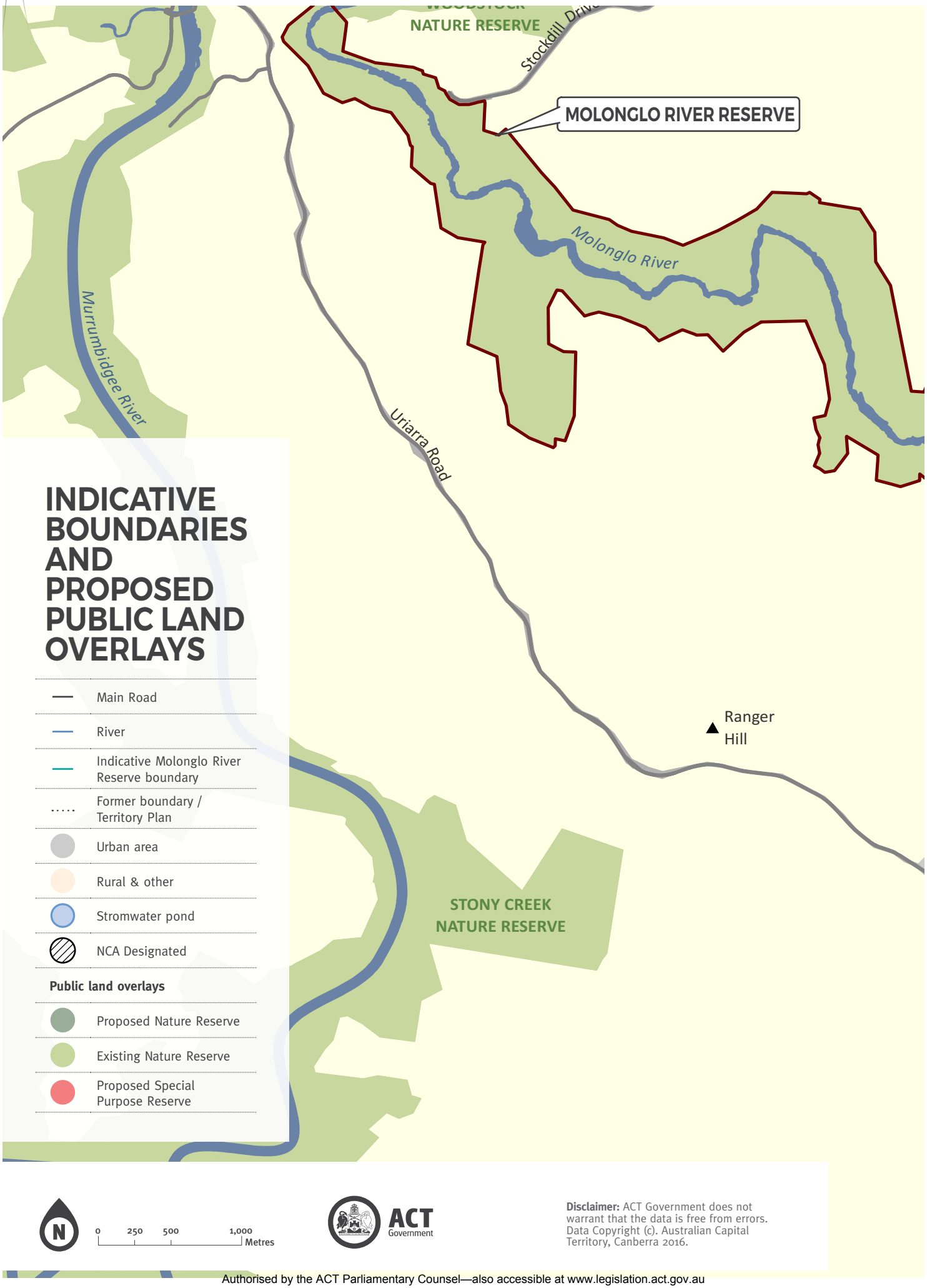
Table 3.1 Functional criteria for the mitigation of edge effects of urban development on Kama

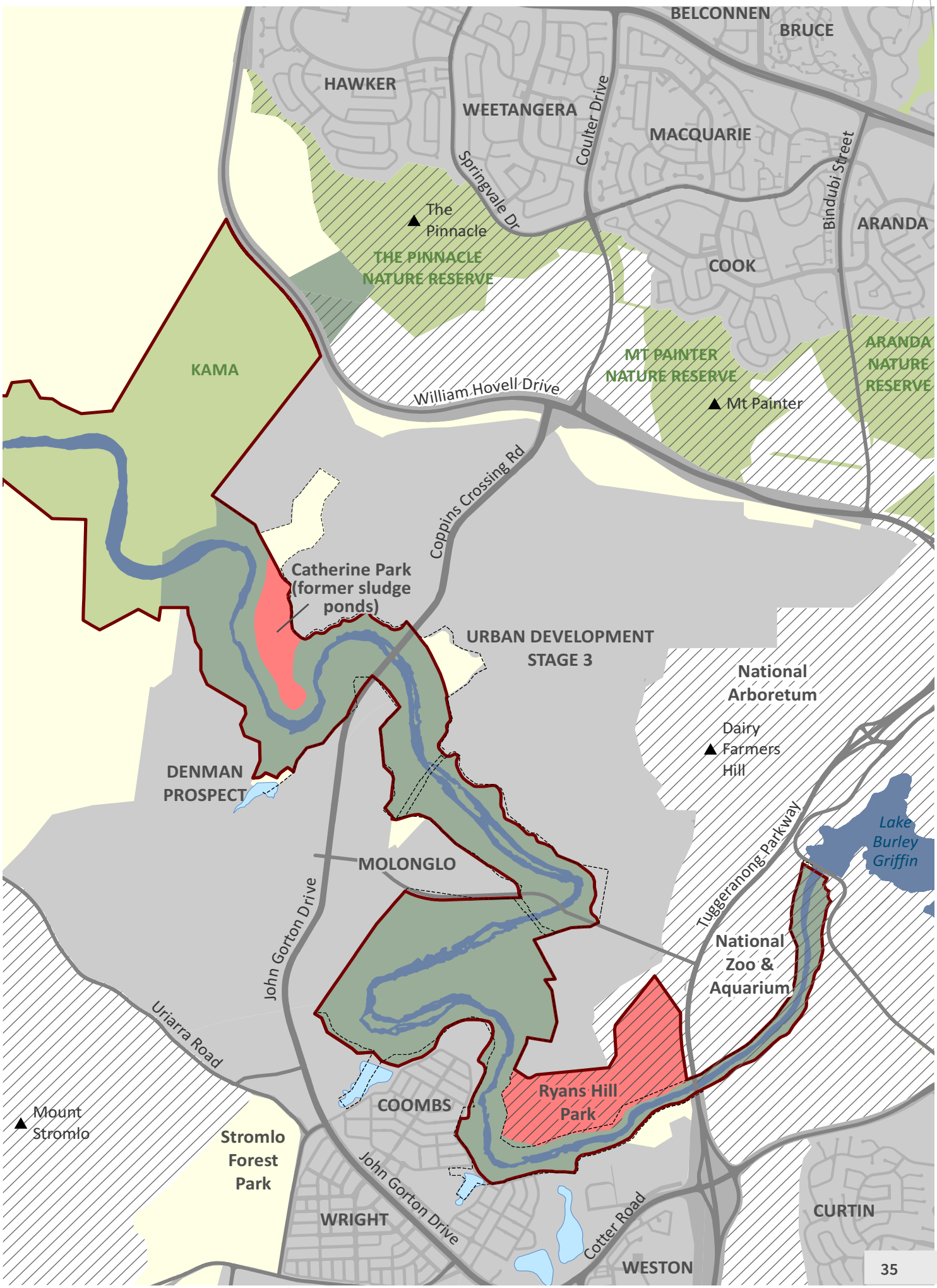
Issue	Criterion
Habitat loss and fragmentation	Minimise loss of existing habitat and its fragmentation that would further isolate Kama and restrict wildlife movement and dispersal along the river corridor, especially for superb and swift parrots which are listed as Matters of National Ecological Significance in the NES Plan. This includes a) retaining the large scattered trees that provide disproportionate habitat value for birds in modified urban areas, b) avoiding obstruction of the corridor and c) minimising disturbance to habitat and soil structure at the ground surface, especially during urban construction (see Section 5.2.5).
Fire management	Minimise the impacts of fire and fire management on Kama through undertaking as much fire management outside Kama that is consistent with managing an Asset Protection Zone, and minimising disturbance due to fire management in the SFAZ in Kama (also see 6.7.4).
Invasive flora	Provide a sufficient sentinel zone for spotting and taking early action against the spread of new invasive or declared pest plants into Kama.
Domestic animals	Reduce the risk of entry of domestic animals, especially cats and dogs, into Kama.
Light and noise	Minimise the impacts of noise and light pollution in Kama from sources such as vehicles, street lights and sporting fields.
Invasive fauna	Reduce the impact on Kama of invasive fauna (both native and exotic) that prosper in urban areas. This includes urban-adapted feral species such as foxes that predate on wildlife, and exotic birds such as the common myna that outcompete native birds at nesting hollows. Hyper-aggressive urban-adapted native birds such as the noisy miner, red wattlebird and pied currawong also have detrimental impacts on some native fauna.
Hydrology	Minimise changes to hydrology or water quality that have a deleterious impact either on Kama or the urban area. This includes mitigating against soil erosion associated with infrastructure works, including road building in or adjacent to the buffer.
Direct human impact	Reduce the direct impact of local residents on Kama by providing appropriate recreation facilities in the buffer (e.g. pedestrian trails for on-leash dog walking, allowing Kama to function as a dog prohibited area), by restricting pedestrian access to a minimum number of points at the edge of Kama so that they are directed to established paths, and by making it inconvenient to use Kama for dumping rubbish.

3.3 Objective, policies and actions

RESERVE BOUNDARIES	
Objective 1: Reserve boundaries, management zones and buffers adequately protect its threatened species and communities.	
Policy	**Action**
1.1 Future changes in boundaries and management zones must be consistent with the objectives of the Management Plan, and in particular not compromise the capacity to protect threatened species and communities.	1.1.1 Monitor urban edge development, its impacts and policy changes that might impact on the capacity to effectively protect threatened species and communities; and propose appropriate actions if that capacity is threatened.
1.2 The design and management of the Kama buffer must meet the functional criteria listed at Table 3.1, designed to protect its conservation value.	1.2.1 Monitor Kama annually for edge effect impacts (Table 3.1), as part of the Adaptive Management Strategy (ACT Government 2013d).

Figure 3.1 Indicative boundaries and proposed public land overlays for Molonglo River Reserve





Aerial view over Barrer Hill to Lake Burley Griffin

4. CONTEXT

The Management Plan is strongly shaped by the location and biophysical nature of the Reserve, and the agreements that society has made, through its governments, about how natural resources should be used and treated in this region. This chapter outlines those key features.

4.1 Regional setting

The Reserve straddles the Molonglo River for its last 23 km run from Srivener Dam into the Murrumbidgee River. (Figure 4.1) It lies in the Murrumbateman subregion South of the Eastern Highlands bioregion of Australia and is set in a landscape that has mixed rural and urban uses.

Hydrological and wildlife connectivity with the regional setting of the Reserve are particularly important for their ecological connections with the wider region.

4.1.1 Hydrological connectivity

The Molonglo River is a tributary of the Murrumbidgee River, a major river in the Murray-Darling Basin. The Molonglo River catchment, largely in NSW, covers 200,000 ha. The 115 km long river originates in Tallaganda State Forest in the Great Dividing Range above Captains Flat. Tailing dams from old mines in that area have leached heavy metal contaminants into the Molonglo River in the past and traces still remain (Lintermans 2002). The river then flows through agricultural land where farming practices like tree clearing, willow planting and stock access to the river have contributed to an altered river ecology and a reduction in water quality (Molonglo Catchment Group 2010).

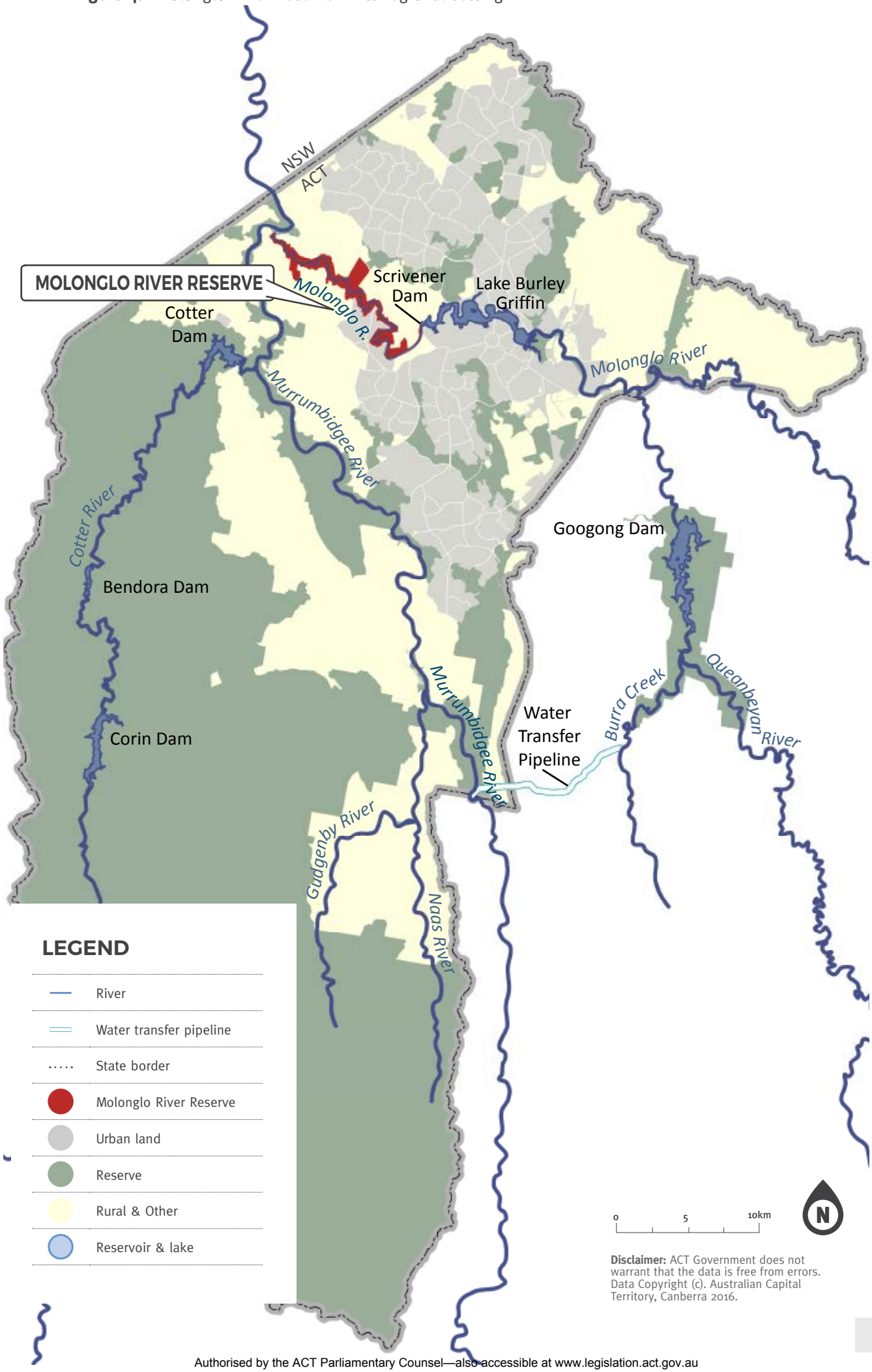
The largest tributary of the Molonglo is the Queanbeyan River, which is dammed at Googong Dam upstream of Queanbeyan. It contributes to water supplies for Canberra as well as Queanbeyan. Treated sewage from Queanbeyan is released into the Molonglo River and untreated sewage has occasionally escaped during floods. The Molonglo is dammed by Scrivener Dam to form Lake Burley Griffin, a central feature of the design for Canberra. The sediments and urban nutrients that have accumulated in the Lake since it was formed in 1963 contribute to significant water quality issues in the Lake. Water flows in the Lower Molonglo River are highly dependent on releases of water from the dam as most of the catchment area is above the dam. The tributaries below the dam contribute only a small proportion of total flows. Measures are in place to mitigate many of the impacts of these upstream land uses, but the location of the Reserve at the lower end of the River means that the ecology in the River is still accumulatively influenced by past and current actions upstream in the river and catchment.

Brown treecreeper
Climacteris picumnus

4.1.2 Wildlife connectivity

For wildlife, connections into the wider region are also important, especially for birds. Kama forms an important link between the Murrumbidgee River Corridor Reserve and the reserves of Canberra Nature Park in the north of Canberra including Mt Majura, Black Mountain, Aranda Bushland, Mt Painter and the Pinnacle. The vegetation along the river also features in wildlife linkages to the west and south and into NSW (Mackey et al. 2010).

Figure 4.1 Molonglo River Reserve in its regional setting



Riparian Vegetation

4.2 The Reserve and its local setting

The Reserve is located in the Molonglo Valley, partly in and partly outside the urban envelope of Canberra in the Australian Capital Territory (Figure 4.2). It is largely a river corridor Reserve that bounds the Molonglo River between Scrivener Dam and the junction with the Murrumbidgee Corridor Reserve, about a kilometre before the Molonglo joins the Murrumbidgee.

The Reserve is long and narrow in shape. It varies from less than 300m wide near Coombs to a 2 km wide section where it encompasses Kama, a grassy woodland of high conservation significance. But generally it is less than 500 m wide with the river effectively dividing the Reserve into two as there are few river crossings. The total length of the river in the Reserve is 23 km, the area is approximately 1280 ha and the perimeter 49 km (Appendix 6).

The winding river and its channel and gorges and riverine vegetation are the key visual features of the Reserve. Along with the long sloping grasslands and grassy woodlands above the river, the Reserve has diverse habitats and high biodiversity values, despite its history of active agricultural, forestry and recreation use and consequent degradation in some areas.

4.2.1 Place names

Key features of the Reserve in its local setting and some existing and proposed place names associated with it are in Figure 4.2. These new names have been supported, in principle, by the Place Names Committee and may be considered formally by the Committee as the Molonglo Valley is developed. Background to the proposed new names is in Appendix 2.

4.2.2 Urban and rural sections

In the urban section, which is about 540 ha in size (% of the total area), the Reserve will be bounded by residential development along most of its length, with a commercial centre facing the river in the suburb of Molonglo. In the rural section, about 740 ha, the Reserve is largely bounded by rural leases used for livestock grazing. The division between the 'urban' and the 'rural' section (Figure 1.1) is made only to simplify communication about the Reserve and there is no formal boundary between them.

4.2.3 Linkages in and out of the Reserve

Locally, the linkages to other nature and recreation reserves nearby is very important, especially considering the long narrow nature of the Reserve. The ecological linkages are important for wildlife species that require cover to move around in the landscape, and for species to adapt their location as the climate warms. Recreationally the linkages are important because they broaden the choice of recreational opportunities available locally, and also connect the Reserve into longer distance trails. The ACT Centenary Trail and the Bicentennial National Trail pass through the Reserve and several major recreation destinations are close by. These include Stromlo Forest Park, the National Arboretum Canberra and the National Zoo and Aquarium, and a little further away, Lake Burley Griffin and the Murrumbidgee River.

4.3 Reserve history and prior land uses

The Reserve consists of three areas with different histories of progression into reservation as public land. The rural section has been public land since at least the inception of the Territory Plan in 1993. In 2001 it became the Lower Molonglo River Corridor Nature Reserve with a dedicated Plan of Management (ACT Government 2001).

Kama was reserved in the Territory Plan as nature reserve in 2008 and also placed on the ACT Heritage Register in recognition of its significant natural heritage values (ACT Heritage Council 2012). Before that it was being managed by ACT Government for its conservation values, after having being withdrawn from rural lease in the 1970s.

The remainder of the area, the corridor from Scrivener Dam nearly down to Coppins Crossing, has been used for pine plantations, recreation and grazing since the 1920s and been classified as Special Purpose Reserve and Urban Open Space. A small area was used as sludge ponds associated with the sewerage treatment works at Weston Creek between the 1920s and 1970s. Canberra's sewerage treatment was then moved to the new Lower Molonglo Water Quality Control Centre near the end of the river and the main sewer pipeline built in the corridor on the north-eastern side of the river. The whole length of the river corridor became a formal part of Canberra's open space system in the 1970s. In 2001 and 2003 severe fires burnt up along the river and through the pine forests, prompting the reconsideration of maintaining pine plantations on Canberra's vulnerable north-western margins.

No part of the new Reserve therefore has a long history of being managed as a nature reserve, and the legacies of past land and water uses contribute to some of the challenges the Management Plan has had to address.

4.4 Government legislation, agreements, plans and strategies

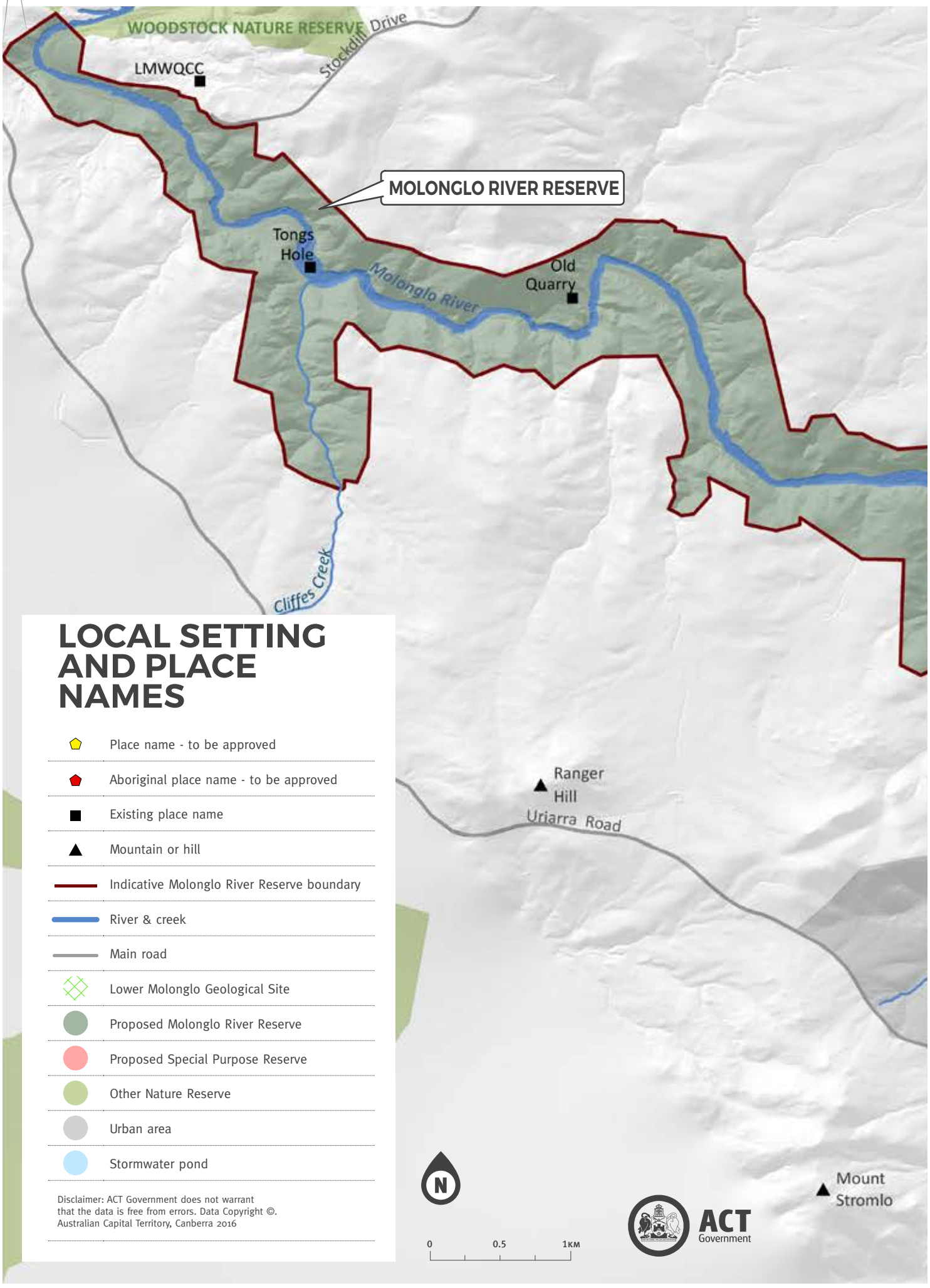
The major pieces of legislation and governmental agreements that have contributed to shaping the Plan are outlined below. There are many other statutory and government agreements that shape the Plan in specific ways, for example, recovery plans for threatened species (termed Action Plans in the ACT), and these are described in the relevant chapters that follow.

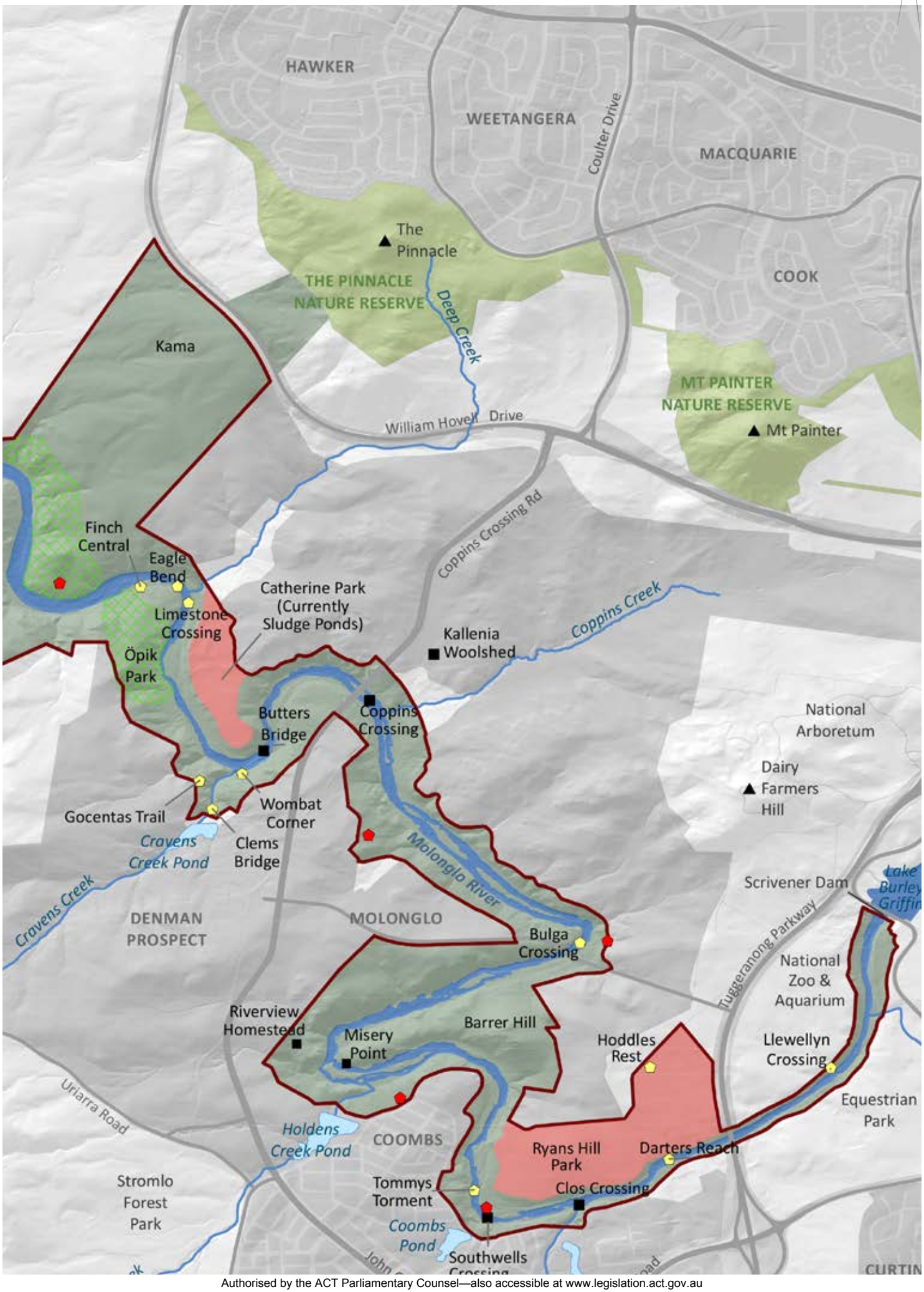
4.4.1 The National Capital Plan

The National Capital Plan (NCP) is a plan prepared under Commonwealth legislation (*Australian Capital Territory [Planning and Land Management] Act 1988*). The NCP prescribes the Molonglo River as a River Corridor within the National Capital Open Space System. The NCP outlines specific principles and polices for River Corridors. The principle for River Corridors is to **'protect and enhance the environmental quality, landscape setting and the natural and cultural resources of the Murrumbidgee and Molonglo River Corridors.'** A Nature Conservation Area is a permitted use in the River Corridor. The NCP defines a Nature Conservation Area as an area declared or intended to be declared under relevant ACT legislation to be a Reserve area.

Box Gum Grassy Woodland

Figure 4.2 Molonglo River Reserve – local setting and place names (Proposed new names are explained in Appendix 2.)





4.4.2 ACT Planning and Development Act 2007

The Molonglo River Reserve is public land reserved as Nature Reserve and Special Purpose Reserve under the ACT *Planning and Development Act 2007*. The management objectives for Nature Reserves are: **to conserve the natural environment and provide for public use of the area for recreation, education and research.** The Act also specifies (s. 317) that if there is an inconsistency in the application of two objectives for a single land use classification, the second objective is to be read subject to the earlier objective (s. 317). That means that in a Nature Reserve, where the two objectives are not compatible, the conservation objective has more weight than the recreation, education and research objective. The management objective for Special Purpose Reserves is **to provide for public and community use of the area for recreation and education** (ACT Government 2013a).

4.4.3 Nature Conservation Act 2014

This Act provides for the protection and conservation of native plants and animals, declaration of threatened species and ecological communities, and for the management of areas reserved as nature reserves and, through regulation, some special purpose reserves. The Act also provides the process for developing and approving a reserve management plans for areas identified as 'reserves' under the *Nature Conservation Act 2014* and Nature Conservation Regulation 2015. Activities declarations are used to regulate recreation activities in the Reserve, and there is a range of offence and penalty provisions that apply in the reserve. The Act establishes the ACT Parks and Conservation Service as the Custodian of the Reserve.

4.4.4 The ACT Planning Strategy 2012

The ACT Planning Strategy specifies that **"In the Molonglo Valley, environmentally sensitive areas of the Molonglo River corridor will be protected from the adverse impacts of the development. ... Those areas included in the rural setting, ... which have biodiversity values, such as Yellow Box–Red Gum, will also be managed for conservation purposes"** (ACT Planning and Land Authority 2012).

4.4.5 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects matters of national environmental significance (MNES). Urban development in the Molonglo Valley will affect five matters of national significance:

ACT Government inter-Directorate planning field trip

1. White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland, BGW);
2. Natural Temperate Grassland of the South Eastern Highlands (Native Temperate Grassland, NTG) ;
3. *Aprasia parapulchella* (pink-tailed worm-lizard);
4. *Polytelis swainsonii* (superb parrot); and
5. *Lathamus discolour* (swift parrot).

The ACT and Commonwealth Governments have agreed to a range of actions to ensure that the conservation impacts of development will be offset by a range of conservation gains nearby. The agreed actions are detailed in the Molonglo Valley Plan for the Protection of Matters of National Environmental Significance (NES Plan; ACT Planning and Land Authority 2011). Some of these actions fall outside the designated area of the Reserve, but those actions that largely depend on the new Management Plan for the Reserve are summarised in Table 6.2. There are no direct conservation measures for the superb parrot, swift parrot and the rainbow bee-eater (an EPBC protected migratory bird that visits the Molonglo Valley) as they are considered to depend on Box-Gum Woodland, which is itself a priority for conservation.

4.4.6 Emergencies Act 2004 and the Strategic Bushfire Management Plan 2014-2019

Bushfire is identified as an extreme risk in the ACT, and the topography, aspect, position and shape of the Reserve make it a potential avenue for fire to enter the urban area, threatening public safety and urban assets. Widespread high intensity fires are also a risk to values within the Reserve, from threatened habitat to soil and water quality, cultural heritage and recreation and urban service infrastructure.

The *Emergencies Act 2004* requires the Government to develop a Strategic Bushfire Management Plan (ACT Emergency Services Agency 2014a) to provide a basis for bushfire hazard assessment and risk analysis; bushfire prevention, including hazard reduction; and agency and community preparation and response to bushfires. The Act also requires land managers to take reasonable steps to prevent the outbreak and spread of fire on their lands or onto neighbouring properties, and to prepare operational plans for the mitigation of bushfire risk on the land they manage.

Molonglo River Reserve

4.4.7 Heritage Act 2004

Several places in the Reserve are already listed or may become listed under the *Heritage Act 2004*. The Act provides for the recognition, registration, conservation and promotion of places and objects of heritage significance and the protection of all Aboriginal places and objects in the ACT. Cultural heritage sites listed on the ACT Heritage Register require the development of a Conservation Management Plan to guide management and decisions about any changes to the use and/or fabric of the place.

4.4.8 Commonwealth Water Act 2007

Under this Act control of Commonwealth water resources (including Lake Burley Griffin) in the ACT will be referred to the ACT Government. Following that referral the National Capital Authority and the ACT Government will together formulate how to meet environmental flow obligations both in Lake Burley Griffin in the Molonglo River downstream, whilst ensuring that Lake Burley Griffin fulfils its functions in the Parliamentary Triangle (ACT Government 2013b).

4.4.9 ACT Water Strategy 2014–44

This strategy includes an outcome "Healthy catchments and waterbodies" and a number of strategies that help shape the Management Plan, especially Strategy 1 – Achieve integrated catchment management across the ACT and region; Strategy 2 – Protect and restore aquatic ecosystems in urban and non-urban areas; Strategy 3 – Manage stormwater and flooding; and Strategy 7 – Engage the community on understanding and contributing to a more sustainable city (ACT Environment and Planning Directorate 2014).

4.4.10 Other ACT legislation

Many other pieces of ACT legislation control specific actions that are relevant to park management and the use of the land by the public. Those already mentioned and others that are relevant are summarised in Appendix 3. An additional set of strategies and plans relating to conservation objectives is outlined in Chapter 5.

4.4.11 Molonglo Valley urban development

The Molonglo Valley is being developed as a new urban settlement for approximately 55,000 people. Over a 30-year timeframe, work will proceed in three stages: Stage 1 (south of the Molonglo River) – the suburbs of Coombs, Wright and North Weston; Stage 2 (southwest of the River) – the suburbs of Denman Prospect, with a local centre and Molonglo, with the principal commercial centre; and Stage 3 (northeast of the River) additional suburbs, with a secondary commercial (group) centre and local centres. Improving the sustainability of urban development is a core theme of the development and the planning documents identify the river corridor as a key component of achieving it. **"The Molonglo River Park ... will be a legacy for future generations. Central to its relationship with stage 2, the Molonglo River Park provides a recreation setting and benefits for the new residents of the Molonglo Valley based on its special gorge landscape qualities"** (Molonglo Stage 2 ACT Government 2012b). Principles and policies guiding the development as a whole are set out in the Territory Plan (ACT Government 2010a). Those that are relevant to the Reserve are reproduced in Appendix 4. Many of the principles for place making in the Molonglo Valley (ACT Planning and Land Authority 2010) are also relevant to the Reserve, and the Reserve plays a role in fulfilling them for the Valley as a whole. Those principles are: respond to site, create connectivity, encourage diversity, grow and adapt over time, tell stories, nurture community and reinforce identity. The proximity of a large urban population raises expectations about the use of the Reserve by local people and increases the day-by-day management challenge.

4.4.12 Territory Plan

The reserve lies largely in the NUZ4 (River Corridor) zone of the ACT Territory Plan. The objectives of NUZ4 are to:

a) Conserve the ecological and cultural values of the ACT's major river corridors;

b) Protect stream flow, water quality and flood plains from adverse impacts;

c) Ensure that the type and intensity of developent is sustainable;

d) Provide opportunities for a range of ecologically sensitive water and land based recreational activities;

e) Ensure compatability between land uses, water uses and the general character of the rivers;

f) Provide opportunities for appropriate environmental education and scientific research activities; and

g) Prevent development that would significantly increase fire hazard.

4.4.13 Molonglo River Park

One of the commitments of the NES Plan was the preparation of a concept plan for a Molonglo River Park, consisting of the corridor for some 13 km each side of the Molonglo River in the urban section. This area of about 582 ha falls wholly within the new Molonglo River Reserve. It will be a central feature of the urban development of Molonglo; protecting important ecological values, while adding greatly to the amenity of the new residents of Molonglo Valley. The Territory Plan envisages the River Park as being **"... an important natural asset to the ACT and region [and that] the environmental quality, landscape setting, natural and cultural values of the river corridor be reinforced by the provision of an open space corridor on each side of the Molonglo River ... and a balanced range of recreational activities"**.

A concept plan for Molonglo River Park was developed in 2012 (Hassell 2012a) and its fundamental principles for the urban section of the Reserve are largely reflected in this Management Plan. In particular, public consultation over the concept plan supported the proposal to reclassify a significant portion of the park from Special Purpose Reserve to Nature Reserve in order to better reflect the ecological values of the site and the management emphasis in the future. In accordance with this reclassification, and on the basis of more detailed site assessments, two significant features of the concept plan have been refined. These are:

- realigning the trunk path so that it falls within the Inner Asset Protection Zone, thus utilising the lighting corridor of the edge road and minimising lighting impact and fragmentation of the Reserve; and
- centralising recreation facilities such as parks, access roads, car parking, barbecues and toilets to two Special Purpose Reserves: Elizabeth Park (Sludge Ponds) and Ryans Hill. This will reduce the overall impact on visual amenity, habitat, soil disturbance and fragmentation in the Reserve as a whole.

While the concept plan was endorsed by the ACT Government as a planning tool, the Management Plan is the statutory instrument that determines the objectives, policies and actions for the larger Reserve, of which the urban section is one part.

4.4.14 West Belconnen urban development

A development in West Belconnen by the Riverview Group has been proposed that could add 4,500 residences to the area west of Holt over the next 10-15 years. The development is still subject to statutory approvals. Complementary development across the border in NSW is planned to take the combined development to 12,000 dwellings over 30 years. Provision for recreational activities within the Murrumbidgee River corridor is included in these proposals and this will bring many people within easy walking range of the rural section of the Lower Molonglo River Reserve.

4.4.15 Infrastructure

Infrastructure in or adjacent to the Reserve consists largely of urban services in place before the Molonglo development began (some which will need upgrading), services recently completed or that have approval to proceed and those that are likely to be required to facilitate the Molonglo development. The Management Plan needs to provide for appropriate access and protection of infrastructure and clear guidelines for managing construction and management impacts on ecological and cultural assets. Table 4.1 lists the main infrastructure items that could impact on the Reserve, either through their location within the Reserve or directly adjacent to its boundary. Where these developments are not already addressed by the NES Plan or a decision made under the *Planning and Development Act 2007*, further approvals will be required that include the need for them to be considered against the requirements of the Management Plan.

Table 4.1 Infrastructure in the Reserve – present and anticipated

Infrastructure Item and location	Location
In place before 2016	
Molonglo Valley Interceptor Sewer (MVIS)	Located along the northern side of the river, mostly near or on the boundary, this 2.5 m diameter pipe is Canberra's main sewer line to the Lower Molonglo Water Quality Control Centre. It is buried for most of its length, except where it crosses five incised creek-lines. There are several vents (small towers) and structures for mechanical ventilation associated with it.
Power lines	Two transmission (132kV) power lines traverse the Reserve and cross the river and a third runs largely outside and parallel to the Reserve on its northern side, passing through the Reserve in a few places. Some of these may be relocated as part of Molonglo Stage 3 development. An 11kV power line is also located in the northern end of the Reserve.
A mains water pipeline that crosses the Reserve south of Coppins Crossing.	The water main is buried, including under the river.
Low level river crossings (4)	These consist of a public road bridge (Coppins Crossing), a service bridge (Southwells Crossing), the MVIS bridge (Clos Crossing), and a ford used by walkers and horse riders near Equestrian Park.
Management tracks	Management tracks serving the infrastructure, as noted above, as well as others that served the former pine plantations and other management requirements (e.g. fire protection).
A sewer line ("Sewer 3 Central")	Crosses the river at Link Bridge and also passes in and out of the Reserve along its boundary.
A high level bridge ("Butters Bridge")	Downstream of Coppins Crossing. Carries the sewer line above to the MVIS and also designed to serve as a pedestrian and cyclist crossing.
Water quality control ponds (4)	North Weston Ponds, Coombs Pond are Holdens Pond are completed, and Cravens Creek Pond is near completion. Their outflows to the Molonglo River pass down existing creek lines within the Reserve. Areas surrounding the ponds within the urban boundary will be landscaped and recreation infrastructure will be provided as residential population grows.
Infrastructure recently completed, under construction or in advanced planning stage	
Urban edge infrastructure	Within the urban development area along the Reserve boundary this includes a road, a trunk path, verges, retaining walls and earth banks to control stormwater flow.
Infrastructure planned or likely to be required to complete the development of Molonglo	
A bridge for John Gorton Drive over the Molonglo in the Coppins Crossing area	
Further sewers to service Molonglo Stage 2 and 3.	
Further Water Quality Control Ponds in Molonglo Stages 2 and 3.	
New odour control plants and vents for the MVIS.	
An 11 kV underground power line, location to be determined, plus possible additional overhead power lines.	
An East -West Arterial bridge in the Bulga Crossing area.	
Possible new water mains and gas lines that will cross the river with the new bridges.	

Overland flow into Molonglo River

5. GEOLOGY, LANDFORMS, SCENERY AND SOILS

5.1 Objectives

Objective 2:
Conserve the condition of the heritage geological site.

Objective 3:
Ensure that no land remains close to or below a critical threshold for landscape function in the long term.

Objective 4:
People are able to access, view and enjoy a diversity of scenery that is dominated within the Reserve by natural features.

5.2 Introduction

5.2.1 Geology

The geology of the Reserve is largely of volcanic origin dating from the Silurian period with some outcropping of limestone from the subsequent Devonian. The limestone and shale outcrops, which are scattered across an area of about 50 ha on both sides of the river slopes between Kama and a point about 3 km upstream of Coppins Crossing, are significant. The site is listed on the ACT Heritage Register for its rich evidence of marine fossils, including corals, trilobites, brachiopods, gastropods and ostracods, including some species first described from specimens from this site. It is one of the best-known and richest Middle Silurian faunal assemblages in eastern Australia, dating from 425 million BP. The outcrop is of value in dating similarly aged rocks elsewhere in the region, and is well known to geologists and paleontological societies (ACT Heritage Council 2013). The heritage listing reports that the site is generally in good condition.

5.2.2 Landforms

The Reserve displays a variety of river landscape forms due to the meanders in the river caused by the intersections of old fault lines, and the long period of weathering and geological stability allowing deep incision of the river into the landscape. In the **rural section** the river has cut a 100 metre deep, winding and rocky channel in a landscape of rolling hills. Kama woodland sits on a long gently facing hill slope facing towards the river. In the **urban section,** cliffs and rock faces mark the south bank, facing gentler slopes on the north bank of the still meandering river. In the uppermost reach below Scrivener Dam the river is more gently incised in a rolling landscape and the river is considerably straighter.

5.2.3 Soils

The soil Landscape Group of the **rural section** is largely Paddy's River with incised channels. The risk of gully erosion is high. Soils on the slopes upstream are similar to those downstream and erosion in the gullies is evident (Sharp 2011a). In Kama and the **urban section,** there are soils of the Burra Landscape Group (Jenkins 2000), which like the Paddy's River Group, are generally strongly acidic and also have low fertility and a low available waterholding capacity. They are also susceptible to moderate mass movement (terracetting), sheet erosion and localised shallow soils (Sharp 2011a). Deeper and better drained soils in the urban section are largely of the Williamsdale Landscape Group (Jenkins 2000). In the river channel there are also pockets of alluvial soils of the Pialligo Group (Jenkins 2000).

5.2.4 Topography

The **topography** of the Reserve is characterised by considerable slope (Figure 5.1). The valley is generally one of rolling hills, into which the river channel is incised, deeply in places. Kama, further from the river, is gently sloping but the remainder of the Reserve has relatively little flat land. Outside the river channel only 18% of the land in the urban section has a slope of less than 12.5%, which is considered the upper limit for developing recreation facilities with little land disturbance (Hassell 2012). The safe slope for mowing for fuel management is 20%.

5.2.5 Landscape function

Issue Box 5.1 The importance of landscape function

The physical attributes of landscapes, like the geology, soil type and condition, slope and aspect combine with biophysical attributes, like vegetation cover and litter, to regulate the flow of water, nutrients and materials (including seeds) in landscapes. Cleared sloping landscapes with few surface barriers to water flows (e.g. stones, litter, perennial grass clumps) and with erodible soils, lose resources faster than their natural geological rate and will not sustain the vegetation growth of landscapes where the resource flows are in a steady state. This attribute of landscapes is independent of the biodiversity values of the vegetation, but it underpins the capacity of a landscape to support biological structure and activity above and below ground, and to minimise sediment and nutrient flows into creeks and rivers. The capacity to retain such resources is termed **landscape function** and a practical method for its measurement, Landscape Function Analysis (LFA) has been developed (Tongway and Ludwig 2004).

Landscape Function Analysis has been applied in the ACT in a survey of landscape condition in all the reserves of Canberra Nature Park (Sharp 2011a). The rural section of the Reserve (excluding Kama) was visually estimated as having satisfactory landscape function across 90-95% of its area, with 5-10% approaching critical condition. Once a critical condition is reached it is very difficult to re-concentrate sufficient resources in the area for it to become self-regulating again. The major causes of deterioration in condition were fire and annual weeds, with grazing by rabbits, deer and goats a minor cause. In Kama, landscape function was similar and the main impact was from grazing by kangaroos. No assessment has been made of the urban section, but its past lack of protection, recent fire damage and its higher density of weeds means it is likely to have patches that are at or near the threshold. Repeated fires (natural or controlled), a high density of annual weeds that leave large patches of soil bare in summer and autumn, and any development activity that leaves large areas of land smooth and bare, are other threats to maintaining good landscape function in the Reserve.

5.2.6 Scenery

The scenery of the Reserve is produced by a combination of its landforms, water, vegetation and man-made features. Scenery is an important determinant of the aesthetic response of people to the Reserve, that is their feeling of pleasure at viewing, or otherwise sensing (e.g. listening) a place in the Reserve. As the major open space in the urban section, its aesthetic attractiveness will contribute significantly to the perceived value of the Reserve. Aesthetic responses to places generally are also influenced by social and cultural norms, as well as past experience and knowledge but in predominantly natural places, a number of studies have established that there is a strong positive relationship between perceived scenic beauty and perceived naturalness (Gobster et al. 2007).

The river is the central scenic feature in the Reserve. Its incision in the landscape means that its presence it is not often visible from a distance, particularly in the **rural section.** In this section, the winding line of Casuarina tree tops is often the only signal that there is a river hidden in the landscape.

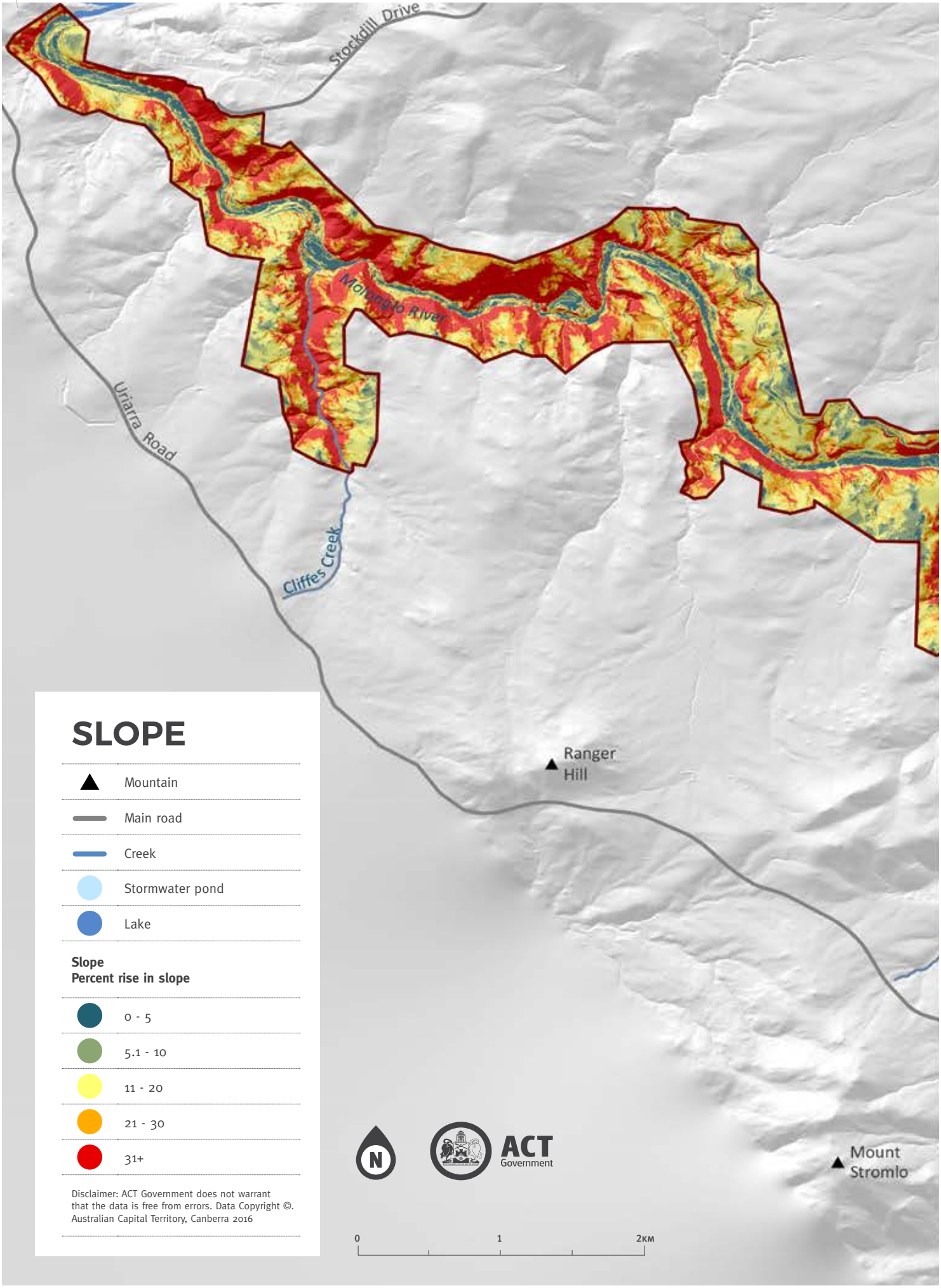
The mosaic of open grassland and woodland above the river channel allows distant views of this meandering line. Closer to the river, rock outcrops and cliff edges provide views of the water and the twists and turns of the river. Rock reef outcrops and islands within the river bed make interesting features whether viewed from above, or down at water level. Native vegetation dominates in the river channel and built infrastructure is rarely visible. In Kama, views are more enclosed and the vegetation provides the major point of visual interest. In the **urban section,** sloping grasslands above the river provide wide open views across the urbanising valley but within the Reserve, the tops of rock faces and knolls inside the meanders provide good viewpoints down into and along the river. Native vegetation still dominates in the river channel but more weeds are present. Higher and longer views of the river in the landscape in this section are provided from Barrer Hill and Bold Hill. At river level, there is again a variety of pools, rock reefs, rapids and islands. In the uppermost reach of the river, the river is straight and the vegetation is dominated by exotic species.

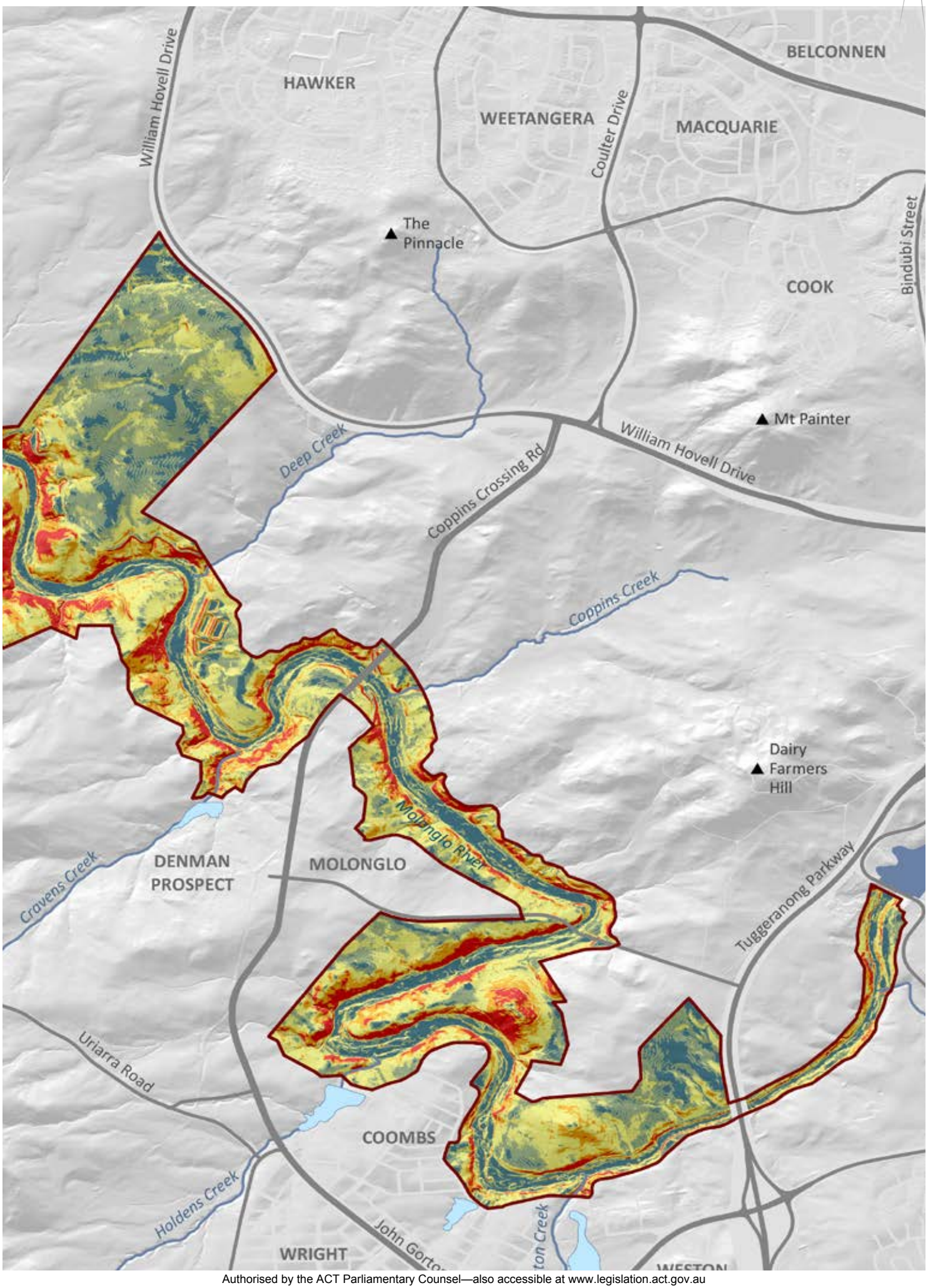
Existing man-made visible structures in the Reserve include management roads, the sewer pipeline where it occasionally breaks the surface to cross tributary creeks, sewer pipeline vents and other smaller pieces of infrastructure associated with the pipeline and the buried water main, river crossings, power lines, the old Sludge Ponds and the remains of Riverview farm. Additional planned and proposed infrastructure in or near the Reserve is listed in Table 4.1.

As seen from points within the park or from a high point on the other side of the river, middle distance views in the urban section are largely determined by the urban edge and the suburbs beyond. The edge will usually be bounded by first a path, then a local street and the frontages of residential properties. In the commercial centre, an urban park, retail, civic and higher density residential features will face the Reserve. Creek lines will also be visible as open space leading up to retention basins and beyond. These will be planted with native species for ecological linkage to the Reserve but will also serve as green threads providing visual linkages to more distant views. In the uppermost reach of the river, where the Reserve is very narrow, the backyard of the National Zoo and Aquarium and Scrivener Dam are prominent features.

The view into the Reserve from the urban areas is also relevant as it shapes the middle-distance view for residents at the urban edge. The river is not always visible and it is the vegetation above the river bank and the slope upwards across the river that will largely determine these views. This will be largely grassland with scattered trees.

Figure 5.1 Classification of slope in the Molonglo River Reserve





In the longer distance are familiar landmarks such as Black Mountain tower, the white domed observatory on Mt. Stromlo and the Arboretum whose plantings will become more visible and distinctive as they grow. The longer distance is also framed with vegetated hills and ridges in the urban section, components of the National Capital Open Space System, and in the rural section is framed by the treed ridgeline to the east (Kama, Mt Painter etc.) and grazed rural leases to the west.

5.3 Management considerations

5.3.1 Heritage geological site

The geological site's heritage listing means that it must be "conserved and appropriately managed in a manner respecting its heritage significance and the features intrinsic to that heritage significance, and consistent with a sympathetic and viable use or uses. Any works that have a potential impact on significant fabric (and / or other heritage values) shall be guided by a professionally documented assessment and conservation policy relevant to that area or component" (ACT Heritage Council 2013). Actions most likely to degrade the site are rock collection and vandalism by visitors, and trail or road construction. The fossil bearing limestone underlies most of the site, so damage to the resource is not restricted to the outcrops that are above ground.

The site is not currently identified or interpreted but its location is known to geologists and access via existing management roads is relatively easy. With the increase in people living close to the site, it is certain to be visited more frequently. As the fossil outcrops are scattered over the 50 ha site, physical protection is not feasible. The strategy for protection of the outcrops is based on raising the perception of their value through guiding the access and providing interpretation. Besides its heritage value, the site has an educational value and a value in contributing to the range of experiences the Reserve offers.

5.3.2 Land surface condition

The combination of erodible soils and sloping topography makes this Reserve particularly vulnerable to deterioration in land surface condition (landscape function), which in turn reduces the capacity of that land to support vegetation growth and diminishes water quality in streams and the river.

The sustainable land use recommendations for the main soil types in the Reserve are: for the Williamsdale Soil Landscape Group "Avoid activities that bring to the surface or expose the dispersible subsoils and hardsetting A2 horizon"; for the Burra Soil Landscape Group "Maintain ground cover at or above 70% to minimise potential sheet erosion; and for the Burra Group "Watercourses should be fenced off from stock" (Jenkins 2000).

Achieving and maintaining a healthy soil surface condition not only raises the potential for habitat restoration and protection, but reduces future management costs, particularly in terms of reduced need for weed control and reduced cost of water quality interventions. Degraded patches in the landscape are also likely to be perceived as 'ugly' and detract from its scenic value. They also encourage people to walk across them, compounding the difficulty in restoring them with a vegetated cover.

Therefore, as a matter of policy, as little as possible soil disturbance should occur in the Reserve. Where it is deemed necessary in order to fulfil other objectives for the Reserve or the ACT, the slope, soil type, type of disturbance, area, and capacity for remediation need to be considered. Construction Environmental Management Plans (CEMPs) are already required for areas covered in the NES Plan (ACT Planning and Land Authority 2011) and complementary measures need to apply elsewhere in the Reserve.

Large patches of land surface which are now at or near the landscape function threshold will be targeted as a priority for remediation. Conversely, where condition is satisfactory, and particularly on the more sloping land, activities that reduce landscape function, like removing physical barriers, will be restricted. Over-grazing is another threat to landscape function that will be monitored and controlled.

Natural events, like fire or intense pockets of rainfall, might lead to short term loss of soil cover and temporary crossing of the threshold but the expectation is that these places would recover naturally. Achieving the objective depends upon preventing patches remaining in poor condition for long periods of time.

5.3.3 Scenery

The diversity of scenery associated with the river is potentially the major attraction in the Reserve, although it is not currently widely visited for this purpose due to limited access. In the context of a reserve where the conservation of natural features and processes is the primary objective, developing and protecting the scenic values will be guided by a principle of retaining the Reserve's 'naturalness' except in the concentrated recreation zones. Protecting places for their 'natural beauty' was the foundation of the development of

protected areas, predating concerns about species and ecosystem conservation. Protecting 'naturalness' is likely to also protect ecological values: there is a preponderance of evidence suggesting that for many wildlands, perceived naturalness maps closely with more objectively quantified indicators of ecological quality" (Gobster et al. 2007).

'Naturalness' in the context of the Reserve means allowing the natural (non man-made) features to fill or dominate views, especially within the Reserve. Given the setting in the **urban section**, man-made features will usually be visible in the distance and sometimes in the middle ground, but in closer views, achieving 'naturalness' requires man-made features to be in reverse proportion – inconspicuous and infrequent.

Concentrating recreation infrastructure in two places is consistent with this approach and echoes that taken at Tidbinbilla. In other places, such as Namadgi National Park and Cradle Mountain – Lake St Clair National Park in Tasmania, most visitor facilities and accommodation are located outside or just inside the park boundary. While Molonglo River Reserve is small in comparison and partly located in an urban area, the aesthetic and ecological reasons for taking this approach remain the same. In fact the urban setting is likely to lead to a higher demand for structures in the Reserve compared to more distant parks and the scenery objective will protect the 'front-yard' values of the Reserve from independent but multiple cumulative decisions about the presence and location of built structures.

The main management consideration in achieving the scenery objective is deciding where new (or modifications to existing) structures will be placed in the Reserve, and how they are designed. Other objectives and management considerations relating to ecological objectives will also contribute to these decisions. Recreation trails fall within the category of man-made structures and a balance will be needed between providing access and safety mechanisms (e.g. guard rails) and maintaining natural vistas.

The strategy for achieving the scenery objective is to focus scenic protection on a set of identified views, provide access to them and protect their 'naturalness'. The Molonglo River Park Concept Plan notes potential viewing sites in the urban section (Hassell 2012a) and established processes for assessing the impact of development proposals on landscape character and views can be drawn upon e.g. Landscape Institute and I.E.M.A. (2013). Design principles are outlined in Guidance Box 5.1.

Guidance Box 5.1
Guidance for design that enhances and protects natural scenery

Principles

- Avoid large structures on high points
- Avoid tall structures, particularly in lower parts of the landscape
- Locate structures in parts of the landscape where they are less visible from a distance
- Use colours that blend with the background
- Design trails to follow natural contours and curve through the landscape
- Use natural materials where feasible e.g. soil or gravel in preference to bitumen or concrete.
- Use the same quality of design as is used in urban areas (to convey that the structure and its surroundings are of equivalent value and worthy of equivalent respect)
- Apply the principles more rigorously in the views identified as most significant.

Additional considerations

At the boundaries, rehabilitation plans inside the Reserve will consider how plantings can be used, after meeting conservation and fire management objectives, to enhance views into the Reserve.

Just outside the Reserve boundary, opportunities for reflecting the character of the Reserve will be sought through collaboration with residents and those responsible for plantings at the urban edge. Infrastructure placed on the Reserve boundary will be encouraged to conform to the design principles above.

Some views of the river and its scenery can be seen from a distance e.g. from Barrer Hill and the proposed recreation park on Bold Hill/Ryans Hill, or when passing over the Reserve on traffic bridges. The capacity to enjoy these views will be enabled where feasible.

5.4 Policies and actions

HERITAGE GEOLOGICAL SITE	
Objective 2: Conserve the condition of the heritage geological site.	
Policies	**Actions**
2.1. Protect the site from disturbance.	2.1.1 Avoid significant infrastructure development at the heritage geological site but if unavoidable, a statement of heritage effects must be developed that outlines impacts, proposed mitigation strategies, and a mid to long term management strategy. 2.1.2 Avoid disturbing outcrops or sub-surface limestone when designing infrastructure such as trails, trenches and fences.
2.2 Raise awareness of the value of the site.	2.2.1 Consider building a short trail through a selected part of the heritaggeological site and provide interpretation.

LAND SURFACE CONDITION	
Objective 3: Maintain and enhance landscape function in the long term.	
Policies	**Actions**
3.1 Soil disturbance is avoided in the first place or remediated when disturbed.	3.1.1 Design routes and trails to minimise the risk of people trampling or riding off path. 3.1.2 Apply the design and construction approach used in the new sections of the Centenary Trail (CBRE 2014) to new trails in the Nature Reserve, where appropriate. 3.1.3 Promote a culture of people staying on trails (especially in the urban section), vehicles remaining on roads and tree litter and rocks remaining in place. 3.1.4 Works Plans for all significant park management activities will include the mitigation of soil and habitat disturbance.
3.2 Monitor, manage and remediate soil disturbance and erosion.	3.2.1 Remediate eroding areas that are near or have crossed their landscape function threshold. 3.2.2 Monitor the impact of grazing, especially from cattle, kangaroos and rabbits and take action to modify the grazing pressure if soil surface condition is likely to approach thresholds.

SCENERY	
Objective 4: People are able to access, view and enjoy a diversity of scenery that is dominated within the Reserve by natural features.	
Policies	**Actions**
4.1 The 'naturalness' of the Reserve will be protected.	4.1.1 Design structural elements within the reserve to ensure integration with landscape character and ecological objectives.
4.2 Identify and provide access to a diverse set of views, and protect their 'naturalness'.	4.2.1 Select a set of views that reflect the diversity of natural features, and identify and map them to give them status and aid in wayfinding.

6. ECOLOGICAL CONSERVATION

6.1 Objectives

Objective 5:
The population size of threatened species is at least maintained; the areas of listed threatened communities are at least maintained and their condition improved; and the diversity of all other native species is conserved; and the ecological condition of the dryland matrix is improved.

Objective 6:
Raise the ecological condition in the river and riparian zone to support the recovery of native fish in the river.

Objective 7:
Achieve fire protection for people and property in ways that also effectively protect threatened habitat and other ecological conservation values.

Objective 8:
Connectivity within and outside the Reserve is improved.

Black-shouldered kite
Elanus axillaris

6.2 Introduction

For its size, the Reserve is home to an important habitat for part of the year, to a rich diversity of species, including a number of threatened species and communities. Ninety-two species of birds have been recorded in and around Kama alone, and the Molonglo Valley is a hunting and breeding ground for 12 species of birds of prey (Canberra Ornithologists Group 2007). The Reserve, along with the Murrumbidgee River nearby, is one of the few areas in the ACT that supports a breeding pair of the little eagle. An active nest was identified in the Molonglo corridor in 2002-2003 (Olsen and Fuentes 2004), and nesting and foraging territories have since been identified in more detail (Debus 2006). Five of the twelve species of native fish and crayfish in the ACT are found in the River.

Plants are also unusually diverse. In the last comprehensive survey in the rural section, 225 plant species were recorded in about 700 ha (Barrer 1992). Approximately twelve bat species, five frog species, twenty reptile species, platypus, water rats and other mammals were also recorded. All these organisms, along with fungi, lichens, myriad invertebrates and microorganisms provide not only genetic diversity but a diversity of functions that support the lives of other species and deliver important ecological functions like the regulation of water, nutrient and material flows across the land surface, soil stability and water infiltration, water quality in the river and connectivity across the landscape.

This diversity reflects the mix of both riverine and dryland ecosystems in the Reserve. These have been substantially modified by the last 180 years of land and water management practices across south eastern Australia which have left few areas in the condition they were in at the time of European settlement. A list of the threatened species and communities known to be, or to have once been, in the Reserve and their conservation status under various legislation, is in Table 6.1.

Based on similarity with where they are found elsewhere, other threatened species may also be present (e.g. hoary sunray and button wrinklewort, found in Natural Temperate Grassland elsewhere in the ACT (Eco Logical 2008)).

The major vegetation communities found in the Reserve are listed and mapped in Figure 6.1. The area of each community is listed in Appendix 6.

Table 6.1 Threatened communities and species that live in the Reserve, depend on it seasonally, or, in the case of fish, have been present in the past and could potentially be returned

Species/community	Common name	Cwlth*	ACT**	NSW***
Community				
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Box-Gum Grassy Woodland	Critically endangered R+, NES+	Endangered R+, NES+	
Natural Temperate Grassland of the South Eastern Highlands	Natural Temperate Grassland	Critically endangered R+, NES+	Endangered R+, NES+	
Plants				
Pomaderris pallida	Pale pomaderris	Vulnerable	-	Vulnerable
Birds				
Xanthomyza phrygia	Regent honeyeater	Endangered R+	Endangered R+	Critically endangered
Lathamus discolor	Swift parrot	Endangered R+, NES+	Vulnerable R+, NES+	Endangered
Polytelis swainsonii	Superb parrot	Vulnerable R+, NES+	Vulnerable R+, NES+	Vulnerable

Species/community	Common name	Cwlth*	ACT**	NSW***
Melanodryas cucullata	Hooded robin	-	Vulnerable R+	Vulnerable
Climacteris picumnus	Brown treecreeper	-	Vulnerable R+	Vulnerable
Grantiella picta	Painted honeyeater	-	Vulnerable	Vulnerable
Daphoenositta chrysoptera	Varied sitella	-	Vulnerable	Vulnerable
Lalage sueurii	White-winged triller	-	Vulnerable (R+) Action Plan 27	-
Hieraaetus morphnoides	Little eagle	-	Vulnerable R+	Vulnerable
Merops ornatus	Rainbow bee-eater	a)	-	-
Fish (A)				
Bidyanus bidyanus	Silver perch	Critically endangered	Endangered	Vulnerable
Macquaria australasica	Macquarie perch	Endangered	Endangered R+	Endangered
Maccullochella macquariensis	Trout cod	Endangered R+	Endangered	Endangered
Maccullochella peelii	Murray cod	Vulnerable R+	-	-
Reptiles				
Aprasia parapulchella	Pink-tailed worm-lizard	Vulnerable NES+	Vulnerable	Vulnerable
Invertebrates				
Euastacus armatus	Murray River crayfish	-	Vulnerable R+	-
Perunga ochracea	Perunga grasshopper	-	Vulnerable R+	-

(A) Nationally and ACT threatened fish that were present in or near the Lower Molonglo historically but are not found or rarely found there now include silver perch, Macquarie perch and trout cod.

Critically endangered – at extremely high risk of extinction in the wild in the immediate future

Endangered – at very high risk of extinction in the wild in the immediate future

Vulnerable – at high risk of extinction in the medium term future

R+ An approved recovery plan exists for this individual species or this community.

(R+) This species is covered by a threatened community recovery plan.

NES+ Protected under the Molonglo Valley Plan for the Protection of Matters of National Environmental Significance, 2011 (NES Plan). This is the Act that governs the NES plan.

a) The Rainbow Bee-eater is an internationally listed migratory bird also covered by the EPBC Act. It has the same level of protection in the ACT.

* Listing under the Environment Protection and Biodiversity Conservation Act (Department of the Environment 2014)

** Listing under the ACT Nature Conservation Act (ACT Government 2013c)

*** Listing under the Threatened Species Conservation Act 1995 (NSW Environment and Heritage 2014). Included here because the Reserve is close to the border with NSW.

Australasian darters
Anhinga novaehollandiae

Nankeen kestrels
Falco cenchroides

For the purposes of this Management Plan, the area of the Reserve is divided into three ecological groupings based broadly on their conservation priority and differences in management requirements. These areas are intermixed spatially and therefore not suited to differentiation by more formal zoning which is the more usual approach in protected area management. The classification also facilitates clear communication about the ecological requirements of the Reserve, which are complex for a relatively small area. The groupings are:

- **Threatened habitat** – the areas of listed threatened vegetation communities and pink-tailed worm-lizard habitat above the river. In the urban section, it includes the NES-specified buffers around PTWL habitat. It does not include buffers in the rural section where there is a lower requirement for protection from disturbance.
- **Dryland matrix** – the matrix of dryland vegetation surrounding the patches containing threatened habitat.
- **River and riparian** – the river, aquatic habitat and riparian zone. The riparian zone is the area of land next to the river that is affected by periodic inundation, wetting and drying and therefore supports vegetation communities that are different from those on nearby land unaffected by the river (Johnston et al. 2009).

The distribution of these three areas across the Reserve is shown in Figure 6.2.

6.3 Threatened habitat

This area comprises all the listed threatened vegetation communities and pink-tailed worm-lizard habitat in the Reserve. In the urban section, it includes the NES-specified buffers around PTWL habitat. It does not include buffers in the rural section where there is a lower requirement for protection from disturbance. Threatened habitat defined in this way represents about 497 ha or about 38% of the Reserve.

Before European settlement, the two now-threatened vegetation communities, Box-Gum Grassy Woodland and Natural Temperate Grassland covered around 65% of the area of the Reserve (estimated from Figure 6.1). Clearing, grazing, weed invasion and the establishment of pine plantations have substantially modified these communities and only remnant patches of their original area is sufficiently representative of these communities to merit protected status.

For Box-Gum Grassy Woodland, the criteria that determine whether a patch should be protected under Commonwealth legislation include having a predominantly native understorey and being greater than 0.1 ha in size with good non-grass understorey plants, or greater than 2 ha in size if tree representation is good, but the understorey is modified (Threatened Species Scientific Committee 2006). Under the ACT *Nature Conservation Act 2014* the listed community can encompass lower condition woodlands. For Natural Temperate Grasslands, the criteria for listing are based on the diversity and cover of native species, the presence of disturbance sensitive species, the diversity of forbs and the proportion of exotic species. The BGW and NTG remnants that meet the listing criteria are scattered through the Reserve and together with the scattered patches of grassland that support PTWL, are the areas that have the highest priority for protection and rehabilitation in this Management Plan (Figure 6.1, Figure 6.2).

The treeless grassland habitats where PTWL are found have usually been considered as modified BGW or modified NTG which do not meet the criteria for listing as either of these communities. Recent research suggests

that the grasslands in PTWL habitat map to one of the eight distinct vegetation associations of Natural Temperate Grasslands called Kangaroo Grass – Purple Wire-grass – Wattle Mat-rush Dry Tussock Grassland. This association has not been previously identified in the ACT (Sharp et al. 2013). As such, it would meet the Commonwealth criteria for listing as threatened Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT. Whether or not the grassland community in which PTWL is found has protected status, protection of the threatened PTWL necessitates protecting the habitat in which they live.

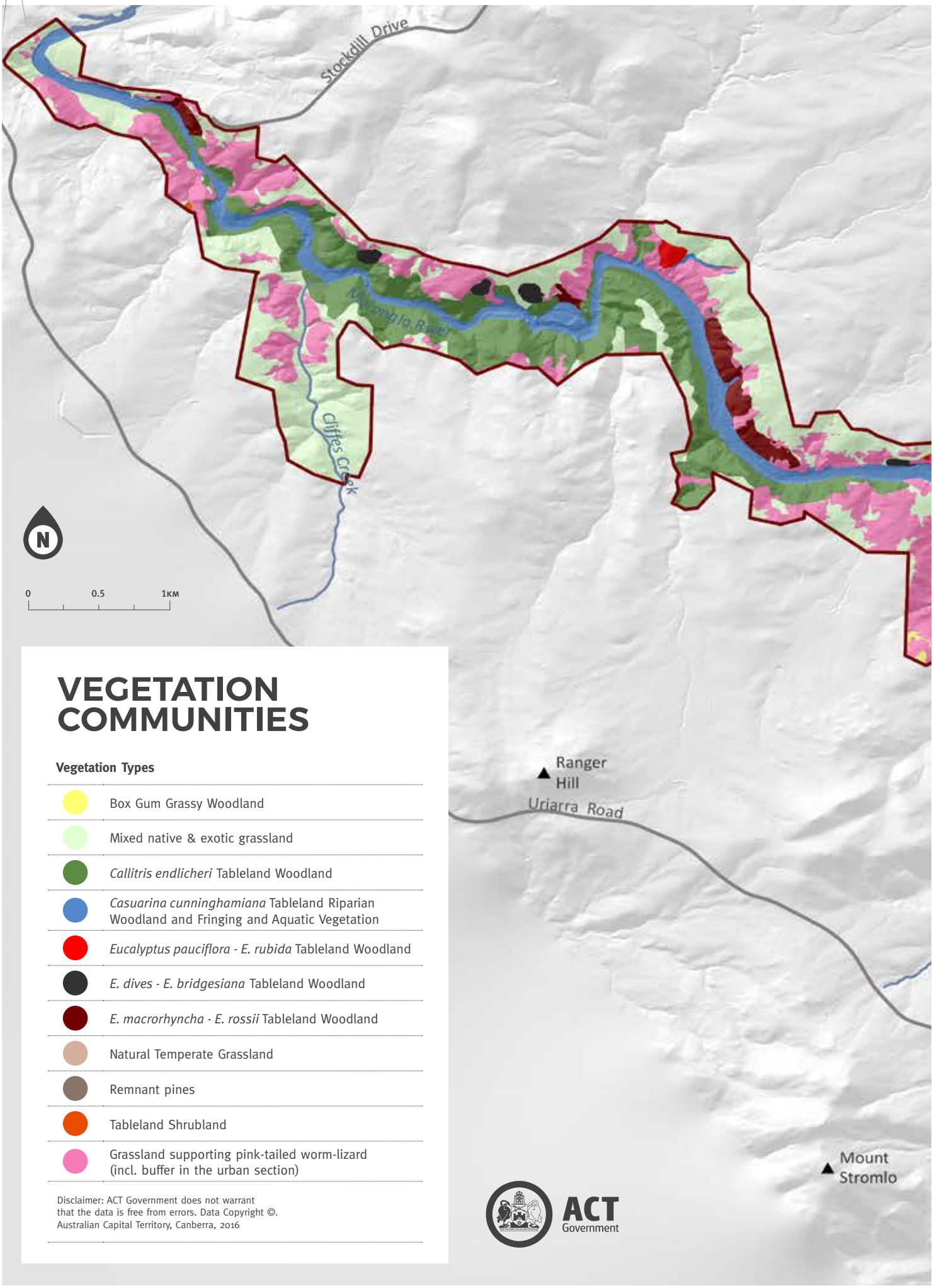
6.3.1 Agreements in the NES Plan

Five of the species and communities listed in Table 6.1 are subject to specific measures agreed by the ACT and Commonwealth Governments (see Section 3.4). It is part of this agreement that these goals be incorporated into this Management Plan (ACT Planning and Land Authority 2011). The communities and species concerned are: Box-Gum Grassy Woodland, natural temperate grassland, pink-tailed worm-lizard, swift parrot and superb parrot. The swift parrot and superb parrot are considered covered by actions that improve the conservation status of Box-Gum Grassy Woodland.

Not all the NES actions refer to land that falls within the Reserve. Those that do are mostly in the urban section and in Kama, and are reproduced in Appendix 5. A consolidated summary of the required actions is in Table 6.2.

Kama and the urban section of the Reserve are offsets under the NES agreement. Principle 5 of the Commonwealth Government's offset policy (SEWPaC 2012) states that "Suitable offsets must effectively account for and manage the risks of the offset not succeeding".

Figure 6.1 Vegetation Communities of the Molonglo River Reserve



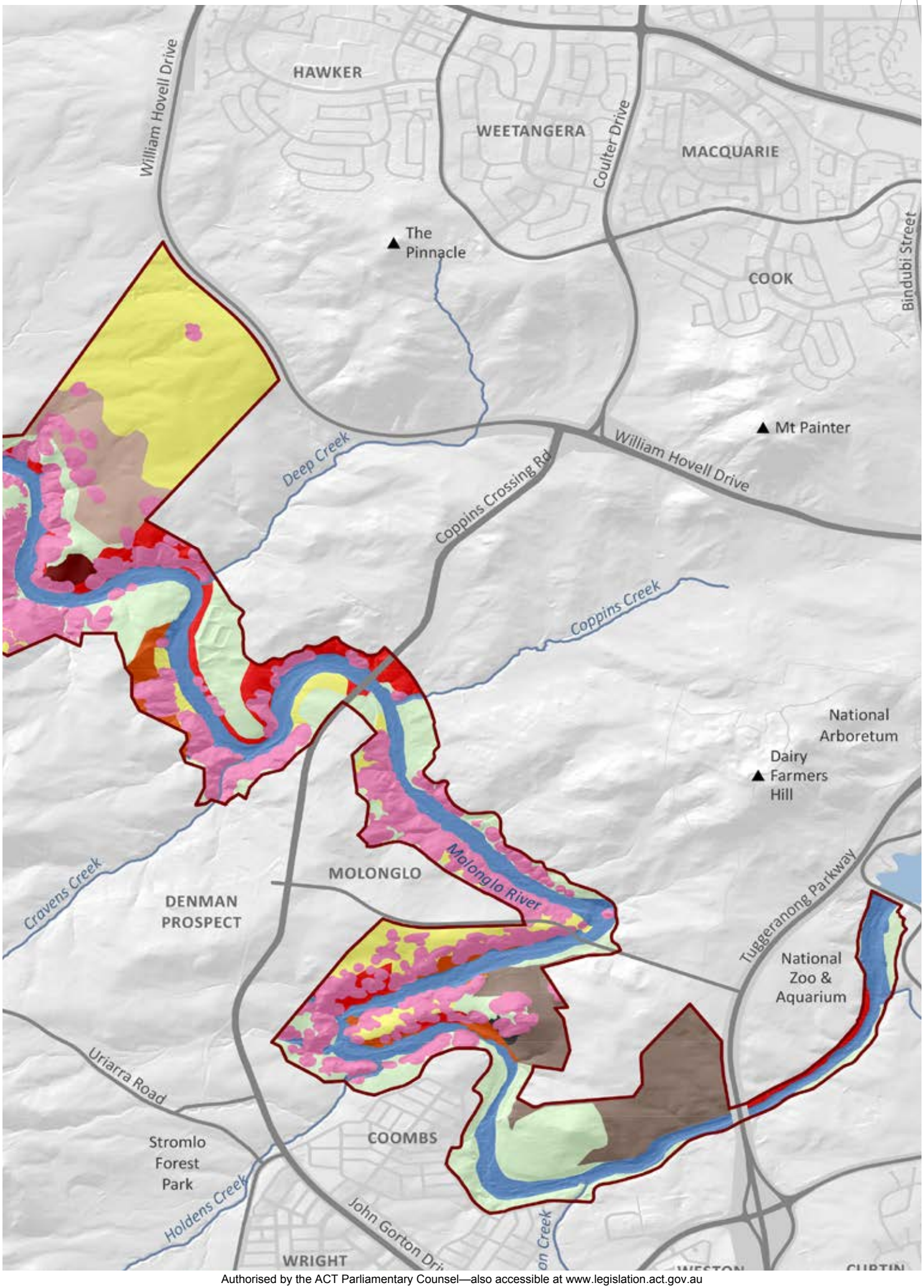
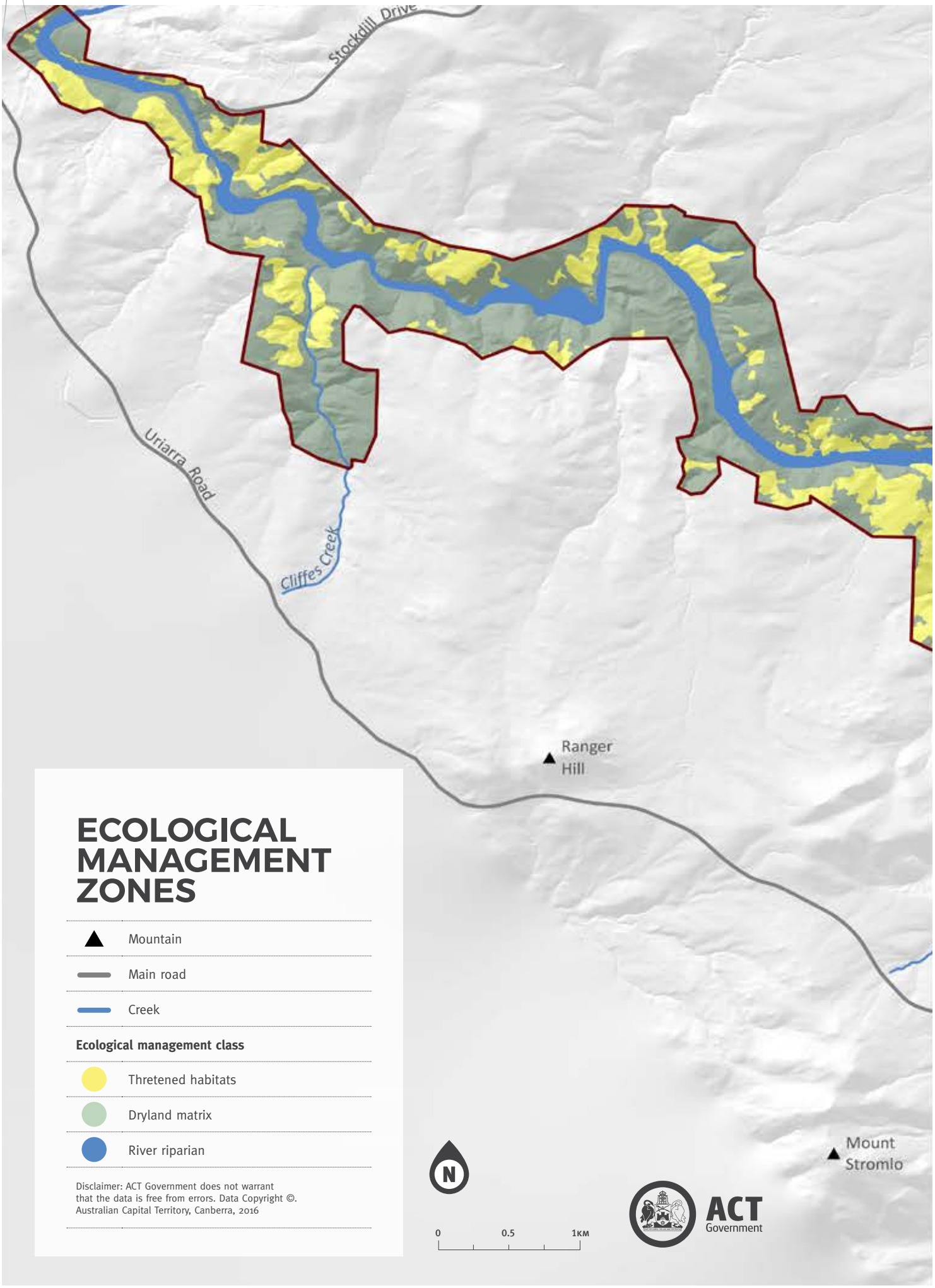

HAWKER
WEETANGERA
MACQUARIE
William Hovell Drive
Coulter Drive
Bindubi Street
The Pinnacle
COOK
Mt Painter
Deep Creek
Coppins Crossing Rd
William Hovell Drive
Coppins Creek
National Arboretum
Dairy Farmers Hill
Molonglo River
MOLONGLO
Cravens Creek
DENMAN PROSPECT
Tuggeranong Parkway
National Zoo & Aquarium
Uriarra Road
Stromlo Forest Park
COOMBS
Holdens Creek
John Gorton Dri
WRIGHT

Figure 6.2 The three ecological management zones in the Reserve.



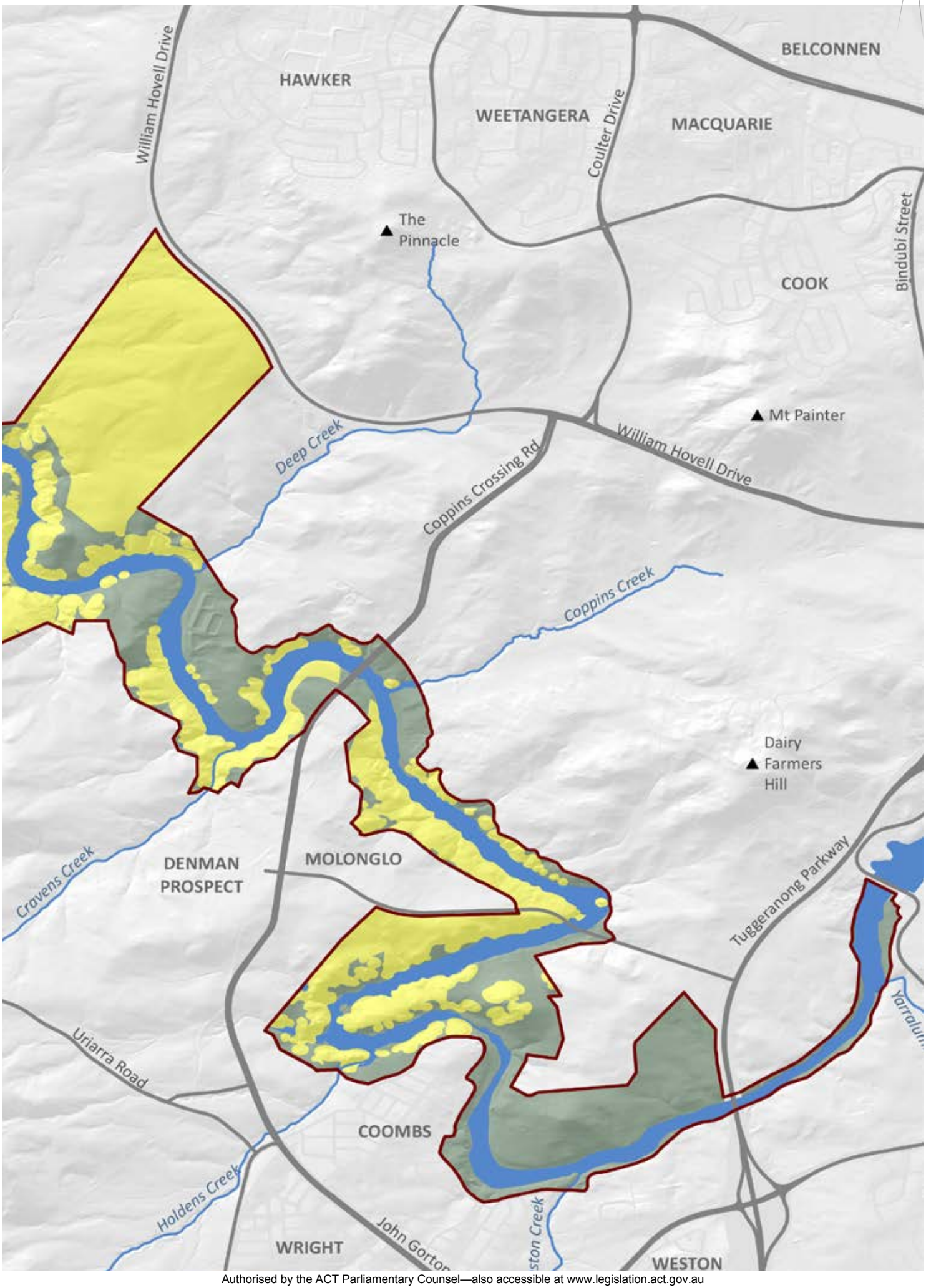

William Hovell Drive
HAWKER
WEETANGERA
Coulter Drive
BELCONNEN
MACQUARIE
The Pinnacle
Bindubi Street
COOK
Mt Painter
Deep Creek
Coppins Crossing Rd
William Hovell Drive
Coppins Creek
Dairy Farmers Hill
Cravens Creek
DENMAN PROSPECT
MOLONGLO
Tuggeranong Parkway
Uriarra Road
COOMBS
Holdens Creek
WRIGHT
WESTON

Table 6.2 Consolidated actions in the NES Plan that apply to the Molonglo River Reserve

Topic	Consolidated action	Action Nos. in NES Plan
Box-Gum Woodland and pink-tailed worm-lizard protection	Develop and implement a management plan for the Molonglo River Park* to provide for the maintenance and enhancement of the ecological condition of a) BGW (approximately 73 ha) and b) high and moderate quality PTWL habitat within the park.	9, 10, 36, 38
Box-Gum restoration knowledge	Establish and manage an off-site restoration project, as an indirect offset, for Box-Gum Woodland.	23
Pink-tailed worm-lizard	Establish a 20 m buffer around high and moderate quality PTWL habitat (other than, for example the areas to be impacted by the bridge crossings and strategically placed walking tracks) within the East Molonglo river corridor*. Manage these areas to ensure the maintenance of their conservation value. Management measures will be incorporated into the management plan for the river corridor.	37
Infrastructure design	Design the infrastructure that will occur in the river corridor to avoid or minimise impacts to BGW and to high and moderate quality PTWL habitat.	3, 30
Managing construction impact	Develop, implement and independently monitor Construction Environmental Management Plans (CEMPs) to ensure that unforeseen direct or indirect impacts on BGW and PTWL from construction activities within the development area and the river corridor are avoided.	4, 31
Kama	Develop and implement a management plan for the Kama Nature Reserve* to provide for the protection, maintenance and enhancement of the ecological condition of a) Box-Gum Woodland, b) Natural Temperate Grassland and c) all PTWL habitat (approximately 6 ha) within the park.	5, 6, 24, 25, 26, 32 and 33
Pink-tailed worm-lizard habitat in rural section	Continue implementation of the Management Plan for the Lower Molonglo Nature Reserve* to provide for the maintenance of the ecological condition of the high and moderate quality PTWL habitat that occurs there.	40
Adaptive management	Develop and implement an adaptive management strategy.	Section 7

* this area now part of the Molonglo River Reserve to which this plan applies

The NES Plan outlines the ACT Government's obligations in relation to monitoring and reporting on the implementation of the NES Plan. The ACT Government is required to produce a publicly available annual report identifying:

- achievement of the MNES conservation outcomes;
- progress in completing the actions listed in the NES Plan; and
- any deviation or non-compliance with the actions.

The Annual Reports are available for viewing online at www.environment.act.gov.au.

Issue Box 6.1 Actions that increase the risk of losing the threatened communities and PTWL in the Reserve

- For **Box-Gum Grassy Woodland:** clearing for infrastructure provision leading to loss of habitat and fragmentation; firewood collection; failure of tree regeneration; rural tree die-back; grazing by any animals at levels which suppress regeneration of trees and alter the understorey; invasion by weeds and feral animals; fire regimes (planned and unplanned) that prevent maintenance of woodland structure and species richness, loss of connectivity to habitat outside the Reserve; and alterations in drainage and runoff that lead to changes in moisture and nutrient levels (ACT Government 2004a).
- For **Natural Temperate Grassland:** land management that leads to overgrazing; soil disturbance (including compaction from vehicles or walkers); inappropriate fire regimes, whether planned or unplanned; weed invasion; tree-planting; and alterations in drainage and runoff that lead to changes in moisture and nutrient levels (ACT Government 2005).
- For **pink-tailed worm-lizard:** disturbance or removal of rocks; degradation of surrounding Themeda grassland (including the buffers) through weed invasion, trampling, increased erosion or sediment accumulation, inappropriate fire (planned and unplanned) or fire protection measures; predation; tree or shrub establishment; overgrazing and lack of connectivity with other populations; alterations in drainage and runoff that lead to changes in moisture and nutrient levels (Osborne and Wong 2013).
- For **threatened birds** generally: removal of trees (living and dead), removal of fallen timber and litter; predation by feral or uncontrolled domestic animals; invasion of key habitats by introduced pasture plants and weeds or birds (native and alien) that compete for nesting hollows; inappropriate fire regimes (planned and unplanned); overgrazing; lack of connectivity within and outside the Reserve; rural tree dieback; and use of chemicals (compiled from Action Plans in Table 6.3).

Table 6.3 Action plans for the recovery of threatened vegetation communities relevant to the Reserve

Threatened Species/Community	Action plans	Reference
Box-Gum Woodland and associated bird species, including: brown treecreeper, hooded robin, superb parrot, regent honeyeater	Woodlands for Wildlife: ACT Lowland Woodland Conservation Strategy (Action Plan No. 27)	ACT Government 2004a
Natural Temperate Grassland and Perunga grasshopper	A Vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy (Action Plan No. 28)	ACT Government 2005

6.3.2 Management considerations

Generally the approach to protecting threatened species and communities is to protect their habitat from further loss, manage threats, improve habitat condition, extend the area through rehabilitation and enhance connectivity. Rehabilitation is especially important in this Reserve because its past history of land use has resulted in considerable fragmentation and degradation. Specific approaches and detailed actions for the listed species and communities in this area have been drawn from the recovery plans in Table 5.3 and incorporated into the Ecological Management Guidelines (Sharp et al. 2015).

6.4 Dryland matrix

The dryland matrix consists of the remainder of the area of the Reserve that is not river or riparian. This area represents about 628 ha or 47% of the Reserve. It consists of:

- the remaining areas of BGW and NTG that would originally have been classified in these two communities and that is now a mix of modified and weedy grasslands with scattered trees
- former pine plantations containing mixes of remnant pine trees, self-regenerating pine and native trees with a weedy understorey containing a low proportion of native plants (about 69 ha)
- habitat of *Pomaderris pallida*, an ACT threatened plant scattered along the river banks in the rural section
- patches of other vegetation communities:
  - Black Cypress Pine – Brittle Gum Tall Dry Open Forest (about 135 ha)
  - Snow Gum Grassy Woodland (about 72 ha)
  - Broad-leaved Peppermint – Brittle Gum Tall Dry Open Forest (about 7 ha).

These latter communities are not listed as threatened, but Snow Gum Grassy Woodland, where it lies between woodland and grassland, is targeted for protection in the ACT Lowland Woodland Conservation Strategy (ACT Government 2004a).

While not meriting protection at the level of threatened communities, this matrix between the less modified patches contains a diversity of native plants, provides important habitat for many species, including threatened species, and acts as crucial connectivity between the scattered areas containing the listed communities inside and outside the Reserve. The dryland matrix also encompasses the two proposed Special Purpose Reserves at Sludge Ponds and Bold Hill/Ryans Hill. Sludge Ponds and Bold Hill are currently highly modified grassland and Ryans Hill a former pine plantation.

Species inside remnant patches may also be partly dependent on the matrix for supplementary or complementary resources and there is growing evidence that matrix quality crucially influences the abundance and composition of species within remnant patches (Didham et al. 2012). In the sense that the matrix has been substantially modified, it is a novel ecosystem (Hobbs et al. 2009) where objectives can depend less on attaining a prior species composition and structure and more on achieving good landscape function. This allows some scope to manipulate or design to particular objectives, for example minimising bushfire risk through biomass management.

Conservation priority for this area as a whole is medium, with a larger focus on those measures most important for threatened species and communities in or adjacent to the matrix, connectivity across the Reserve, improving the condition of patches of remnant BGW and NTG and rehabilitating areas now covered with remnant pine plantations.

6.4.1 Management considerations

Because the dryland matrix is more disturbed and has a lower conservation priority, it is the area that will be targeted for recreation use, both in the nature reserve and in the two special purpose reserves. Nevertheless, in the nature reserve in particular, important ecological functions have been identified and must be protected. These include maintaining landscape function described in Chapter 4 and also maintaining habitat for natural soil engineers. Soil engineers like invertebrates, especially termites and ants, but also burrowing bees, wasps and spiders play critical roles in drilling, mixing and processing the soil in grasslands and grassy woodlands. In the process, they contribute to soil formation, decomposition and nutrient cycling, carbon and nitrogen fixation and sequestration, infiltration, purification and storage of water (Colloff et al.

2010). Threats to healthy populations of soil engineers are disturbance and fragmentation, erosion, loss of vegetation (especially woody and understorey vegetation with nectar-bearing flowers for bees), reductions in soil moisture and loss of invertebrate biodiversity (especially invertebrate prey for spiders).

A major threat to the dryland matrix is that its largely open nature, history of recreation use, weediness and evidence of past disturbance creates an impression that it has little conservation value and is 'empty' and available for any human use.

A significant area in the lower eastern corner of the Reserve (see Figure 6.1) is vegetated with radiata pine trees that have regenerated since the 2001 and 2003 fires and are steadily increasing in biomass. Part of this area is in a Strategic Firefighting Advantage Zone and will require fuel management. In the long term they would more appropriately be replaced with vegetation based on native species. A Box-Gum Woodland restoration project has already begun in such an area on Barrer Hill (NES Action 23).

The impact of urban development on local hydrology (surface and groundwater flows) needs to be monitored for its possible impact on vegetation condition on the slopes and banks of the river in the urban section.

6.5 River and riparian

The river and its riparian zone represent the remaining area in the Reserve, about 203 ha or 15%. The riparian zone is that area above the water level where a damper microclimate supports vegetation with different characteristics from adjacent dryland areas (Johnston et al. 2009). The conservation priority for this area is medium to high. It has fewer threatened species and communities but it is the icon of the Reserve and generally in better base condition for rehabilitation than the dryland matrix.

6.5.1 Conservation goals

Conservation goals for the river and riparian zone in the Reserve are already embodied in the ACT Aquatic Species and Riparian Zone Conservation Strategy 'Ribbons of Life' (ACT Government 2007a).

The objectives of the Strategy that apply to the Murrumbidgee and Molonglo rivers and their tributaries within the ACT, are to:

- Conserve in perpetuity viable, wild populations of all aquatic and riparian native flora and fauna species in the ACT, including listed threatened species.
- Conserve in perpetuity aquatic and riparian native vegetation communities in the ACT as viable and well-represented ecological communities.
- Maintain aquatic and riparian communities and habitats in the ACT and where degraded, rehabilitate to support the range of flora and fauna typical of the ACT. Rehabilitation may include the re-introduction of threatened or locally extinct fish species to ACT and/or regional streams where they no longer occur naturally.
- Maintain in perpetuity a well-connected system of aquatic and riparian environments that support movement of aquatic and riparian fauna in the ACT and region.

The Water Resources Environmental Flow Guidelines (ACT Government 2013b) also set out requirements for environmental flows in the ACT, including flows in the Molonglo River below Lake Burley Griffin. It is a statutory requirement that environmental flows be maintained in all ACT catchments (but not necessarily all river reaches) in order to protect the environmental values of rivers further downstream waters. Environmental flows are expressed in terms of regimes of base flow, riffle maintenance flows, pool or channel maintenance flows and special purpose flows.

6.5.2 Riparian vegetation

Four riparian vegetation communities are present in the river and riparian zone in the Reserve: two on the sandbars and banks: River She-oak Dry Riparian Forest and River Bottlebrush – Burgan Rocky Riparian Shrubland, and at the water's edge and in the river: Tableland Riparian Fringing Aquatic Vegetation; and Tableland Aquatic Floating and Submerged Vegetation. None of these communities are threatened. However, the River She-oak community has high significance as a movement corridor for birds, including threatened birds, and the aquatic vegetation is crucial for supporting life in the river, including threatened fish. Willows and other weeds are prevalent in the riparian zone, especially in the first five kilometres below Scrivener Dam.

View from the trail

The condition of the riverine vegetation communities was assessed as very low in the upper reaches grading to moderate to high in the lower gorge section (Eco Logical Australia 2008, Peden et al. 2011). The main reasons for poor condition were the predominance of weeds and slow recovery from the bushfires of 2001 and 2003. A long history of uncontrolled stock access to the river has also damaged the riparian zone in places but recent fencing of river banks in the rural section has been noted to already increase the complexity of riparian zone vegetation (Peden et al. 2011). Generally, the aquatic fringing vegetation has retained a higher proportion of native species than the tree and shrub vegetation communities. Common invasive weeds documented included willows, blackberries and radiata pine wildings. African lovegrass has also established in the lower section. Reach by reach descriptions of the riverine vegetation, including weeds and recommended management actions, are in Peden et al. (2011).

6.5.3 Native fish

The status of the five threatened fish and crayfish species listed as historically or currently present in Table 6.4 in the Lower Molonglo River (Beitzel et al. 2009) is:

- Murray cod: historically present, present nearby in the Murrumbidgee and stocked into Lake Burley Griffin, potentially present in the Lower Molonglo, suitable habitat available, limited by low flows.
- Trout cod: historically present in nearby tributaries and the Murrumbidgee, suitable habitat available, limited by absence of moderate flows, very low likelihood of occurrence now.
- Macquarie perch: historically present, habitat limited, very low likelihood of occurrence now.
- Murray River crayfish: historically present in the Molonglo or nearby tributaries, habitat is reasonable.
- Silver perch: not recorded in the Lower Molonglo, despite stocking into Lake Burley Griffin, no longer in the Murrumbidgee nearby.

Other fish present include the native fish golden perch, Australian smelt and western carp gudgeon. Exotic fish, especially carp, heavily dominate fish numbers and fish biomass in the river.

6.5.4 River morphology

Also crucial for maintaining habitat in a river and its riparian zone is the morphology of the river. Through much of its length the river is characterised by fast flowing riffle sections broken by long pools, often rock bottomed. There are also minor alluvial banks and fans, especially at bends and the entry points of tributaries (Peden et al. 2011). Under natural conditions, the water regime (the timing, pattern and volume of flows) maintains this physical pattern in the river through actions like scouring pools, removing sediments from riffles and clearing vegetation. In turn this is important for water quality and for supporting a variety of habitats and life processes for aquatic and riparian plants and animals.

The banks of the river are also important as potential nesting sites of the rainbow bee-eater, a protected migratory species (Table 6.1). The rainbow bee-eater is a summer breeding migrant to the ACT. It is an insect eater that builds nests at the end of long tunnels dug into sandy river banks or sandy ridges.

6.5.5 Water quality

Water quality in the river is governed by the quality of the water entering the river and the combination of river morphology, water flow and riparian and aquatic life in the river which filter and process contaminants in the water. The long term median water quality monitored at Coppins Crossing has been rated as moderate (Skinner 2011) but this is less than in most reaches and tributaries upstream in the catchment. New urban development has the potential to diminish water quality but most stormwater from the Molonglo town will eventually pass through bio-retention basins in order to moderate storm water flows and to filter sediment, nutrients and contaminants from the water. Further works are planned for the Yarralumla catchment which currently contributes significant pollution into the Lower Molonglo River. Both Yarralumla Creek and the Lower Molonglo are focus catchments in a new bilateral Murray-Darling Basin project "Improving Long Term Water Quality in the ACT and the Murrumbidgee River System."[1] The project includes a comprehensive water monitoring program so that the effectiveness of water quality actions will be monitored and further improvement in water quality can be targeted to the areas that produce the most pollution.

However, most of the flow in the river arrives through releases from Scrivener Dam and its quality reflects both the quality of water in Lake Burley Griffin and the fact that the released water is drawn from depth and is both colder and less oxygenated than a natural flow.

1 http://www.environment.gov.au/minister/birmingham/2014/mr20140226.html

Issue Box 6.2 Actions that threaten native fish and their habitat in the Molonglo River

For native fish, the main threats are: overfishing, human disturbance, sedimentation, habitat modification, alien species, barriers to fish passage, thermal pollution; discharge from Lower Molonglo Water Quality Control Centre and an inadequate flow regime (ACT Government 2007a; Beitzel et al. 2009).

Threats to vegetation condition include: weeds, erosion, bushfire or inappropriate fire prevention measures or regimes and inadequate or inappropriate flows.

6.6 River and riparian management considerations

6.6.1 Flows

Addressing the issue of altered flow regimes is a major consideration for the long-term health of the river. Suitable habitat (large pools and woody debris) is still present in the river for murray cod and trout cod but their presence is limited by low flows (Beitzel 2009) and possibly the effect of the outfall from the Lower Molonglo Water Quality Control Centre. A sustainable population of Murray cod lives in the Murrumbidgee not far downstream from its confluence with the Molonglo and instituting environmental flows would provide the connectivity up and down the river they require for feeding and breeding. Connectivity with the Murrumbidgee would require resolving whether the outflows from the water treatment plant limit the movement of fish into the bottom reach of the Molonglo (Lintermans 2002), and if that is the case, exploring options for redesigning the outflow accordingly.

Consistent with the ACT Environmental Flow Guidelines (ACT Government 2013b), a water regime that would maintain and enhance ecological value would include a base flow for most days of the month, periodic flood or flush flows to clear the riffles and pools, and occasional bank-full flows to maintain the channel structure and prevent excessive vegetation from growing in the river. Additional special purpose flows at specific times of the year might be needed to enhance fish breeding or deliver water to riparian plants. A recommended water regime for achieving good morphological and ecological outcomes in the rural section was designed during assessment of the option for creating a lake in the new Molonglo development but the lake was not progressed.

Maintaining environmental flows is not only beneficial to fish but to the condition of riparian vegetation and was recommended for the Lower Molonglo River (Peden et al. 2011). Increasing flows down the Molonglo would also increase the dilution of salts released from LMWQCC, especially in drought years when salt concentrations approach maximum recommended levels (Tomkins et al. 2009). Increasing environmental flows in the Lower Molonglo is much more feasible now that the ACT has additional storage capacity in the Cotter and the ability to transfer water from the Murrumbidgee into its water supply system. Through the infrastructure developed in the Murrumbidgee to Googong Water Transfer Project, a water allocation from Tantangara Dam could be transferred to the Lower Molonglo via the Murrumbidgee River to Googong Dam, and then to the Queanbeyan River which joins with the Molonglo River. Passage of the water through Lake Burley Griffin would need coordination with the National Capital Authority.

6.6.2 Barriers

As well as adequate flows for movement up and down rivers, barriers to fish movement need to be addressed or avoided. Fish need to be able to move up and downstream to find food and to shelter from predators, respond to changing temperatures and water levels and to breed. Two new road bridges, a high level sewer and pedestrian crossing, and at least one recreational crossing are planned to cross the river. Their siting and design, including the approaches and bank vegetation, must be selected to minimise barriers to fish passage and disturbance of significant river habitat, for example a pool or a riffle section. Guidelines for designing appropriate waterway crossings are available (e.g. Fairfull and Witheridge 2003).

6.6.3 People and stock

With a high resident population of people nearby, the river and riparian zone is also at risk of being impacted by inappropriate human activities like illegal fishing, over fishing, disturbance in and around the river (e.g. moving rocks, paddling, disturbing sediment, release of aquarium plants and fish). These are addressed in Chapter 9.

Restricting stock grazing from the river edge and assessing grazing impacts in other areas for appropriate action, are appropriate management actions. In particular, the river banks where rainbow bee-eaters breed must be protected from damage and their burrow entrances not concealed with vegetation.

Table 6.4 Action plans for threatened species previously or potentially present in the Lower Molonglo River, and for aquatic communities in the ACT

Threatened Species/Community	Action plan	Reference
Fish (threatened and non-threatened species)	Ribbons of Life. ACT Aquatic Species and Riparian Zone Conservation Strategy (Action Plan No. 29)	ACT Government 2007a
Aquatic communities	Environmental Flow Guidelines	ACT Government 2013b

6.6.4 Recovery plans

Recovery plans have been developed for threatened riverine species and communities that apply to the Reserve (Table 6.4) and the actions they detail have been incorporated into the Ecological Management Guidelines.

6.7 Managing conservation in the Reserve as a whole

Specific requirements and approaches to protecting threatened species and communities in particular parts of the Reserve have been mentioned. Because of their broader scale nature, some remaining issues apply across the whole of the Reserve and are better managed at that scale. General strategies for dealing with some of these in the ACT are already developed (Table 6.5) and detailed guidelines have been spelt out in the Ecological Management Guidelines. The interaction between fire protection and conservation in the Reserve is also addressed here as the measures apply to mixes of threatened patches, the dryland matrix and the river.

6.7.1 Threatened species

One threatened bird species in the Reserve depends on its full mosaic of open woodland, grassland and riparian vegetation. This is the little eagle, which nests in the rural section of the Reserve and requires suitable trees for nesting in and a foraging range of several kilometres. Its protection depends on protecting both the nesting site and an adequate foraging area. Nesting can be disrupted by frequent and close visitation of people into breeding areas. Detailed actions in the recovery plan in Table 6.6 and in the Woodlands for Wildlife Strategy (Table 6.3) have been incorporated into the Ecological Management Guidelines.

Table 6.5 Abatement strategies for broad scale threats to conservation in the ACT

Threat	Abatement strategy	Reference
Weeds	ACT Weeds Strategy 2009-2019	ACT Government 2009
Kangaroo overgrazing	ACT Kangaroo Management Plan	ACT Government 2010b
Pest animals	ACT Pest Animal Management Strategy 2012-2022	ACT Government 2012c
Climate change	AP2. A New Climate Change Strategy and Action Plan for the Australian Capital Territory	ACT Government 2012d

Table 6.6 Action plan for the Little Eagle

Threatened Species/Community	Action plan	Reference
Little eagle	Action Plan No. 35. Little Eagle (*Hieraaetus morphnoides*)	ACT Government 2011a

6.7.2 Fire protection requirements

The statutory requirement of land managers to reduce the risk or severity of bushfire entering the suburbs has been noted (Section 4.4.6) and the SBMP overrides public land management plans where they are inconsistent (Section 77A, *Emergencies Act 2004*). The general approach in this Plan is to select mitigation measures that achieve the required levels of fire protection and are also compatible with achieving ecological objectives.

The NES Plan also refers specifically to fire management: "Within the strategic assessment area fire management will be aimed at the protection of both built assets and MNES values. This will be achieved through the identification of appropriate asset protection zones and the application of hazard reduction techniques that will both: ensure that the standards for fuel loads in the SBMP are met; and protect MNES values through the use of sympathetic management techniques" (ACT Planning and Land Authority 2011).

Proposed asset protection zones within the Reserve have been identified by ESA in consultation with the Fire Management Unit of the Environment, Planning and Sustainable Development Directorate. The proposed zones are based on current boundaries and shown in Figure 6.3. The zoning requires approval by the Emergency Services Agency and will then be included in the relevant Regional Fire Management Plan for the area. The Fire Management Unit translates the Regional Plans into annual Bushfire Operational Plans. Any subsequent changes to boundaries may require adjustment to the zones and further approval from ESA.

The key features of asset protection that interact with conservation objectives are the requirement to manage fuel load and to provide access. Fuel management standards that need to be applied in the zones in the Reserve are in Appendix 7. In Outer Asset Protection Zones (OAPZ) that bolster Inner Asset Protection Zones within the suburban envelope, vegetation must be managed so that its biomass in summer (estimated from its height and extent of cover) stays below a prescribed level. In Strategic Firefighting Advantage Zones (SFAZ), which are strategically located accessible corridors designed to break up a fire front, fuel load must be maintained below a set level and the canopy must be discontinuous. The remainder of the Reserve is designated as a Landscape Fire Management Zone, in which fuel management standards are not applied.

Managing bushfire risk in the Reserve will be governed by three plans, due to the diagonal track of the river. These are the Regional Fire Management Plans for Canberra, Cotter and Umburra.

6.7.3 Fire protection in Pink-tailed worm-lizard habitat

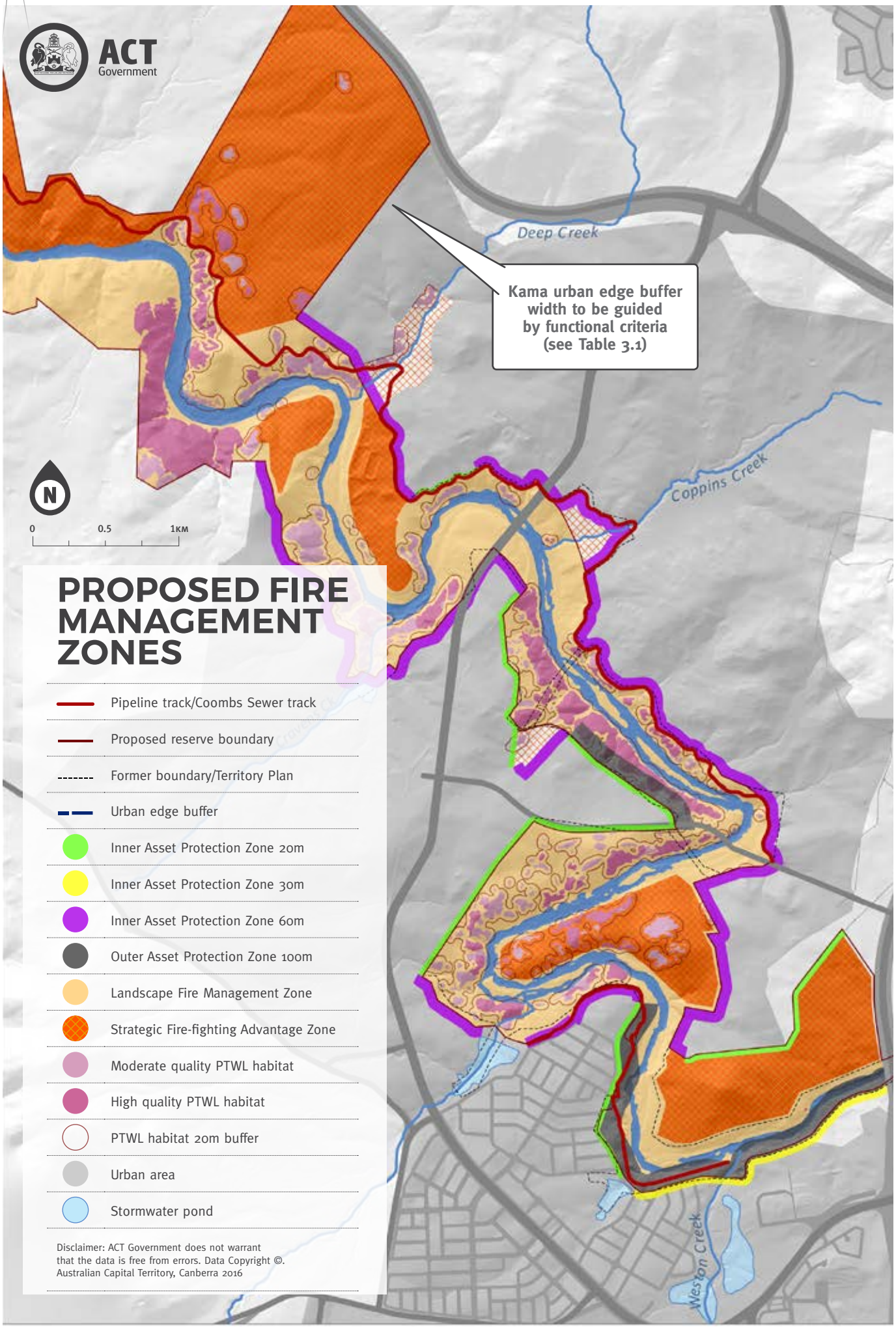
The NES Plan requires that measures to control fire risk do not threaten the survival of Pink-tailed worm-lizard (quoted in Section 6.7.2 above). There are two areas where Pink-tailed worm-lizard habitat and proposed fire protection zones overlap.

In the **urban** area an OAPZ is proposed in the area where the Reserve abuts the planned Molonglo Town Centre and where there is high quality PTWL habitat (see Figure 6.3). This is referred to as Patch K in the NES Plan. PTWL habitat in good condition generally meets the OAPZ standard because a) the area covered by rock produces no biomass and reduces the continuity of fuel (Cheney and Sullivan 2008), and b) native grasses associated with good quality PTWL habitat is naturally of moderate productivity. However, the buffer zones around the mapped patches of good quality PTWL habitat, the matrix between patches and their buffers, and the moderate quality habitat areas will not generally meet OAPZ standards without some biomass management. This is largely due to the absence of rock (in buffers) and often, higher proportions of introduced grasses like wild oats and Phalaris, or weeds like St Johns wort, which on average produce higher biomass than native grasses under the same conditions. Practices traditionally used to meet fire management objectives in OAPZs, like slashing, stock grazing, and hazard reduction burning on a regular basis are not appropriate in PTWL habitat. Therefore the approach taken will be to rehabilitate these areas back to native rocky grasslands and the ACT Government has commenced a trial in Patch K to determine the best grassland rehabilitation methods for this situation.

Residual risk to the survival of Pink-tailed worm-lizards living in an OAPZ could come from their proximity to urban activity, including the actions of people in the Reserve. Fencing, boardwalks and interpretation will provide clear guidance to people about avoiding disturbance to this lizard's habitat (Chapter 5). A healthy population of Pink-tailed worm-lizards has remained stable on Mt. Taylor for the last 20 years, in proximity to housing and people and in the presence of some local disturbance (Osborne and Wong 2012). This gives confidence to the assessment that this risk is manageable in Molonglo River Reserve as the habitat will be more intensively monitored and managed than on Mt Taylor.

Parts of the **rural** section (which includes Kama) are proposed to be zoned as Strategic Firefighting Advantage Zones. There are patches of high and medium quality PTWL habitat scattered throughout this section, but due to their moderate fuel levels and the less stringent and larger area over which the requirements of a SFAZ can be achieved, it is expected that PTWL habitat in this section can be protected from damage by fire protection measures.

Figure 6.3 Proposed fire management zones and interactions with threatened habitat



6.7.4 Fire protection and conservation in Kama

Kama is zoned as an SFAZ. Fire protection requirements will be achieved using a number of biomass management techniques that are not inconsistent with the conservation objectives for BGW and NTG. These include: ecological burns and planned fuel reduction burns, strategic grazing and herbicides to control high biomass grassy weeds, clumping of restoration plantings so they can be protected from fuel reduction measures, no further planting of red stringybark (*Eucalyptus macrorhyncha*) and tree by tree charring of the lower bark of existing red stringybark trees. If these measures do not achieve the necessary fuel reduction, fuel management may be undertaken in accordance with the Ecological Guidelines for Fuel and Fire Management Operations and the Molonglo River Reserve and Offset Area Ecological Management Guidelines.

6.7.5 Fire protection and conservation elsewhere in the Reserve

Fuel reduction issues elsewhere in the Reserve include the interaction between connectivity for conservation and fuel breaks to hinder bushfire passage, and the risk to various plant communities of fire (bushfire or planned fire) that is too frequent or too severe. Birds in particular use the cover of the she-oak Forest community to move along the river and this has significance beyond the Reserve as it has been identified as an important regional corridor (Manning et al. 2010). While the she-oak community is naturally patchy due to the variable nature of the river, increasing the distance between patches risks the corridor becoming unviable as a movement corridor for some species.

In particular the Black Cypress Pine – Brittle Gum Dry Open Forest (*Callitris endlicheri* in Figure 6.1) is fire sensitive and should never be deliberately burnt (Appendix 8). It is proposed that this be zoned as a Landscape Management Zone for fire management. The River She-oak Dry Riparian Forest should only be burnt every 20-25 years, and Snow Gum Woodland only every 12-50 years. Detailed guidelines for designing fuel and fire management operations so that they limit harm to ecological integrity in the ACT have been prepared (ACT Government 2012) and are reflected in the Molonglo Ecological Management Guidelines.

6.7.6 Pests and weeds

Invasive weeds that displace native vegetation are of particular concern for ecological conservation across the Reserve. African love grass has colonised most of the length of the Lower Molonglo River within the last ten years (Sharp 2011b). Other significant weeds in the Reserve include blackberries, willows and St John's wort (Sharp 2011a). Blackberries and most willow species are on the national list of Weeds of National Significance (Australian Weeds Committee 2012) and declared as pest plants in the ACT (Pest Plants and Animals (Pest Plants) Declaration 2009 (No 1)).

Pests recorded in and around the Lower Molonglo River include rabbits, foxes, goats, pigs and fallow deer on land, and carp, redfin, gambusia and oriental weather loach in the river (ACT Government 2001; Beitzel et al. 2009).

6.7.7 Climate change

Climate change as a threat will become incorporated into action plans as they are developed and reviewed, as a result of the *Nature Conservation Act 2014*. An adaptive management approach will be essential so that as the degree and type of change reveals itself, management can be adjusted. The ACT Government has committed to "continue to assess the potential impacts of climate change on ecological systems in the ACT and the surrounding region and integrate this knowledge into environmental management and development planning decisions to ensure our natural environment is conserved and enhanced" (Action 17 in its latest climate change action plan, ACT Government 2012d). Concepts about conservation may need to evolve too, because today's conservation frameworks were developed at a time when stationary climates, even if variable, were the usual expectation (Dunlop et al. 2013).

Issue Box 6.3 Climate change

The magnitude and rate of change in climate cannot be predicted with accuracy but the direction of change in Australia is reasonably consistent across different climate models. Recent observations are also consistent with predicted trends, for example 2013 was the warmest year on record across Australia and maximum temperatures were the second warmest on record in the ACT (Bureau of Meteorology 2014). General projections for the ACT are that it will experience increased temperatures, changes in the seasonal pattern of rainfall with a possible decline in the average, and increased frequency and intensity of extreme weather events. Higher temperatures and the same or less rainfall will mean more evaporation and drier soils.

The likely impacts of such climate change in Canberra Nature Park include: disturbances in landscape function leading to loss of habitat; invasion by more resilient species; and increased fire through both bushfire and more prescribed burning (Cooper 2011). Individual species responses are very difficult to predict but species with restricted climatic ranges, small populations and limited ability to migrate, are most at risk (ACT Government 2012d). In the Molonglo River Reserve particularly, the impact of extreme drought or extreme rainfall events will be most significant for biodiversity, function and use values associated with the river. On the sloping lands, where there are few trees and little litter, erosion risk will increase.

6.7.8 Fragmentation and connectivity

Achieving the objectives for threatened species and communities in the Reserve depends not only on actions taken in and around the patches where they exist in the Reserve, but on how well those patches are connected with others both inside and outside the Reserve regardless of land tenure.

Reconnecting fragments across landscapes and regions constitute two scales at which fragmentation is important. Fragmentation also operates at much smaller scales. For example, small reptiles and invertebrates may not cross a road or a trail or an extended patch of bare soil. Banks associated with building trails on sloping land may become impassable to small creatures. The management issue at this scale is less one of reconnecting fragments already established, and more one of minimising future fragmentation through the introduction of multiple trails, tracks, roads or other infrastructure. New road crossings need to be designed to allow for wildlife corridors and fencing designed to allow wildlife access to foraging routes.

Issue Box 6.4 Connectivity in fragmented landscapes

Connectivity in landscapes where past land uses have fragmented native species into small patches is critical for a number of reasons: for supporting the survival of species that feed over wide areas, move around seasonally or need to find refuge in times of drought; for ensuring that populations do not become genetically isolated and lose the capacity to respond to changing environments; and for ensuring the maintenance of ecological processes that cross landscapes, like water and nutrient flows (Mackey et al. 2010). Climate change accentuates the need for connectivity as species will move to find habitat and conditions to which they are adapted. The Lower Molonglo River is recognised in the Canberra Spatial Plan as a wildlife corridor helping to connect nature conservation areas across the ACT and into the wider region (Map 7, ACT Government 2004b).

As an action under the ACT's first climate change action plan (ACT Government 2007b), the status of ecological connectivity in the ACT and region was analysed (Manning et al. 2010). The Molonglo River corridor and Kama feature as important connections in the wider region. Maintaining and improving those connections will be of mutual benefit not only to the Reserve itself but to the wider region as well.

Of particular relevance to the Reserve is the recommendation that the link Black Mountain – Belconnen Hills – Lower Molonglo River be considered a high priority for connectivity action. Some linkages from the Reserve towards Stromlo Forest Park are also already planned (refer to map). These will follow the old creek lines in which new retention basins are being placed. As well as establishing new corridors, connectivity can also be increased by adding individual connectivity elements between remnant patches, for example trees, shrubs, water bodies, grassland or dead wood. These can be useful even within suburbs (Manning et al. 2010). Subsequent work by Barrett et al. (2010) has expanded on this analysis and contains practical advice on restoring connectivity in the region.

Two specific types of habitat in the Reserve that also need special attention are Pink-tailed worm-lizard habitat, and the habitat provided by large old remnant trees. A specific study on connectivity needs for the Pink-tailed worm-lizard provides recommendations about the re-connection of sub-populations that are currently separated, and the prevention of any new barriers to their dispersal (Knopp et al. 2013). Their capacity to cross the discharge creek lines from the stormwater ponds is a special concern and must be addressed if works are found to be required to ameliorate erosion in these gullies. Issues associated with scattered trees are in Issue Box 6.5.

Issue Box 6.5 The biodiversity value of scattered living and dead trees

Scattered remnant habitat structures, especially large old trees and dead standing trees (snags) contribute significantly to biodiversity value (Manning et al. 2006; Fischer et al. 2010; Lindenmayer et al. 2010; Lindenmayer et al. 2014; Le Roux et al. 2014). In particular, scattered trees that are isolated in modified landscapes (e.g. agricultural or urban settings) tend to be disproportionately valuable as habitat resources for wildlife, relative to their size and availability in the landscape (Stagoll et al. 2012; Le Roux et al. 2015b). This is consistent with the law of diminishing returns: where habitat resources are in short supply, they can gain value and may even become 'keystone' ecological structures (Cunningham et al. 2014; Le Roux et al. 2015b).

Large old trees and snags that have increased senescence tend to form and accumulate unique habitat structures such as large complex canopies, numerous exposed dead branches, tree cavities (hollows) with varying dimensions, and coarse and fine fallen woody debris (litter and logs). These habitat structures provide important nesting, sheltering and foraging sites for a multitude of species, including: fungi and epiphytes (e.g. attachment and exploitation of aging and dead wood); birds, bats and marsupials (e.g. perching and resting at dead branches and/or hollow-nesting); and ground-dwelling mammals, reptiles, amphibians, and invertebrates (e.g. foraging in and around fallen debris). Furthermore, scattered trees and snags can facilitate dispersal by animal species, acting as 'stepping stones' for wildlife in otherwise impacted landscapes. This is especially important in the light of predicted climatic changes, particularly for dispersal limited and threatened taxa (e.g. superb parrots: Manning et al. 2009). The immense time lag (›200-300 years) required to replace large old trees and their associated habitat structures makes the retention of existing old trees particularly critical (Le Roux et al. 2015a). Other innovative restoration efforts that involve the recreation of vertical habitat in areas where mature trees are in decline or absent can also have biodiversity benefits. For example, relocating and resurrecting intact dead trees that can be enriched with habitat structures used by wildlife (carved nesting boxes, artificial bark and perch cross-beams).

Wherever possible, targeted protection and retention of scattered and remnant habitat structures like large old and dead trees should be a high conservation priority, thereby ensuring that crucial habitat resources and habitat connectivity are maintained.

Connectivity is ecologically important in the river as well as on land, and the importance of increasing connectivity with the Murrumbidgee River at the lower end of the river has already been addressed in Section 6.5.

6.8 Policies and actions

Because of the protected status of threatened species and communities, and the planning associated with urban development in the Valley, the presence, extent and condition of threatened species and communities in the Reserve is well described, especially for those covered by the NES Plan. Objectives and some actions for these species and communities have already been specified in some detail, and general recovery plans and threat abatement plans exist. The major planning considerations are:

- Ensuring that the higher level objectives are translated into practical on-ground plans that as they are implemented across the Reserve effectively add up over time into achieving the desired objectives.
- Ensuring a sound knowledge base on which detailed rehabilitation strategies can be based, including allowing for the requirement to manage fuel loads and help protect urban areas from the risk of wildfire.
- Maintaining an adaptive approach to the management of threatened species and communities situated within or near a new urban development, where the cumulative impacts of development and residents' behaviour in and outside the Reserve are not fully predictable.

Less well covered by specific action plans is the river and its riparian zone, and the need to maintain and improve connectivity inside and outwards from the Reserve. More detailed actions are specified for these.

ECOLOGICAL CONSERVATION

Policies		Actions	
Objective 5: The population size of threatened species is at least maintained; the condition of threatened communities are at least maintained or condition improved; and the diversity of all other native species is conserved; and the ecological condition of the dryland matrix is improved.			
5.1	On-ground activities will be designed and implemented through a suite of plans informed by ecological management guidelines for the Reserve and an adaptive management approach. (Applies to all Objectives 5-9.)	5.1.1	Develop a set of scientifically-based ecological management guidelines that incorporate the NES agreements (Sharp et al. 2015) (Table 6.2), bushfire protection, action plans (Table 6.3, Table 6.4, Table 6.6) and threat abatement plans (Table 6.5) and provide integrated guidance to designing the on-ground activities for achieving the goals.
		5.1.2	Develop 3-year Operational Plans for discrete areas that prioritise the on-ground actions for each area.
		5.1.3	Annually develop and implement a Work Plan for each Operational Plan.
		5.1.4	Implement the adaptive management strategy for the NES areas (ACT Government 2013d) to track progress and adjust management as learning grows; and review other objectives in Years 5 and 10 (see Chapter 11).
Objective 6: Raise the ecological condition in the river and riparian zone to support the recovery of native fish in the river.			
6.1	A long term river habitat restoration plan will guide recovery of ecological values in the river and riparian zone.	6.1.1	Monitor water quality and flows upstream (above Yarralumla Creek) and downstream of the urban section and develop a quantitative understanding of the impact of new retention basins in the catchment on the quantity and quality of flows into the river.
		6.1.2	Review the environmental flow recommendations developed during earlier Molonglo Valley development planning and seek mechanisms for their implementation.
		6.1.3	Investigate the extent to which outflows from LMWQCC deter some fish species from entering the Molonglo River from the Murrumbidgee and if required, investigate options for changing the point or pattern of discharge.
		6.1.4	Review the impact of the release of cold water from Scrivener Dam and explore options for improving the quality of water released from the Dam in consultation with the NCA.
		6.1.5	Combine these actions with other appropriate measures from the Aquatic Species and Riparian Zone Conservation Strategy in a Lower Molonglo River Restoration Plan.
Objective 7: Achieve fire protection for people and property in ways that also effectively protects threatened habitat and other ecological conservation values.			
7.1	Requirements of the Strategic Bushfire Management Plan will be met in ways that minimise loss of threatened habitat and ecological function.	7.1.1	Complete the PTWL rehabilitation trial in Patch K and progressively apply the results to PTWL buffers and moderate and high quality PTWL habitat patches in Outer Asset Protection Zones in the urban section.
		7.1.2	Incorporate requirements into the Molonglo Development Fire Management Strategy and the three Regional Fire Management Plans that apply to the rural section, and implement them in Operational Plans.
		7.1.3	Prohibit the use of open fires in the Reserve (Chapter 8).
Objective 8: Connectivity within and outside the Reserve is addressed and improved.			
8.1	Connectivity within and outside the Reserve will be improved.	8.1.1	Analyse connectivity, identify gaps and target the gaps for habitat rehabilitation.

See also Chapters 8, 9 and 10 for policies and actions that deal with people's activities in and near the Reserve, and Chapter 11 for improving management through adaptive management and targeted research activities.

7. ABORIGINAL CONNECTIONS

7.1 Objective

Objective 9:
Respect, promote and protect Aboriginal use, past and current, of the land and waters of the Molonglo River Reserve.

Murra Bidgee Mullangari event

7.2 Aboriginal connection with Country

Aboriginal people have a connection with their traditional Country that links the past, present and future together and does not separate 'nature' from 'society' or 'people'. When Aboriginal people care for Country they also care for their culture and well-being, in the present and in the future (Government 2013c). Involving them in managing Country is not simply a matter of acknowledging their cultural history and respecting their 'traditional' knowledge from a historical perspective but acknowledging and respecting their knowledge and cultural practices of today (Muir et al. 2010).

Therefore identifying 'Aboriginal cultural heritage' in management plans and treating it predominantly for its historical value does not represent the breadth of Aboriginal interests in Country. This Management Plan therefore combines Aboriginal interests into its own chapter and an objective that addresses the breadth of their interest and involvement in the Reserve.

The traditional custodians of the land and waters of the Reserve are the Ngunnawal people. They have managed this landscape for tens of thousands of years and their relationship to the area is still strongly held today. The ACT Government acknowledges the role of landscape in the Ngunnawal people's continuing sense of responsibility for preserving the spirit and stories of their ancestors (ACT Government 2013e). It has also committed to a vision for reconciliation that includes "Aboriginal and Torres Strait Islander peoples living in the ACT and surrounding region [enjoying] a quality of life, life expectancy and health status equal to all Canberrans" (ACT Government 2011b). Other Aboriginal groups with interests in the Canberra region include the Ngarigo, Wolgalu, Gundungurra, Yuin and Wiradjuri people who traditionally, and currently, gathered together in the region.

Opportunities for employment and economic independence are important contributors to quality of life for Aboriginal people, as they are for everyone else. Jobs that in addition have strong cultural meaning are highly prized by Aboriginal people because they exemplify the traditional link between ecological and social health.

The socio-economic benefits of Aboriginal people working on Country have been well described (Weir et al. 2011) and are an objective, along with environmental objectives, of the Commonwealth's Working on Country program in which over 680 Aboriginal rangers are employed across Australia (Commonwealth of Australia 2013). A review of the economic outcomes alone of the program found that the program delivered more financial benefit than it cost, by a margin of up to 23%, due to reduced welfare costs and increased tax revenue (Allen Consulting Group 2011). Working on Country is also an opportunity for Aboriginal people of the Stolen Generations or whose ancestors were removed from their land to reconnect with their traditional lands. Some Ngunnawal people living in Canberra and the region today fall into this group.

ACT Parks and Conservation Service already employ Aboriginal staff in a variety of roles. They come together as *Murumbung Yurung Murra* to strengthen their identity, acknowledge the importance of their work on Country and forge relationships with local Traditional Custodians of the region. They also support Traditional Custodians in their determination of the identification, protection and interpretation of sites and customary lore across the ACT and understand the importance of cultural heritage enriching lives and for knowledge and experience to be passed on to youth and future generations

The NSW Government's operational policy (2011) on protecting Aboriginal Cultural Heritage describes how cultural heritage "includes people's memories, storylines, ceremonies, language and 'ways of doing things' that continue to enrich local knowledge about the cultural landscape. It involves teaching and educating younger generations. It is also about learning and looking after cultural traditions and places, and passing on knowledge. It is enduring but also changing."

A cultural practice that is relevant to this Reserve is small scale patch burning by Aboriginal people working with park managers to achieve ecological outcomes. This is being used in other parts of Australia and has recently been initiated at Jerrabomberra Wetlands Nature Reserve and in Namadgi National Park.

7.3 Aboriginal history and heritage sites

As well as being a location with good food and water, the Molonglo River was very significant to Aboriginal people because of its use as a corridor for people travelling across the region for trade and ceremonial purposes. Yuin people from the coast would come out of the mountains in the Captains Flat area and travel down the Queanbeyan and Molonglo Rivers to the Murrumbidgee and on to the Australian Alps, and then return. River corridors provided easy wayfinding and a convenient source of food and water while travelling (ACT Government 2010c). Local people had a responsibility for keeping the corridor in good condition for the use of travellers. That would include ensuring a good food supply, easy access points

to the river and a clear route to follow. Traditional use of rivers as pathways and a variety of ways in which routes were marked and maintained is quite well documented for south-eastern Australia (Spooner et al. 2010).

The margins of the Molonglo and Murrumbidgee Rivers were focal points for Aboriginal activity in the region and many signs of their use of the land in this Reserve have been recorded, mostly small artefact scatters and single artefact finds (English 1985, Bullbeck and Boot 1990, Saunders 1995, Paton 2009). However, artefact collection, a high degree of land disturbance in recent years, inaccurate geolocation information and successive flooding of the floodplains, means that relicts are no longer found in all those places.

A recent survey of the urban section identified a total of 64 Aboriginal heritage sites and 17 Potential Archaeological Deposits (PADs) that had been found previously or were newly recorded in this survey (Huys et al. 2013). The significance of these sites has been assessed and on this basis, management requirements for each developed in a Conservation Management Plan. The majority of sites and PADs had low significance and have already been salvage collected or actioned. These have no further management requirements. Thirteen sites and two potential archaeological deposits have management requirements that need incorporating into the Management Plan for the Reserve (Appendix 7). The sites include one special cultural place, two with scarred trees and the remainder are areas containing artefact scatters. The location of some sites may not be published for Aboriginal cultural reasons. The two PADs require conservation in situ.

Evidence from test pits dug at the PAD near Coppins Corner suggests this site was used regularly by Aboriginal people as a short-term camp at times during the mid to late Holocene, dating to the last 5000 years. The site was probably selected because it is one of the few along the Lower Molonglo River where slightly elevated and level rises with well drained soils occur adjacent to the River (Huys et al. 2013). This is consistent with the wider pattern of evidence established from other deposits in the Molonglo Valley. Sites that are close to the river or its tributaries and where access is easy, such as in bends or near the end of low, level spurs, were preferred for campsites in the Molonglo Valley (Paton 2009).

The rural section of the Reserve has not been resurveyed recently. Earlier surveys have documented numerous low density artefact scatters but no Aboriginal site of high conservation significance (Saunders 1995).

Cultural heritage is also expressed in landscapes and how they were, and are still, used by Aboriginal people. The combination of water, and a diversity of grasslands, woodlands and wetlands means that much of the land within the Reserve boundary was traversed or used for food gathering and hunting, and as a source of medicine and materials for tool making. The rich supply of fish in the Molonglo River was noted by early settlers and an account of Aboriginal people fishing in the river near the Duntroon Dairy is given in Shumack (1967). Evidence of patch burning is also contained in early descriptions of the region (Gammage 2011). A number of plants documented as being used by Ngunnawal people in the ACT (ACT Government 2014) are, or were likely to have been, found in the Reserve.

7.4 Management considerations

The main management considerations are: the promotion of Aboriginal interests in the Reserve, past and present; establishing how Aboriginal people can play a role in the management of the Reserve that is both culturally relevant to them and socially beneficial; and how Aboriginal heritage can best be protected. The four Representative Aboriginal Organisations (RAOs) declared under the *Heritage Act 2004* must be involved in the assessment and management of Aboriginal heritage places and objects.

The establishment of a new reserve at the same time as new residents establish themselves is an opportunity for place-making in which Aboriginal people and culture have a visible role. A recent ceremony (Murra Bidgee Mullangari) on the banks of the Murrumbidgee where Ngunnawal and Ngambri people from this region came together with Ngarrindjeri people from the Coorong is an example of activity that had high value for its participants and raised awareness more widely. Of greater permanence and wider visibility would be the use of more Aboriginal names in naming places within the Reserve. Further advice on appropriate languages will be sought from Traditional Custodians and a linguistic anthropologist. Consultation will then occur with the United Ngunnawal Elders Council (UNEC) and the ACT Aboriginal and Torres Strait Islander Elected Body.

The most important principle guiding Aboriginal involvement in the Reserve is that as descendants of the people who once lived there, they have a right to be involved. The Reserve also offers some particular opportunities for a greater involvement of Aboriginal people in its management. The poor condition of some of the habitat requires ecosystem rehabilitation activities that will span a number of years, and these will offer training and employment opportunities beyond those usually required in park management. Some of this work could be done by Aboriginal people.

Considerable work has already been done on identifying, assessing and developing conservation management plans for Aboriginal heritage sites in the urban section, which is of highest priority given the urban development nearby. The main issue is ensuring that plans are developed and implemented and, where conservation is to occur on site, to monitor that the protection measures put in place are being effective. With a high population nearby, vandalism is a threat and the conservation management plans should be adaptively revised if there are early indications that they are not providing sufficient protection.

Murra Bidgee Mullangari event

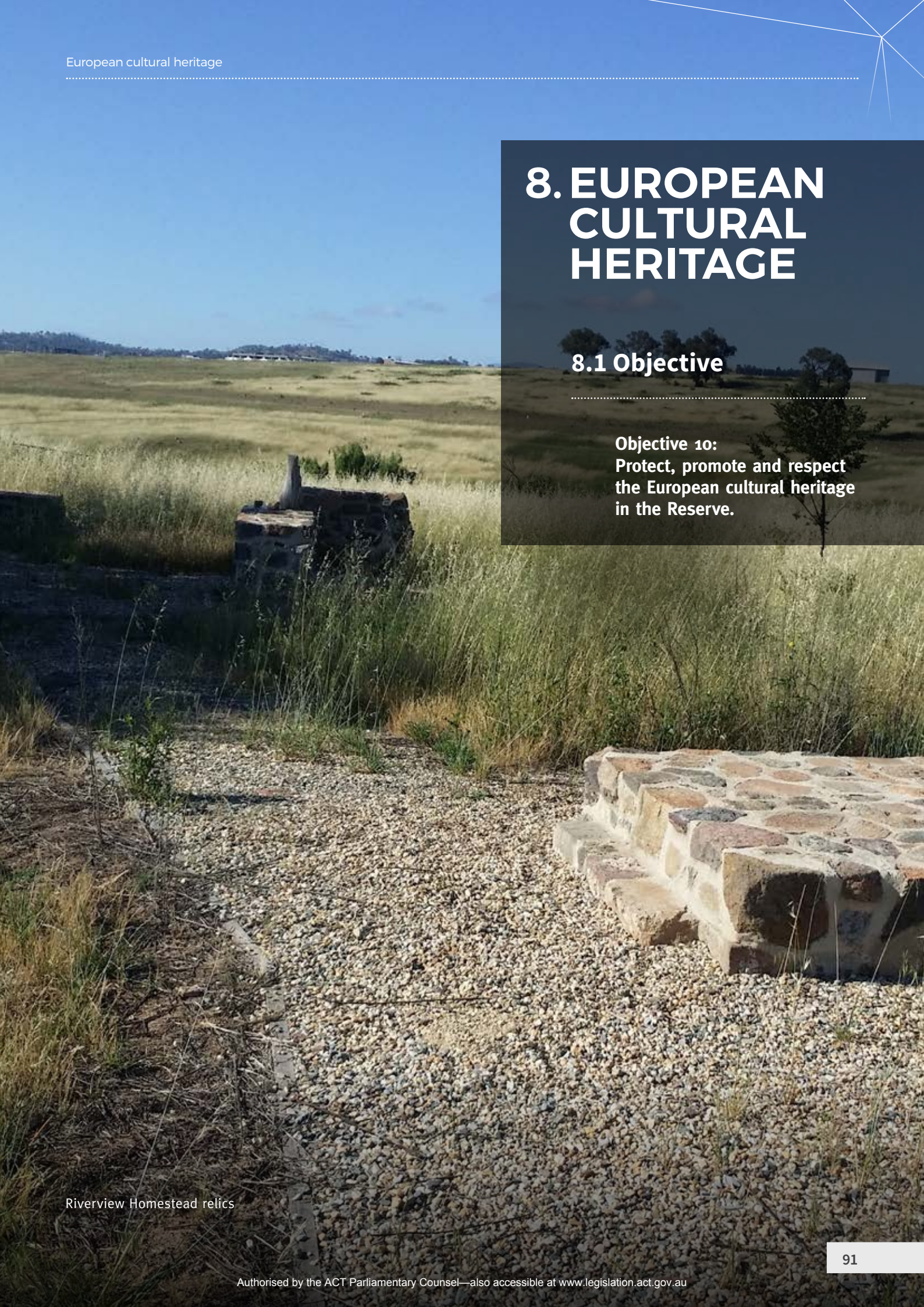
7.5 Policies and actions

ABORIGINAL CONNECTIONS	
Objective 9: Respect, promote and protect Aboriginal use, past and current, of the land and waters of the Molonglo River Reserve.	
Policies	**Actions**
9.1 Aboriginal connection with Country, past and present, will be visibly promoted.	9.1.1 With Aboriginal involvement, seek government approval to name the Reserve with an Aboriginal name. 9.1.2 Include Aboriginal perspectives in all major promotion and interpretation material.
9.2 Aboriginal people will be involved in the management and interpretation of the Reserve.	9.2.1 The right of the Ngunnawal community to be consulted and involved in issues that affect their interests will be respected and protocol for how consultation should occur will be developed. 9.2.2 Establish a site that interprets how Ngunnawal people used the river, its food and its plants. 9.2.3 Identify and document traditional Aboriginal cultural knowledge and, where appropriate, use it in reserve management through partnerships with Aboriginal people.
9.3 Aboriginal heritage sites and objects will be protected.	9.3.1 Aboriginal cultural heritage will be managed in accordance with statutory requirements, National Heritage principles, and guidelines for Aboriginal cultural heritage places. 9.3.2 Develop and implement Conservation Management Plans for the following sites and areas: MRC14, MRC15, MRC17, PAD1, PAD5 and the Special Cultural place. 9.3.3 Monitor the effectiveness of the conservation actions and adapt the management plans if required. 9.3.4 Return agreed salvaged artefacts to Country. 9.3.5 Develop and apply a protocol for action in the event of new sites being found. 9.3.6 Review and if required, resurvey the rural section of the Reserve for Aboriginal sites and apply the same mechanisms to their protection as in the urban section.

8. EUROPEAN CULTURAL HERITAGE

8.1 Objective

Objective 10:
Protect, promote and respect the European cultural heritage in the Reserve.



Riverview Homestead relics

8.2 European cultural history

8.2.1 From first settlement

The Molonglo River was first encountered by Europeans in 1820, near the present Lake Burley Griffin. The grassy plains and access to good water made it attractive for sheep grazing and it began to be settled from about 1823. Most early establishments were on the flatter grassy plains and the higher country, so there are few records of people living within the current Reserve boundaries in the early days of white settlement. By 1827, James Martin (also known as James Taylor) lived in a three-roomed hut located on the eastern side of Yarralumla Creek, near to its intersection with the Molonglo River. The hut was probably just outside the Reserve boundary but he used the land running to the river. This land, like much of the land in the area later became part of Yarralumla, owned by Frederick Campbell (Frei 2014).

Further downstream and on the south side of the Molonglo River, Captain Edmund Harrison Cliffe purchased 4200 acres ('Craven Estate') and was assigned convicts in 1836. He did not appear to ever live there and his estate was disposed of soon afterwards. Cliff(e)s Creek still carries his name today (Figure 4.2) (O'Brien 2011).

Around the middle of the river and on the north side, Goat Station was established as an outstation of Ginninderra before 1860. Ginninderra was owned by George Palmer. John Coppin and his family lived there in a three-roomed hut from 1860 to 1878, then purchased a small-holder's block nearby on the southern side where they lived until the late 1880s (Boxall 2013; O'Brien 2011). The location of their second home has not been confirmed. A possible location for it now has little remaining physical evidence of their occupation there and has been assessed as not significant for conservation (O'Brien 2011). The Coppins are commemorated in the name for the local river crossing, 'Coppins Crossing' (Figure 4.2). John Coppin's descendants still live in the region.

Not far away and also on the southern side, near today's Misery Point, Isaac and Emily Blundell (nee Shumack) purchased a 40 acre small-holder's block in 1878 (Frei 2014). Their first home was too close to the river and was flooded out, and they built another nearby on higher ground. The death and burial on their property of a baby son, in December 1902, may have led to the name Misery Point. The home, 'Riverview' (Figure 4.2) was occupied by the family until 1913 when it was acquisitioned by the Commonwealth Government. The site represents one of the best surviving examples of the small farm settlements of in the Molonglo Valley that were established after the 1861 Robertson Land Acts which prescribed that the large grazing properties had to make suitable land available for farming by small settlers. The remains at the site include chimney foundations, stone fireplaces, a stone bread oven, garden remnants and the track down to the Molonglo River which was their main source of water. A Conservation Management Plan has been prepared for the site (O'Sullivan and Huys 2011). Descendants of Isaac and Emily live in Canberra today.

A long disused limestone quarry in the geological heritage site (see Chapter 4) and to the south of Kama is also a site dating from settlement history. Little is known about its history but it has been assessed as having moderate significance and a high conservation value. It has been recommended that it be conserved in place (Huys et al. 2013).

In 1911 all the land in the ACT was acquired by the Commonwealth to form the new Federal Capital Territory.

8.2.1 Post Federation

Following acquisition of the land that formed the ACT, land in rural regions that was not immediately required, was leased to landholders. Riverview was leased by the Tully family during this time and they retain a strong interest in the protection of the site.

Sludge Ponds (Figure 4.2) is an area of disused sewerage sludge drying ponds that were associated with Canberra's sewerage treatment plant at Weston Creek, probably from the late 1960s when odour became an issue as the new suburbs of Weston were developed and the sludge drying ponds were moved. Weston Creek sewerage works and the Sludge Ponds became redundant when a new treatment plant (Lower Molonglo Water Quality Control Centre) was developed near the junction of the Molonglo and Murrumbidgee Rivers in 1978. The Sludge Ponds is planned to be renamed as Catherine Park and developed as a recreation site.

Changes in land use on the slopes of the Reserve and adjoining land in the 1900s also have cultural histories associated with them. Grazing has continued on some of the land, but a substantial area of pine plantations (Stromlo Forest) was established from the 1920s. Workers in the plantations, and, since 1967, many walkers, runners, cyclists and horse riders who used the plantation trails passed in and out of land that is now in the Reserve, and also used or crossed the river. Their memories of this use of the land are strong and especially poignant as with the recent fires and subsequent urban development, those opportunities are rapidly disappearing. Stromlo Forest Park, on the slopes of Mt Stromlo, is being developed to provide recreation opportunities similar to those that existed in Stromlo Forest. Expectations are also high about the Molonglo River Reserve continuing to provide the same recreation opportunities as in the last 40 years.

Conservation of Riverview Homestead

For a white settlement record of less than two hundred years, the Reserve has a rich history of dramatic changes in land and water use which have each added different impacts to land and water. From grazing to forestry to massive fires and urbanisation, and from damming the river to toxic mine spills, the stories of successes, failures and lessons learned add interest and value to the Reserve. They also help set the scene and explain to people the need for the rehabilitation efforts that will take time to implement and even longer to have their full effect.

The holotype specimen (the individual on which the species description was based) for the Pink-tailed Worm-lizard was collected in the Coppins Crossing area by R. Barwick and others on the 20th December 1971. There is an apparent error in the geolocation data so the precise site cannot be determined (R. Palmer, Australian Wildlife Collection, pers. com.). The preserved specimen is kept in the Western Australian Museum. This is a small but significant piece of scientific cultural heritage worth recording due to the importance of this Reserve as a key national (and global) conservation site for the species.

8.3 Management considerations

The main management issues are ensuring protection of European cultural heritage, both in its physical and in its social forms. With 55,000 new residents in the area, cultural heritage sites will be highly visited and subject to associated impacts. Like the Aboriginal heritage sites in the urban section of the Reserve, considerable work has already been done on identifying and assessing European heritage sites and developing conservation management plans for their protection. Due to the irreplaceability of these sites, rapid responses will be required if the protective measures adopted are insufficient protection.

Descendants of the early settlers known to have resided within the Reserve area live in Canberra and the region and have family legacies that are now approaching two hundred years in length. Some of them feel a strong sense of attachment to their family heritage and the places where they lived. And the many people with fond memories of recreation time spent around the river have already been mentioned. There is social value in keeping the memories of these places alive, even though they may not be formally recognised as having cultural heritage significance and may not be on heritage registers (ACT Government 2012a). Stories about the history of the Reserve also enrich it as a place to people who are new to it, as will be most of the residents in the neighbouring suburbs.

8.4 Policies and actions

EUROPEAN CULTURAL HERITAGE	
Objective 10: Protect, promote and respect the European cultural heritage in the Reserve.	
Policies	**Actions**
10.1 The major European heritage sites will be protected.	10.1.1 Conforming to statutory requirements and best practice principles, implement the Conservation Management Plan for Riverview. 10.1.2 Prepare and implement a conservation management plan for the limestone quarry that aligns with measures developed to conserve the heritage listed geological site (Objective 2). 10.1.3 Monitor the effectiveness of the conservation actions and adapt the management plans if required.
10.2 The history of past land uses and occupation will be reflected in named places and interpretive material.	10.2.1 Synthesise and make publically available an occupation and land use history of the Lower Molonglo Valley 1820-2014, including specific reference to historical sites within the Reserve boundaries. 10.2.2 Promote and reflect the history in the naming of local places and in interpretation material.
10.3 Descendants of families with a strong historical association with the places in the Reserve, and local historians, will be respected and involved.	10.3.1 Involve descendants, former users of the area and local historians in the planning, maintenance and interpretation of European cultural heritage in the Reserve.

Pedestrian boardwalk through grassland

9. RECREATION

9.1 Objectives

Objective 11:
Provide a range of recreation opportunities that are valued by users and that can co-exist with other values and objectives for the Reserve.

Objective 12:
Residents in Molonglo Valley view, treat and protect the Reserve as their 'treasured front yard' and set a new high standard in the ACT for their behaviour in a nature reserve

Objective 13:
The Reserve adds value to the ACT as a distinct recreation destination, a long-distance recreation link, and an attractive contribution to the Canberra Open Space System.

Objective 14:
Visitor safety is addressed in the design of information, facilities and operations.

Molonglo River riparian corridor

9.2 Recreation demand

Providing for recreation in the Reserve is an objective of its use as public land. It forms a complementary recreation opportunity to those offered within the suburbs, and an opportunity to educate and build support for the Reserve. With many local recreational users initially being new to the area, there will be a window of opportunity for influencing their expectations about recreational and associated behaviours in the Reserve before they become entrenched with usage.

9.2.1 Outdoor recreation in the ACT

The ACT has the highest (and increasing) participation in outdoor recreation in Australia, and the highest participation in walking and cycling of any state or territory, according to a survey by the Australian Sports Commission (2010). Participation rates of adults in the ACT in unorganised activities of the type that could occur in the Reserve were 48% for walking (8% specified bushwalking), 18% for cycling and 12% for running. This is broadly consistent with a survey of nature park use conducted as part of the Canberra Nature Park (CNP) Review (Cooper 2011). Walking was found to be the most common use, followed by running and then cycling. Other reported uses were bird watching, horse riding and orienteering. Besides providing personal satisfaction, the individual and social benefits of exercise for health are well recognised (e.g. Maller et al. 2005).

9.2.2 Recent recreational history in the area

In the **rural section**, recreation opportunities in the recent past have been managed through the Lower Molonglo River Corridor Management Plan (ACT Government 2001). Recreation was deliberately kept low key in order to provide a contrast to parks in suburban Canberra. Access was only available on foot or bike, and horse riding allowed only on the sewer management road on the north side. Apart from the management roads there was little additional track building and very little interpretation provided. Walking access from Kama to the management road was added recently. Swimming in the river was not permitted, however fishing (within legal limits) and non-powered boating were permitted.

In the **urban section**, recreation access in the past was provided largely through forest management policies which, since 1967, had permitted use of forest management tracks for recreation. The pine plantations on both sides of the river and across to Mt Stromlo were widely used and enjoyed by walkers, runners, cyclists and horse riders who came from suburbs across Canberra for the extended recreation opportunities (see Chapter 8). Stromlo Forest Park has been designed to partly substitute for these recreation opportunities that were lost, first in the fires, and then in the urban development of the Valley. The Molonglo River corridor was part of the area formerly used for recreation and this has shaped the expectations of those users about its recreation use in the future.

9.2.3 Recreation planning in the Molonglo Valley

When development is completed there will be up to 55,000 new residents in the Valley, many of whom are likely to want to use the Reserve, based on the cited ACT participation rates in recreation. Residents from elsewhere in Canberra, and especially Weston will be additional but less frequent users. To help satisfy urban sustainability objectives for Canberra, the housing density in the Molonglo Valley will be higher than in other districts, delivered through a mix which includes multi-unit dwellings, medium density and standard residential housing. Situated in a valley between two ridges that, like the river corridor, form part of Canberra's Open Space System, planning has taken into account that there are other recreation opportunities nearby at Stromlo Forest Park, the Arboretum, Lake Burley Griffin as well as at planned facilities in the suburbs and in the Molonglo commercial centre (ACT Land and Planning Authority 2011b). Planning has also included the concept of a continuous sealed shared cycle and walking path ("trunk path") around the urban edge and largely following the Reserve boundary.

The Molonglo River Park Concept Plan (Hassell 2012a) has already scoped the options and provided recommendations for recreational development in the urban section of the Reserve. More detailed planning is complete for the Reserve area adjacent to Coombs (Hassell 2013b).

Swift parrot
Lathamus discolor

Kangaroo Grass
Themeda triandra

9.2.4 A diversity of recreation expectations

Expectations about what the main types of recreation users will want include the following.

- **Walking** opportunities suited to a range of ages and physical abilities, from easy social strolls to enjoy a view, to daily active exercise walks or long walks with more challenge. Walkers might include families with young children in strollers and children on bikes, disabled people with limited mobility, and people with dogs. Dog walking is a popular recreational activity in Canberra and there is likely to be a strong community expectation that it be permitted, as it is in most Canberra Nature Parks. Despite the requirement that, where permitted, dogs be on leash at all times in Canberra Nature Park (indeed all public places in the ACT except where expressly allowed) the level of compliance is not always satisfactory.
- **Walkers with mobility constraints,** whose numbers will increase as the population ages. These walkers require access that does not restrict entry of prams, wheelchairs and scooters, trails with smooth surfaces, minimal slope and no obstacles or steps, and an attractive destination, typically within 1,000 metres of origin.
- Organised **group walking**, which is also popular in Canberra. For example, the Heart Foundation supports some 50 walking groups in the ACT (Heart Foundation 2013), and Walking for Pleasure organises walks so that people can "Exercise in a social atmosphere and enjoy Canberra's network of open spaces, parks, lakes and forests" (ACT Walking for Pleasure 2013f). The National Parks Association also organises walks in the ACT and wider region (NPA 2014). (*Meetup* is a website that is using a new media approach for the self-organisation of group walks in Canberra (Meetup 2013). Participants in Meetup refer to their motivation as being a mix of exercise, the outdoors, enjoying nature and socialising. The linkage between regular exercise and health is well established, as is the importance of social connection for health and well-being. The contribution of the Reserve to better health outcomes for Canberrans is an important value of the Reserve.
- **Picknickers** looking for attractive places that have facilities like barbeques, water, tables, shelters, toilets and play space or equipment for children, adjacent to or near a carpark. Opportunities for this will also be available adjacent to, but outside the Reserve boundary in parks around the stormwater ponds.
- **Seekers of natural experiences,** like naturalists interested in native birds, plants and animals; and people who derive spiritual satisfaction from contact with natural places, especially rivers and water.
- **Cycling opportunities**, from casual bike rides to long, challenging rides. Commuter cyclists, who like fast paved surfaces and moderate grades, will be provided for by trunk paths outside Reserve boundaries. These will connect with the trunk cycle route from Weston which passes inside the Reserve in the upstream area. Mountain bike riders, have the use of Stromlo Forest Park nearby. That Park has 50 km of professionally designed cross country trails of varying grades, as well as other types of cycling opportunities. Recreational cyclists generally prefer not to ride on roads with traffic, on gravel, or to be using the same trail as lots of walkers.
- **Horse riding**, which has a long history in the area (see Chapter 7). Several agistment centres and riding schools are located in the Molonglo Valley and there is an expectation that horse riders will continue to be able to use the trails in the Reserve and their connections with the Arboretum, Stromlo Forest Park and the Bicentennial National Trail. Equestrians generally prefer routes that can be linked in loops, rather than out-and-back, and wide trails with a sound surface. They prefer not to mix with cyclists but sharing with walkers is not an issue. Horses are permitted on certain trails in particular reserves. The Conservator of Flora and Fauna identifies restrictions and prohibitions on equestrian activities in reserves through an Activities Declarations for each reserve. On this basis, a number of trails in nature reserves in Canberra have been assessed as appropriate and equestrians have been given permission to use them.
- **Linkages to longer trails** for walking, cycling and horse riding are also desired by recreation users. The Centenary Trail, a new 145 kilometre self-guided trail for walkers and cyclists that loops around Canberra already passes through the Reserve area; as does the Bicentennial National Trail (BNT) a 5,330 km route from Cooktown in far north Queensland to Healesville in Victoria that caters for equestrians, walkers and cyclists. In the ACT the route enters at Hall and passes around West Belconnen and through the International Arboretum to a campsite at the Equestrian Park. From there it crosses the Molonglo River and continues through to Cooleman Ridge and on to Tharwa (Bicentennial National Trail 2013).

9.3 Prohibited recreational activities

Clarity around which recreational activities are allowed and which are not allowed in the Reserve is the first step in good recreation management in parks. Based on the legislation that applies to this Reserve, experience in managing recreation in Canberra Nature Park, and on the physical and ecological nature of this Reserve, recreation activities that will not be permitted are those listed in Table 9.1. Two of these require supporting comment:

- **Car rallies** are permitted in the current Lower Molonglo Management Plan, but only on the management track on the north side of the river, with permission and conditions attached. The disturbance (ground surface, wildlife and other users) attached to such events is now considered not compatible with the values and proposed outcomes for the Reserve.
- **Swimming** is not permitted in the Lower Molonglo River under the Territory Plan. However, given the river's proximity to new homes, there is a risk that children and adults will swim in the river regardless of prohibitions. Appropriate signage and education campaigns outlining the risks of swimming in the river will be important and new residents will be encouraged to use nearby alternative swimming spots located on the Murrumbidgee River, such as the Cotter Reserve and Kambah Pools.

Table 9.1 Prohibited recreational activities

Recreational activity	Permission status
Camping	Not permitted. Fire risk, lack of suitable camping areas and general lack of potable water make camping inappropriate.
Car rallies	Not permitted.
Dog walking	Not permitted in Kama. Allowed elsewhere (see below).
Fires Lighting of fires, apart from those lit for fire management purposes by authorised people.	Not permitted.
Flying (powered, low altitude machines e.g. ultralights and drones)	Not permitted, except where authorised for Reserve management or fire fighting purposes.
Hunting	Not permitted under provisions of the *Nature Conservation Act 2014*, the *Animal Welfare Act 1992* and the *Firearms Act 1996*.
Off-road vehicle use (trail bikes, 4WD vehicles, other powered vehicles).	Not permitted. The geology of the Reserve is not suitable for recreational off-road vehicle use. Potential damage to land surface, sensitive ecological communities and threatened species
Orienteering and Rogaining	Not permitted.
Swimming	Not permitted under the Territory Plan (Part C2). Potential health risk caused by blue-green algae blooms due to low flows, poor water quality and contamination from Lake Burley-Griffin; and a safety risk due to sudden water releases from the Lake. Sudden water increases can also occur due to the lack of flood detention in Yarralumla and Weston Creeks.

9.4 Permitted recreational activities and their management

A range of other recreational activities are broadly compatible with the objectives of the Reserve, subject to them being designed and managed appropriately. A summary of these is listed in Table 9.2 and further rationale for some of the activities follows subsequently.

Table 9.2 Permitted recreation activities and their conditions.

Recreational activity	Permission status and conditions
Bird watching, wildlife and wildflower viewing, nature photography and visiting natural and cultural heritage sites.	Permitted and encouraged. The location of some Aboriginal sites will not be publicised.
Boating – non-powered (e.g. rafting, canoeing). Rafting and canoeing are possible but better access and conditions exist on the Murrumbidgee River.	Permitted.
Cycling (including mountain bike riding)	Permitted on cycling, multi-use paths and management trails only.
Dogs Under the *Nature Conservation Act 2014*, dogs are not allowed in nature reserves unless an Activities Declaration applying to the Reserve allows for dog walking as is the case in some Canberra Nature Park reserves. Dog walking is currently not permitted in Kama.	Permitted, except in Kama and on selected tracks that pass through especially sensitive habitat. These are clearly signposted. Where dogs are permitted it is conditional on the following: • On leash AND on designated walking paths or other hard surfaced areas only. • Dogs must not harass wildlife and must be under the full control of their handler. • Equipment to remove dog droppings must be carried and dog droppings removed from the Reserve. • Dogs must not be led by cyclists or horse riders. • Dogs must swim only in designated areas. • Dogs are not allowed within 10 metres of a designated play space (if children are playing on it) or a fireplace designated for cooking. • On-the-spot fines apply for taking dogs into prohibited areas or not having the necessary equipment to remove droppings or not removing droppings.
Dog sledding	Permitted only in the Special Purpose Reserve at Bold Hill/Ryans Hill.
Fishing Under the *Fisheries Act 2000*, the Lower Molonglo River is classified as 'Open Water' where fishing is allowed with bag, gear, size and seasonal limitations.	Currently permitted but will be reviewed in the light of intensity of activity, aquatic rehabilitation goals for the Reserve and disregard of regulations.
Geocaching events	Permitted, conditional on not involving digging holes and burying objects, depositing objects in rock shelters or other cultural heritage sites, or littering. Requires application for permission.
Horse riding	Permitted on management tracks as indicated in Figure 9.1, subject to an Activities Declaration under the *Nature Conservation Act 2014*.
Non-commercial group activities (e.g. bush walking clubs, social clubs, tour groups)	Permitted.
Picnicking Picnicking involving car parking, barbecues large groups etc. will be available in the two Special Purpose Reserves.	Permitted. Limited infrastructure e.g. seats, tables, shelters, paths will be provided for picnicking in the Nature Reserve.
Rock climbing and abseiling	Permitted only outside the period 01 June to 31 December when raptors are breeding.
Special events Special events are large public gatherings like weddings, ceremonies, concerts or sporting events.	Permitted in Special Purpose Reserves only due to noise and physical disturbance associated with such events which disturbs wildlife, damages soil and vegetation, requires litter management and detracts from amenity for other Reserve users. Requires standard application for permission and conditions.
Walking	Permitted. Walkers will be encouraged to stay on designated walking tracks and management trails. Walking in PTWL habitat is not permitted.

The location, design and management of recreation needs to consider what will be satisfying to a range of users but will not jeopardise conservation objectives. Nearly 40% of the area of the Reserve contains threatened habitat (Section 6.3) scattered in patches across the Reserve. Particular care must be taken to ensure that recreation does not diminish their condition or extent.

The following guidelines will apply to designing and managing permitted recreation activities in the Reserve. An indicative map of tracks and trails in the Reserve is at Figure 9.1.

9.4.1 Protection of Pink-tailed worm-lizard habitat

Removal or turning over of rocks, and trampling of vegetation are major threats in PTWL habitat. Where these occur in areas of highest intensity use, for example, facing the commercial centre, they will be lightly fenced to indicate their presence and interpretation provided. Pedestrian trails in the vicinity of medium and high quality PTWL habitat will be located in the 20 metre buffer zones around the habitat, subject to consideration by a qualified ecologist. If there are no other alternatives for routes, raised walkways that minimise impact on habitat will be used. Trails through BGW and NTG, which are on relatively flat land, have less impact and are generally acceptable, subject to appropriate design considerations and agreement by a qualified ecologist.

9.4.2 Trail density, route design and recreation infrastructure

The long, narrow, sloping nature of the Reserve (Figure 5.1) means that there are few bridges over the river, so each side of the corridor functions independently for local scale recreation. Longer routes that can loop the river will be created over time as new river crossings are added but there may be a demand for shorter looped walks within each side of the corridor. In the urban section, the corridor on each side of the river is usually only between 200 and 400 m wide, sloping, and with limited opportunities for finding good routes. In addition, trail building along slopes requires considerable cut and fill. A flat trail 1 m wide running along a steeper slope in the Reserve would require disturbing the land for a width of up to 5 m. Impacts of cutting and filling include degrading the soil surface condition (Chapter 4), encouraging weeds, and ecological fragmentation (Chapter 5). Continuous braided trails that separate different users are generally not feasible in these circumstances, nor desirable when close to each other for their impact on fragmenting both ecological processes and the naturalistic setting (Chapter 4). Therefore route design will take into account slope and the impact of ground disturbance, and, for similar reasons, recreation infrastructure beyond trail building in the Nature Reserve will be minimal.

The development of unauthorised tracks by users, either as desire lines or created deliberately, will be managed through signage that indicates users should remain on tracks and by early management intervention in disguising or providing barriers on the tracks.

9.4.3 Separation of activities between Nature Reserve and Special Purpose Reserve areas

Recreation in the Nature Reserve areas will be guided to low intensity uses and higher intensity uses provided for in the Special Purpose Reserves. Low intensity activity refers to the vigour or skill level of users and also formed the basis for designing the ACT Centenary Trail (CBRE 2014): "Low intensity walkers, runners and bike riders have a desire to undertake activities which provide a pleasant experience, an opportunity to increase their level of fitness and allow them to interact with friends and family, other trail users and their surroundings in a positive way. Low intensity walkers and runners target trails with smooth, unobstructed surfaces and easy to moderate slopes which are readily distinguished from their surroundings and are complemented by appropriate signage and facilities. Similarly, low intensity bike riders will typically have basic riding abilities but may not have the skills, bike or equipment to negotiate steeper, more difficult trails or technical trail features. These riders prefer trails which are designed to help maintain a consistent, controlled speed and minimise difficult ascents and descents". Higher intensity walkers, runners and bike riders will be guided to the Special Purpose Reserve, Ryans Hill Park, and other locations nearby, like Stromlo Forest Park and the Arboretum.

9.4.4 Separation of user groups and mix of trail types

Separation of users, or giving them track options, will be possible in some areas of the Reserve through a combination of utilising the existing management tracks, the trunk path running along the urban edge and new purpose designed trails. The general principle in both the rural and urban sections will be to use these options to eventually provide a backbone trail on each side of the river with spurs, which may be in the form of small loops, to interesting views from some selected high vantage points and down to the river where access is feasible. Several new river crossings will be provided between the two backbone trails to create opportunities for longer looped walking. Walkers will be able to use all trails and crossings, and other users will be channelled to trails and river crossings most appropriate for their use.

The network of indicative tracks and trails inside and adjacent to the Reserve are in Figure 9.1. The characteristics of each type of route that will differentiate in part between users are:

- The trunk path, which is a sealed 3 m wide path just outside the Reserve boundary, is designed to **shared path** standard, sufficiently wide to accommodate **cyclists** and **walkers**, including those with limited mobility and slower cyclists. It links with the commuter bike path that connects Weston to Central Canberra and will have river crossings at the new Link Bridge and at Coppins Crossing.
- The existing management tracks, which are unsealed roads, can generally be used by walkers and equestrians. In accordance with Chapter 10 of the *Nature Conservation Act 2014* an Activities Declaration provided for equestrians to use this track where indicated in Figure 9.1, as well as the existing Bicentennial Trail. Existing arrangements for them to use the management tracks in the rural section of the Reserve will remain. Equestrians will be able to cross the river at the existing crossing just below Scrivener Dam, at Eagle Bend[2], Southwells Crossing and at a future crossing north of Coppins Crossing. The equestrian trail will link with Equestrian Park, the Bicentennial Trail and Stromlo Forest Park.
- Where the land form is suitable, new trails will be developed within the Reserve that are designed for walkers to access viewing points and the river. These will be designed in detail in step with the location and timing of residential development, and are not shown in Figure 9.1.

9.4.5 Conflict between different user groups

As the intensity of recreation use in the urban section of the Reserve increases, the potential for conflict between users will grow, and their satisfaction with the amenity decline. The major cause of conflict is different speeds of travel (fast cyclists, slow cyclists, runners and walkers) and lack of a clear protocol for overtaking (CBRE 2014). Other issues include horses taking fright at cyclists, dogs taking fright at horses and vice versa, and walkers having to avoid horse and dog droppings. This conflict is more likely to be an issue in the urban section where the intensity of use will be higher. Stromlo Forest Park provides a recent example of how maps and explicit guidelines can make sharing protocols clearer. Like off-leash dog walking, using social networks to help set and monitor standards is helpful. Not all recreation users belong to groups, but where they do e.g. Pedal Power, ACT Equestrian Association, the groups actively encourage responsible behaviour by their members. The potential for conflict will be reduced by clear trail descriptions and give way signage.

9.4.6 Access for recreation

The very long frontage of the urban boundary with the Reserve, and the close conjunction with residences, means that people are likely to want to access the Reserve almost everywhere along this length. The impact of this on threatened habitat and ecological condition, as well as the diminished aesthetics of multiple desire trails forming makes unlimited access unacceptable. Access will therefore be managed by fencing the Reserve boundary in the urban section and channelling access to designated points that connect to formed trails. Many of these access points will be in small urban parks near the Reserve, including those around the stormwater ponds.

In the rural section, access is available via the management tracks on either side from the Coppins Crossing area and via walking tracks through Kama and from the northern end near the LMWQCC. The need for any further access will be reviewed as usage increases.

9.4.7 Public road entry and car parks

Due to the narrow sloping nature of the Nature Reserve, its conservation assets and the ample parking and access points available in the urban area, public roads, car parks and visitor facilities will be provided only in the Special Purpose Reserves.

9.4.8 Rubbish bins

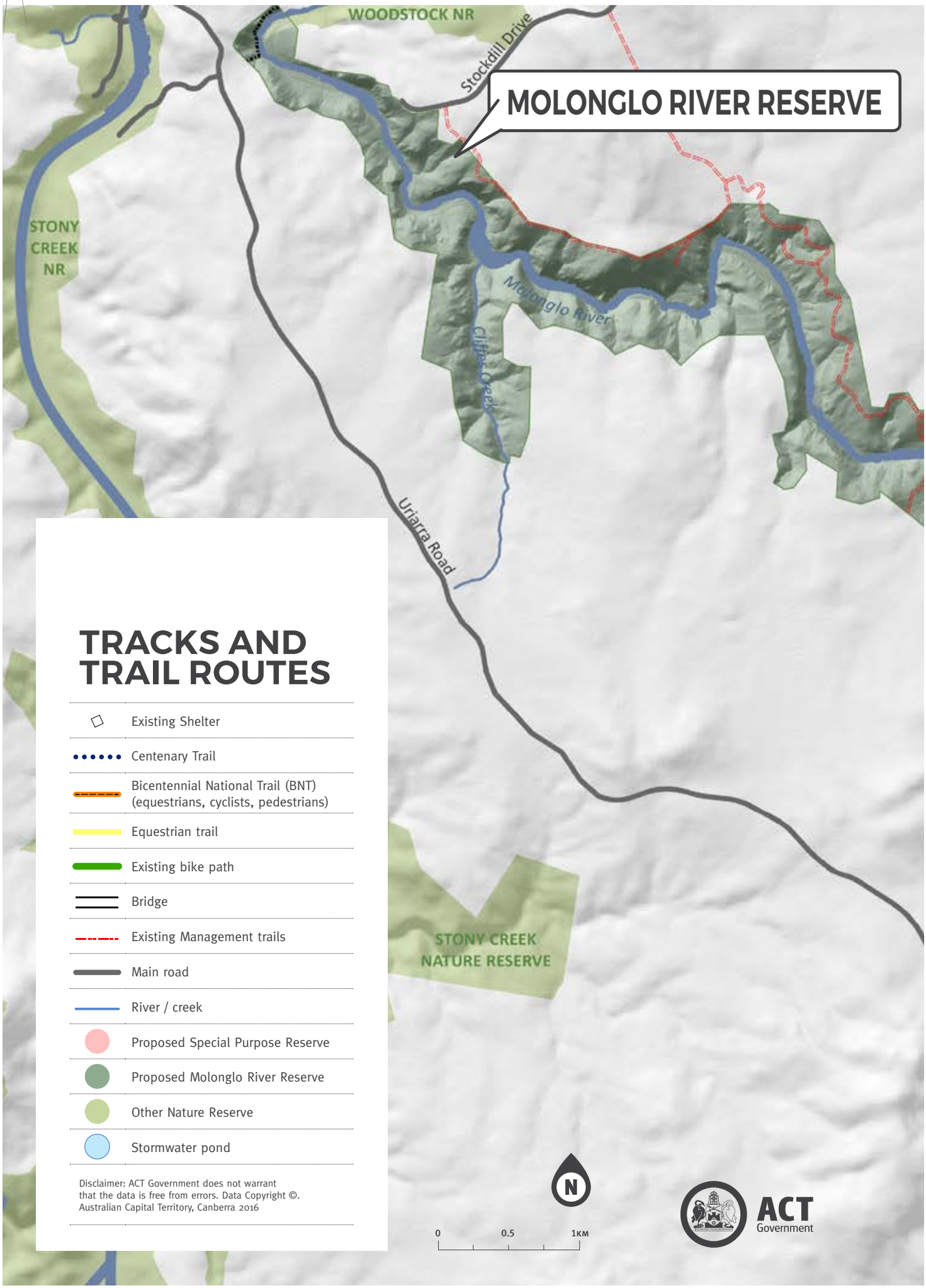
It is increasingly common across Australia for there to be no rubbish bins provided in parks and reserves due to the problems they cause when they overflow, including attracting wildlife. Remnants of what people bring into the Reserve can be just as easily taken out with them and no bins will be provided.

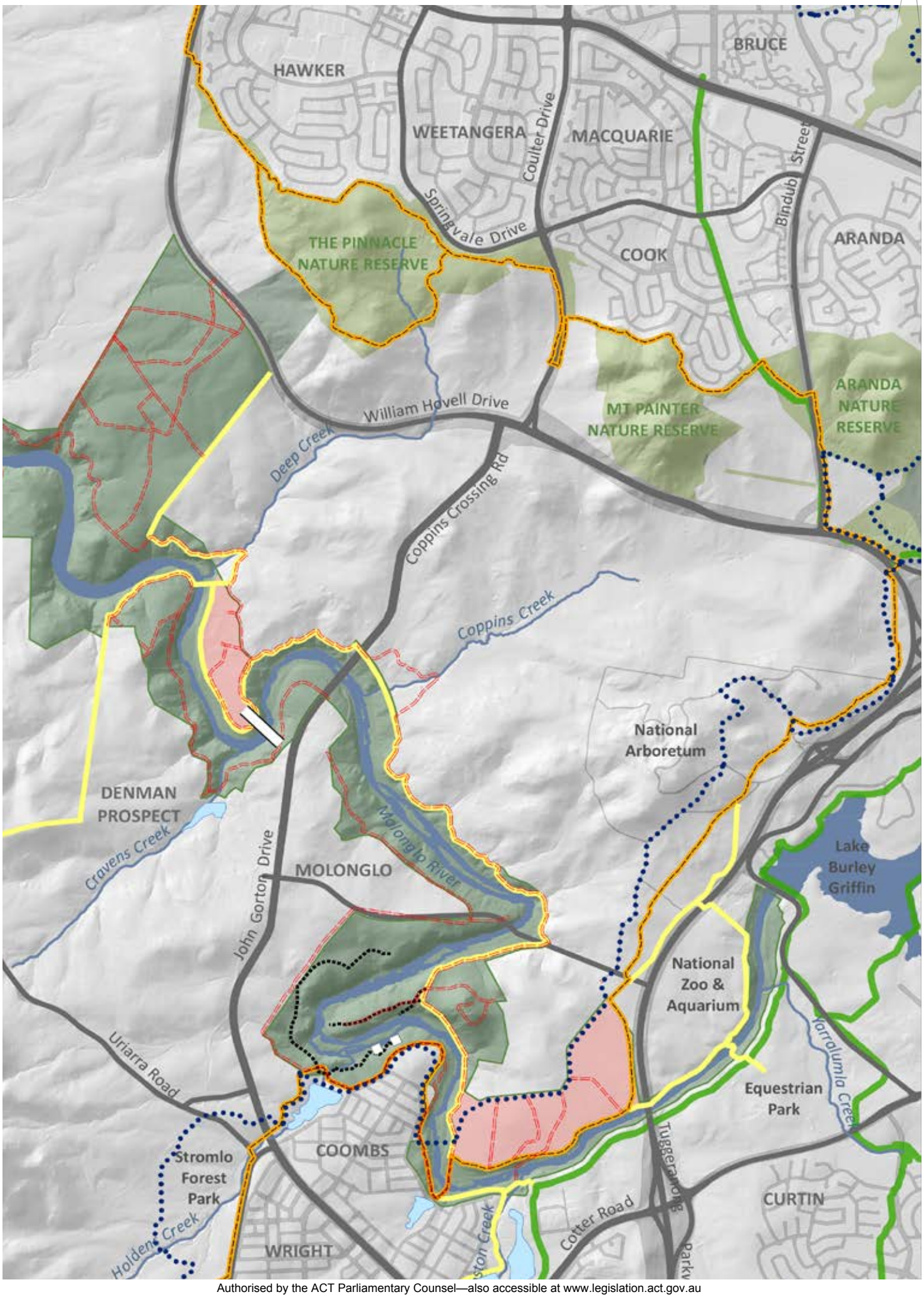
9.4.9 Toilets

The provision of toilet facilities will only be considered for Special Purpose Reserve areas to be managed by TCCS.

2 Proposed new name. See Figure 4.2.

Figure 9.1 Indicative tracks and trails for different recreation users in the Reserve




HAWKER
BRUCE
WEETANGERA
MACQUARIE
Coulter Drive
Springvale Drive
Bindubi Street
ARANDA
THE PINNACLE NATURE RESERVE
COOK
ARANDA NATURE RESERVE
MT PAINTER NATURE RESERVE
William Hovell Drive
Deep Creek
Coppins Crossing Rd
Coppins Creek
National Arboretum
DENMAN PROSPECT
Cravens Creek
John Gorton Drive
MOLONGLO
Molonglo River
Lake Burley Griffin
National Zoo & Aquarium
Uriarra Road
Yarralumla Creek
Equestrian Park
Stromlo Forest Park
COOMBS
Tuggeranong Parkway
CURTIN
Holder Creek
Cotter Road
WRIGHT

9.4.10 Fishing

Fishing will continue to be permitted, as it is currently under ACT legislation, unless its impact becomes unmanageable. Issues in continuing to permit fishing include trampling of vegetation in the riparian zone and the risk of fishing regulations (species and numbers of fish caught) being broken in a place where an objective for the river is to improve its ecological condition and achieve the return of native fish that once lived there. The activities and impacts of people fishing will be monitored and if necessary, prohibition of fishing in this part of the river will be sought under the *Fisheries Act 2000*.

9.4.11 Dogs

Walking dogs on leash is permitted in some of the nature reserves in Canberra Nature Park and is likely to be expected by people in the urban section of the Reserve. Compliance with on-leash requirements is an issue. An off-leash area is planned to be provided outside the Reserve, but dog-owners will remain attracted to walking in or near the Reserve, especially if it is closer to their homes than the dog park. The trunk path running along the urban edge and bordering the Reserve will cater for some of this demand but not for those who prefer to be inside the Reserve. Provisions in the *Domestic Animal Act 2000* allow for dog owners to be fined for not keeping their dogs on leash in any public area (unless designated as off leash), or not carrying or using equipment to pick up their dog's droppings. A persistent disregard of dog control regulations is a growing issue for park management in the ACT and good compliance will require adept social marketing, backed up with a real possibility of being fined.

Dogs are not currently permitted in Kama and this is to be retained due to its conservation value and size, which makes monitoring on and off-leash behaviour more difficult.

Recent studies in Yellagonga Regional Park in Perth found that the behaviour of dog walkers is primarily regulated by their desire for physical exercise and positive social interactions (Ham et al. 2008). For this reason, behaviour relating to off-leash dog walking is more influenced by beliefs about what other dog walkers and people in the park think and the likelihood of their dog being a nuisance to these groups. Typical signage in protected areas that focuses on the ecological consequences and safety issues of walking dogs off the lead is less likely to leverage behavioural change than a message directed at people's social norms. Community leaders and social networks can play a role in setting social norms. The level of compliance will be monitored and permission for dog walking in the Reserve will be reviewed at the mid-point and at the end of the life of the Plan.

Issue Box 9.1 The impact of dogs in nature reserves

Dogs off leash do have a greater ecological impact than walkers due to their wider sphere of influence (Taylor et al. 2005). Impact can include the obvious: chasing and possibly injuring or killing wildlife, and disturbing soil, vegetation and nesting sites; and the less obvious like transmitting diseases and parasites, reducing the feeding times of disturbed wildlife and also causing them to avoid areas where they've left scent (Ham et al. 2008). Most of the obvious impacts can be mitigated by keeping dogs on a leash, on a trail and picking up their droppings.

However, people without dogs have some of the same impacts (e.g. reduced feeding times due to disturbance), and as long as the noted constraints on dogs are observed, and trails do not pass through ecologically sensitive habitat, dogs are not considered to add substantially to the impact of people or threaten the ecological objectives of this Reserve. Studies elsewhere have demonstrated that it is the intensity of human visitation which is a stronger factor than the presence of dogs in determining impact in a protected area (e.g. Reed and Merenlender 2011). Evidence for the physical and psychological benefits of people having contact with companion animals (Maller et al. 2005) and with other dog walkers has been included in the dog policy for this Reserve.

Dog swimming is generally allowed in Canberra's lakes away from sites where people swim and is currently permitted at three locations on the Murrumbidgee River, including Uriarra Crossing in the vicinity of the Reserve. There may be an expectation that dog swimming in the Lower Molonglo River will be permitted; if so, locations should be specified to minimise ecological disturbance.

9.4.12 New recreation proposals

New or unanticipated recreational activities will need to be evaluated against the same criteria that have guided the separation of focus between low intensity recreation in the Nature Reserve and high intensity recreation in the Special Purpose Reserve. Those criteria would include a) degree of fit with the vision for the Reserve b) impact on conservation values, both of threatened habitat and of ecological function, especially soil disturbance and fragmentation, or impact on cultural heritage c) loss of amenity to other recreation users in the Reserve, d) relative benefit to the local community and e) options for doing the same activity elsewhere.

9.4.13 Commercial activities

There are no commercial activities currently in the Reserve but their limited possibility in nature reserves is allowed for in legislation and can be useful in augmenting the visitor experience. Commercial activities may involve purpose built infrastructure (e.g. cafes, restaurants, shops) or may be based on activities (e.g. tourism groups, guided walks) that largely depend on the infrastructure already present for regular visitor purposes. The benefits of commercial activity in conservation parks hinge around enhancing the visitor experience (e.g. enjoying a purchased coffee or meal in a natural setting, or a tour with a paid guide), bringing people into the Reserve who might not otherwise visit; and deriving an income from the fees that can be used to enhance other values of the Reserve. Drawbacks include the intrusion of infrastructure and its environmental impacts, and collateral management and maintenance costs (e.g. roads, parking, and rubbish) that cumulatively add up to more than the income received.

Due to the number of expected eating opportunities nearby in the urban area, the fragmentation of the narrow Reserve that would occur with the insertion of infrastructure and the dependence of the urban population on the Reserve as open space, no commercial infrastructure development will be permitted in the Nature Reserve portion of the Reserve. Commercial infrastructure development in the Special Purpose Reserves will be permitted subject to general ACT policies that apply to commercial operators in public places and demonstration of negligible impact on the Reserve as a whole. Commercial activities like paid guided tours or pop-up food and coffee vans that use existing facilities and conform with the activities listed in Table 9.2 will be permitted subject to the same general ACT policies and where negligible impact on the Reserve and other users can be demonstrated.

9.4.14 Anti-social behaviour

Anti-social behaviour such as vandalism along urban/nature interfaces, dumping rubbish and a persistent disregard of dog control and cat containment regulations is a growing issue for park management in the ACT. Important questions for management are how such potential impacts can be avoided or minimised and what level of impact is acceptable to managers, visitors and the wider community (Frawley 2009). Local community social sanctions and the close proximity of residents in housing that overlooks the Reserve are resources to be drawn upon to address this sort of behaviour. These are addressed in Chapters 10 and 11.

9.5 Safety

Visitor safety is an important feature of reserve management. Although there are a range of potential hazards within the Reserve, the risk of serious harm can be avoided if visitors take reasonable care and Reserve management has adequately evaluated and mitigated serious hazards. Part of the attraction of outdoor activities is self-reliance and the notion of escaping the everyday constraints of the urban setting. Additionally, risks are often mitigated by the skills, knowledge and experience of the visitor.

Reserve management has a particular responsibility to educate and warn people who may not have the skills, knowledge or experience to recognise the risks in this Reserve. Coupled with the likelihood of increased tourist numbers in the Reserve, particular considerations should be made for people with limited experience of the Australian bush. Safety provisions must also be made for family groups and school children.

Safety issues in the Reserve will include the following:

- The risk to people of being caught in a bushfire or a controlled burn.
- Sudden water releases from Scrivener Dam currently occur without warning and have been known to prevent recreation users who have crossed the river at low level crossings from returning. Sudden water increases can also occur due to the lack of flood detention in Yarralumla and Weston Creeks. Sirens at Scrivener Dam and Coppins Crossing are used to sound in advance of a sudden release from the flood gates. This risk will increase in importance in the upper few kilometres of the river when there are more children living nearby this section of the Reserve. The risks associated with the river in flood are similar to those in urban Canberra in stormwater ponds and drains, where people have drowned in the past. The outlets from the stormwater ponds are close to habitation and will also deliver significant flows after heavy or sustained rainfall.
- River hazards such as rapids, deep pools and sharp, protruding rocks and branches will be of concern with children paddling in the river, people trying to cross to the other side or people ignoring the prohibition of swimming.
- Minor falls due to steep or uneven ground in some parts of the Reserve and more significant falls from playing or climbing on the many steep rock faces.
- Collisions between different recreational users of the Reserve.

- Snake bite. Poisonous snakes are found in the Reserve, and some may enter properties along the urban edge. Although snakes won't go out of their way to attack people they may bite if surprised or provoked.
- Poisonous substances used by management for pest or weed control (see Chapter 10).

Policies and actions to mitigate the risk of harm include appropriate design of facilities, clear and adequate signage, publicised temporary warnings, public education and planned response strategies in the event of accidents and emergencies.

9.6 Policies and actions

RECREATION	
Objective 11: Provide a range of recreation opportunities that are valued by users and that can co-exist with other values and objectives for the Reserve.	
Policies	**Actions**
11.1 Provide a range of recreation opportunities differentiated by their level of intensity, allowing low intensity activities in the Nature Reserve and providing for higher intensity activities into the Special Purpose Reserves.	11.1.1 Reflect the distinction between low and high intensity activities in the choice and design of recreation facilities. 11.1.2 Incorporate the distinction between low and high intensity activities into promotion about the Reserve. 11.1.3 Make permitted and non-permitted recreation activities (Tables 8.1 and 8.2) clear on signage and in promotional material. 11.1.4 Evaluate new recreation proposals according to the criteria in Section 9.4.13. 11.1.5 Evaluate commercial proposals according to the criteria in Section 9.4.14. 11.1.6 Prepare landscape plans for the Special Purpose Reserves. 11.1.7 Regularly seek feedback from users and use it to guide management.
Objective 12: Residents in Molonglo Valley view, treat and protect the Reserve as their 'treasured front yard' and set a new high standard in the ACT for their behaviour in a nature reserve.	
12.1 Manage impact through appropriate detailed design of recreation facilities and by addressing the behaviour of users from early on in Reserve establishment.	12.1.1 Develop detailed plans for trails and facilities in successive portions of the Reserve as development proceeds. 12.1.2 Develop and implement a program that includes working with user and community groups to codify, encourage and monitor people's behaviour in the Reserve and applying sanctions where appropriate.
Objective 13: The Reserve adds value to the ACT as a distinct recreation destination, a long-distance recreation link, and an attractive contribution to the Canberra Open Space System.	
13.1 Maintain and enhance trail linkages to destinations beyond the Reserve, working with adjoining land mangers to maintain or improve connectivity.	13.1.1 Maintain existing trail linkages and improve linkages in the rural section of the Reserve.
Objective 14: Visitor safety is addressed in the design of information, facilities and operations.	
14.1 Minimise the risk of harm to people by designing and managing facilities to suitable safety standards and by providing community education and on-site warnings.	14.1.1 Design, build and maintain all facilities, including trails, to standards that minimise risks to visitors and natural assets. 14.1.2 Provide clear descriptions and safety information to visitors at Reserve entrances, in published guides about the Reserve and at specific locations where danger is high. 14.1.3 Work with schools, local community networks and recreation groups to educate users about dangers in the Reserve. 14.1.4 Develop and maintain an Emergency Response Plan for Molonglo River Reserve, in conjunction with the Australian Federal Police, the Emergency Services Agency, NCA and other organisations. The Plan may include protocols for closing the Reserve or parts of it on days of high fire danger or flooding. 14.1.5 Warn visitors about temporary hazards (e.g. herbicide spraying, bait laying, controlled burns).

10. FIRE PROTECTION, INFRASTRUCTURE AND OPERATIONS

10.1 Objectives

Objective 15:
Suitable access and associated infrastructure is available for fire management.

Objective 16:
Avoid or minimise the impact on Reserve values of building and maintaining infrastructure and facilities in or nearby the Reserve.

Objective 16:
Minimise harm to people and the environment from Reserve operations.

Molonglo River Reserve

10.2 Fire protection and management

Fire protection and management interacts with a number of Reserve management objectives and have already been covered in other sections. In summary these are:

- The statutory requirements of the land manager of the Reserve are in Section 4.4.6
- The interaction between fire management and the ecological objectives for the Reserve are in Section 6.7.2, 6.7.3, 6.7.4 and 6.7.5
- Objective 7 specifically deals with fire (*Acheive fire protection for people and property in ways that also effectively protects threatened habitat and other ecological function*).
- public safety in the event of a fire, and warnings about planned burns are in Section 9.5 and Objective 14 (*Visitor safety is addressed in the design of information, facilities and operations*).
- cooperation with neighbours, both urban and rural over a range of issues, including fire, is in Section 11.2.

Of the requirements in the SBMP v3 (ACT Emergency Services Agency 2014a) the remaining issue that the Management Plan must consider is access. Access issues in the urban section were explored in the Molonglo River Park Concept Plan (Hassell 2011) and will form the basis of reviewing and developing an access plan that also incorporates arrangements for the rural section of the Reserve.

Table 10.1 Construction, maintenance and access requirements of current and planned infrastructure in the Reserve.

Infrastructure	Construction, access and maintenance requirements within the Reserve
In place before 2016	
Molonglo Valley Interceptor Sewer (MVIS)	Maintained by Icon Water. Road access required. Sewer crosses the Molonglo River at Clos Crossing, which is also maintained by Icon Water.
Power lines	Maintained by ActewAGL. Road access required. Possible vegetation management in the corridor under the lines. The power lines require an access track for tower maintenance and vegetation control.
Mains water pipeline	Maintained by Icon Water. It requires access to inspection points.
Low level river crossings (4)	Maintained by TCCS and Icon Water using access roads.
Management roads	Maintained by TCCS. Used by utility managers, Reserve managers, fire operations and recreation users.
High level "Butters Bridge"	Recently constructed by ACT Government and will be maintained by TCCS. Maintenance access will be required for the bridge (TCCS) and sewer (Icon Water) – at bridge level, access will be along the pedestrian trail but occasional vehicle access will be required below for pier maintenance.
"Sewer 3 Central"	Recently constructed and will be maintained by Icon Water. Vehicle access will be required for maintenance.
Infrastructure recently completed, under construction or in advanced planning stage	
Water Quality Control Ponds and outlets	Constructed by ACT Government and maintained by TCCS. Pond construction involves ground disturbance within the Reserve where the pond abuts the Reserve boundary. Outlets use existing creek lines that flow through the Reserve to the river. Erosion control works will be required if creek lines further erode. Adequate creek crossings shall be provided by the proponent of the pond works for tracks and trails downstream of the outflows to accommodate larger water volumes.
Urban edge infrastructure	
Trunk Path	Shall not be located inside the Reserve
Infrastructure planned or likely to be required to complete the development of Molonglo	
John Gorton Drive bridge	This will be a significant construction project with potential impact on the Reserve in the Coppins Crossing area. There will be ground and river disturbance during construction. Multiple services are likely to be carried with the bridge. Access below the bridge will be required for maintenance.
Further sewers in Molonglo Stage 2 and 3.	Constructed and maintained by Icon Water. Ground disturbance during construction. Vehicle access will be required for maintenance.
Further Water Quality Control Ponds and outlets	As before.
New odour control plants and vent towers for the MVIS	Constructed and maintained by Icon Water. Ground disturbance during construction of plants and vent towers. Road access required for maintenance.
11 kV underground power line and possible other overhead power lines	Constructed and maintained by ActewAGL.
East West Arterial bridge	As for John Gorton Drive bridge.
Possible new water mains and gas lines	If required, will cross with the new bridges. Ground disturbance impact at approaches and on-going vehicle access required.
Possible relocation of existing 132 KV and 11 KV power lines	Constructed and maintained by ActewAGL.

Besides utilities infrastructure, existing facilities that support the objectives of the Reserve need to be maintained, and new ones constructed. This includes management tracks for fire protection and operations, fences and gates, recreational trails and associated facilities like shelters, boardwalks, lookouts, signage and seats, possible recreational river crossings and as yet undetermined facilities to support recreation in the Special Purpose Reserves.

Construction and management activity outside the Reserve may also impact on the Reserve, especially on slopes leading towards the river where surface flows may carry sediment and contaminants. This potentially includes many aspects of urban development (infrastructure, buildings, landscaping) in the new suburbs on those slopes. Suitable mitigation actions are required as a condition of construction approval, but experience in the development of Molonglo to date indicates that they have not always been satisfactorily implemented. In particular, sediment from construction activities prior to establishment of stormwater ponds has been difficult to contain.

Existing urban neighbours who may also engage in construction or other management activities include the National Zoo and Aquarium, National Arboretum Canberra, Yarralumla Woolshed, Equestrian Park, Australian Defence College and National Capital Authority (at Scrivener Dam).

10.2.1 Management considerations

The main issue during construction is the disturbance of vegetation and soil, not only of the footprint of the structure itself but of usually a much larger area to accommodate the workings of machinery and other temporary support functions like parking, offices, materials and equipment storage and soil stockpiles. Waterways may also be disturbed e.g. in bridge building. Potential impacts of these disturbances include erosion, sediment and contaminant movement away from the site and potentially into waterways, loss of soil structure, the introduction of weeds and alterations to the local hydrology. Many of the soils of the Reserve have a very dispersible A2 horizon. As long as the surface A1 horizon remains intact, the A2 horizon is protected. Piercing or removing the A1 horizon on slopes allows surface flows to rapidly disperse the soil beneath leading to rapid channelling erosion which is difficult to subsequently stabilise. Where the construction work involved removing the A1 or the A1 and some A2 layer, they must be removed separately and replaced in the original pattern. Rehabilitation works after construction is completed need to maintain or improve on the vegetation and habitat that was there previously, in accordance with Reserve objectives.

A major mitigating action is to avoid or minimise the amount of disturbance that needs to occur in the first place. The practice to date of using existing creek lines to discharge water from stormwater ponds is a good example, and should be continued. The construction of temporary stormwater ponds within the Reserve while permanent ponds are constructed and the construction of new channels to discharge outflows instead of using established drainage lines will not be permitted in the Reserve. Similarly the Reserve cannot be used for temporary storage of materials, site sheds or equipment or to facilitate earthworks and construction access for works within the urban area.

Disturbance to wildlife may be an issue in the Reserve, especially where large construction works over long periods of time occur near or over the river. The riparian vegetation is an important corridor for birds and loss of cover over a distance may preclude smaller birds from using this route. This needs to be addressed in environmental approvals for the work.

Management roads in the Reserve need to be maintained at a good standard as they will become more heavily used with increasing management, recreational and infrastructure construction and maintenance demand. To minimise compaction and the risk of erosion, and for aesthetic reasons, management and contractor vehicles should stay on roads and minimise their footprint off-road. Off-road vehicles (e.g. for weed spraying) should be light and have appropriate tyres to minimise vegetation and soil surface damage.

Any development in the reserve that requires approval under the *Planning and Development Act 2007* would be assessed against the requirements of the Territory Plan and other relevant legislation, including the *Heritage Act 2004* and the *Environmental Protection Act 1997*. In addition, the NES Plan requires that a development within the urban section needs to have a Construction Environmental Management Plan (CEMP).

10.3 Infrastructure

Utilities infrastructure to service the new development and to support regional requirements has already, or may yet need to be constructed in the Reserve. This infrastructure has on-going maintenance requirements that entail vehicle access. The nature and location of infrastructure identified as potentially having an impact on the Reserve is described in Section 4.4.14.
The importance of location and design to the scenic values of the Reserve is noted in Chapter 5. Infrastructure that was not specifically included in the NES Plan may also require separate environmental impact assessment.

The construction, maintenance and access requirements that could impact on the ecological values of the Reserve are outlined in Table 10.1. Approval to construct such infrastructure is governed by ACT legislation, including the requirement for assessment and mitigation of environmental impact. As far as possible, structures are better located outside the Reserve except where it can be clearly demonstrated that they are required for the operation of the Reserve or that no feasible alternatives are available.

10.4 Reserve operations

Besides construction and maintenance activities associated with built facilities, all other operations in the Reserve can have a potential impact on the environment or on human health and safety. These include smoke from planned burning; rehabilitation activities, including the removal of remnant pine plantations; use of pesticides and weedicides; and use of firearms. Requirements for most of these are covered by existing legislation (see Appendix 3) or other government policies. Planned burning requires an Environmental Authorisation under the *Environment Protection Act 1997*.

10.5 Policies and actions

FIRE PROTECTION AND MANAGEMENT

Objective 15: Suitable access and associated infrastructure is available for fire management.

Policies	Actions
15.1 An access plan for fire management will be developed that maximises the use of existing management tracks and does not impact on NES matters, except where permitted in the NES Plan.	15.1.1 Develop and implement a fire access plan, taking into account all the other objectives in the Management Plan.

INFRASTRUCTURE

Objective 16: Avoid or minimise the impact on Reserve values of building and maintaining infrastructure and facilities in or nearby the Reserve.

Policies	Actions
16.1 The values, objectives and relevant policies of the Management Plan will be used to guide advice and actions on the impacts of construction and maintenance works.	16.1.1 Provide advice to proponents of constructed works and facilities about how impact can be mitigated. 16.1.2 Monitor and report non-compliance with legislative requirements relating to construction activities and sediment and contaminant flows from neighbouring properties. 16.1.3 Monitor construction activities for inadvertent impact, and design and negotiate appropriate mitigation. 16.1.4 Monitor the impact of using natural creek lines as drainage channels from stormwater ponds and rehabilitate channels or modify their design if required.

OPERATIONS

Objective 17: Minimise harm to people and the environment from Reserve operations.

Policies	Actions
17.1 Relevant legislation and ACT Government policy will be applied to all management actions that have a risk of harm to people and wildlife.	17.1.1 Ensure staff are aware of and comply with prescriptions applying to all activities in the Reserve, particularly those involving: • pesticides and weedicides • firearm use • ecological and fuel reduction burning. 17.1.2 Apply standard ACT Government duty of care to all activities in and associated with the Reserve.
17.2 Reserve operations will not compromise agreed objectives in the Management Plan.	17.2.1 Assess significant operational activities for their environmental impact and mitigate any significant impacts.

11. NEIGHBOURS AND COMMUNITIES

11.1 Objectives

Objective 18:
Achieve productive working relationships with neighbours that contribute to maintaining Reserve values

Objective 19:
Achieve strong community support for the Reserve and active contributions towards its management.

Community Planting Day at
Barrer Box Gum Woodland Restoration area

11.2 Neighbours

This section focuses on those people who live or manage land close to Reserve boundaries. They include people living near or on the urban edge, people using the path adjoining the Reserve boundary, rural landholder lessees managing land adjacent to ACT Government City Services rural section and enterprises whose properties border or are close by the Reserve.

The long narrow shape of the Reserve results in an unusually long boundary length for the area of land enclosed (the perimeter is 51 km long, split about equally between rural and urban). Boundary issues that are not well managed will consume significant management resources. The narrowness of the Reserve also accentuates the risk that neighbours' actions that penetrate the Reserve (e.g. garden or agricultural weed seeds blown in or carried in by birds) can relatively easily cross the full width of the Reserve. Whether neighbouring land is urban or rural, there is considerable contrast in land use objectives, management actions and their relative priorities at the boundary with the Reserve, where the prime purpose for most of the area is nature conservation. Some urban edge impacts have already been outlined in Section 3.2.2.

Issue Box 11.1 Impacts of people's actions that cross Reserve boundaries.

Activities of neighbours in the **urban section** that need to be minimised for their potential impact on Reserve objectives include: disregard of the cat containment and general dog control regulations, damage to boundary fences and gates, rubbish near the urban edge blowing into the Reserve, accidental or deliberate fire lighting and dumping of garden waste over the fences. There are agricultural weeds already in the Reserve, but the introduction of a long urban interface to the Reserve will bring many new garden plants into close proximity to the boundary and the potential introduction of a new range of weeds.

In the **rural section**, local rural leaseholders report a range of impacts from people entering their properties through nature reserves or directly from urban areas. These include:

- People, pests and wildlife entering their properties through fences that provide easy access.
- Fences and gates damaged from people cutting or jumping over them.
- Off leash or escaped dogs chasing stock.
- People entering unlocked gates and leaving them open, allowing stock to escape; emergency services and other authorities cutting fences and leaving gates open without alerting the landholder and allowing stock to escape.
- Building earth ramps for bikes, disturbing land and stock.
- Leaving litter, which is unsightly and a potential risk to cattle and sheep.
- People, horses and dogs conveying weed seeds onto the property.

In the upper reaches of the river there are also neighbouring enterprises whose land slopes down towards the river and where uncontained sediment and contaminants represent a risk to water quality. This specific risk has been dealt with in Chapter 10 but others may emerge.

Conversely, actions of Reserve users, Reserve management or material from the Reserve itself may also cross the boundary and impact on neighbours. In the urban section, these might include smoke from fuel reduction or ecological burning (although infrequent), wildlife on roads or in properties, litter from the Reserve blowing into urban areas and noise from people using the Reserve.

11.2.1 Opportunities

While managing the negative impact of actions across boundaries needs addressing, the presence of neighbours can also be used to advantage. In the urban section, the development of a sense of place for new residents will be strongly shaped by the Reserve, especially those very close to it. With residences facing onto the Reserve, the Reserve will appear as an extension of a front yard instead of a backyard, and likely to be better treated than in older Canberra areas where reserves are faced by backyards. Residences facing the Reserve, and cars, cyclists and walkers passing along the urban edge will also provide 'eyes and ears' over the behaviour of people within sight of the edge.

In the rural section, lessees can play an important role in enhancing characteristics of their land in ways that promote conservation objectives, especially if they are neutral or positive to their economic activity and enhance their own values about conservation. Protecting or enhancing remnant woodland and corridors for birds, controlling weeds that limit both agricultural and conservation objectives or putting cattle into the Reserve to reduce biomass are examples. Collaborative effort between Reserve managers and rural leaseholders is also crucial for effective bushfire management activities,

coordinated weed control programs, and the rehabilitation of creek lines. Land Management Agreements (LMAs) between the ACT Government and rural lessees are vehicles for negotiating how lessees can contribute to environmental outcomes. Rural neighbours of the Reserve already formally agree to some of the actions mentioned. Under the *Nature Conservation Act 2014*, the Conservator of Flora and Fauna can also issue conservation directions to the occupiers of land for the protection or conservation of native flora and fauna.

11.2.2 Management considerations

Many of the actions that need to be managed across Reserve boundaries are not suited to management by regulation and therefore need to be approached through proactive relationship building and community behaviour management. Some urban residents do not have a good understanding of nature reserve or rural land issues and do not realise that their actions may have negative consequences. Sometimes other options are available for achieving what they want with less impact on the Reserve (e.g. a different plant selection in gardens). In the rural section, to discourage the entry of people and passage of pests into neighbouring rural properties, replacements for old fences will be to a specification determined by the Land Manager.

Cooperation with neighbouring rural leaseholders is also important for regional fire protection. The Regional Fire Management Plans (Section 6.7.2) specify the goals for fire protection across the region and landholders meet together to develop collaborative implementation plans.

A corollary to the expectation about neighbours to the Reserve 'doing the right thing' is neighbours' expectation that the management actions in the Reserve will not unreasonably detract from the ways in which they expect to be able to use their properties. Therefore it requires a reciprocal relationship for neighbours to work well together. The key is establishing the relationship early so that issues can be raised before they become serious and solutions can be devised in an atmosphere of mutual respect. This requires a planned approach and a Good Neighbour Policy will be developed for the Reserve, based on local experience and examples from NSW and Queensland (NSW National Parks and Wildlife Service 1994; NSW National Parks and Wildlife Service 1993; Queensland Government 2002). It will be developed in conjunction with appropriate neighbourhood groups and based on the following principles:

- The right of neighbours to the quiet enjoyment of their land is recognised and respected.
- The responsible management and stewardship of protected areas is recognised and respected.
- Generally accepted standards of good neighbourly behaviour will be practised.
- The practical resolution of management matters at a local level is priority.

The practice of ACT Government and the Rural Landholders Association meeting quarterly for sharing information and planning joint activities has been successful and should continue as part of the Good Neighbour Policy.

11.3 Communities

This section focusses on the wider community and the ways in which they interact with the Reserve, including contributing to its care. By sharing some of the responsibility for Reserve outcomes with local residents, more can be achieved in terms of conservation and recreation goals. Active community contribution to Reserve management is also important for giving a sense of ownership to residents, that is, their contribution to a place that affects them and their surroundings has been listened to and had an influence. They are then more likely to use community forces to regulate their members' behaviour in and nearby the Reserve. Working with communities has been recognised as one of the four key dimensions of park management (Queensland Government 2002).

11.3.1 Emerging communities

A challenge for this Reserve is that the urban residents who will become local communities are only just beginning to arrive. Strategies for working with them will have to be responsive to the demographic and social makeup and not make assumptions based on the experience of working with communities in the older parts of Canberra where, for example, park care activity is the highest. Social patterns of community formation are changing rapidly. Communities now often form on criteria other than their home location, and it is possible that neighbourhoods can have no sense of local community ties (Valentine 2001). For example, in rural parts of the Molonglo River catchment, it has been found more successful to take promotional activities about land management to where the children of life-style property owners congregate on weekends than to use traditional rural extension methods. Successful engagement policies for the Reserve will rely on acknowledging such changes, understanding the criteria that shape new and more fluid communities and then drawing on the diversity of knowledge and skills within them.

Holdens Creek
Hill Lookout

In preparing for engaging with future residents in Molonglo about conservation issues, and instigated by the Land Development Agency, a group of stakeholders has been meeting monthly as a 'Bush on the Boundary' group. The group includes people who were involved in a similar group during the development of Forde, which adjoins Mulligans Flat Nature Reserve, and where considerable thought was put into preparing the incoming residents for their role as influencers of what happens across the boundary in the Reserve. However engagement approaches in Molonglo will need to be shaped by the new residents themselves. This process has begun with the development of an LDA sponsored Community Engagement Strategy whose purpose is to encourage incoming residents to become involved in shaping the social and environmental sustainability of the new town.

11.3.2 Community groups

In terms of broader community involvement, the Molonglo Catchment Group is the community-based group that has an interest in the whole of the Molonglo catchment (ACT and NSW). It engages in a range of landholder and community activities as well as supporting the activities of local Landcare and Parkcare groups. Parkcare groups in and around Canberra, with the support of the ACT Government, park rangers and the Catchment Groups, have made substantial contributions to the improvement in condition of the parks in which they work. A recent example was the GPS mapping of rabbit warrens on Mt Majura and Mt Ainslie by members of park care groups so that rabbit control actions by the ACT Government could be directed to the right places. Understanding the motivations of people who do voluntary work for the environment is important because it helps target recruitment and shape the nature of volunteer activities. A study of environmental volunteering in urban Australia (Measham and Barnett 2008) found that volunteers had six main motivations: contributing to community, social interaction, personal development, learning about the environment, general ethic of care for the environment and attachment to a particular place.

Other community groups who engage in or organise environment activities across the ACT include Greening Australia Capital Region, Canberra Ornithologists Group, Friends of Grasslands, ACT Herpetological Association, ACT branch of the Geological Society of Australia and the Conservation Council ACT Region.

11.3.3 Interpretation

Establishing an interpretation program early in the development of the Reserve will be important (Hassell 2012). Interpretation communicates what is special about protected areas and by creating a greater understanding, makes them better appreciated. Interpretation also helps make visitors' experiences more positive and profound, but it should not be too extensive over-explanation takes away the visitor's personal sense of adventure and discovery (Worboys et al. 2001). In addition to written and illustrative interpretation, the way rangers explain sites can help to educate the community, foster management objectives and to give visitors an enjoyable and meaningful experience. The use of new media opens new opportunities for reaching today's people, especially the young, and can decrease the dependence on hard in situ infrastructure. To have the most impact, the type of interpretive information and new media used should be shaped by the most frequent users of the Reserve, the local residents.

11.3.4 School partnerships

Partnerships with schools can directly assist local conservation efforts, principally by getting children interested and informed and they in turn becoming an influence and communication channel with other members of their families. The new schools in Molonglo (a primary school in Coombs will be the first) will be looking for activities that engage students in local issues. High school and college aged students can do activities like Waterwatch and Frogwatch, and participate in park care activities, or use the Reserve as a focus for learning projects. For example, the Molonglo Catchment Group sponsored a project with community volunteers from the West Belconnen and Lower Molonglo districts to map the assets of the lower reaches, partially using GIS courses at Hawker College to encourage engagement with younger people (Molonglo Catchment Group 2013).

11.3.5 Management considerations

The major management consideration is targeting and organising effort so that interactions with communities are productive but efficient. This requires a planned approach, and as much use of existing community groups and processes as possible. It is proposed that a Communication and Engagement plan be developed, encompassing the following principles:

- The plan be developed with local community input and draw on existing neighbourhood programs like the SLA Mingle program.
- Target audiences be defined that relate to incoming communities.

- A program of communication and engagement activities be designed that is appropriate for those audiences and makes good use of the capacity of new media to reach audiences and of new technologies to make interpretation material interesting and widely available.
- A set of clear messages be used that is based on the Management Plan and accompanied by visual brand developed for the new Reserve.
- Community partners with demonstrated experience be used to deliver many of the engagement activities.
- The plan be staged to take into account the rate of urban development.
- The effectiveness of the plan be monitored and adjusted where necessary.

Guidance Box 11.1
Menu of activities for engaging the community.

EXAMPLES OF ENGAGEMENT ACTIVITIES THAT HAVE BEEN USED SUCCESSFULLY ELSEWHERE AND THAT COULD BE CONSIDERED FOR THIS RESERVE INCLUDE:

- Ranger guided walks and 'induction' workshops for new residents (these have been successful at Mulligans Flat in helping foster new Forde residents' understanding of the Reserve, develop their sense of place and attract people to conservation activities).
- Partnering with an appropriate community group to organise the delivery of an agreed set of communication and engagement activities.
- Involving the community in a wide range of activities, including:
  - tree planting and weed control
  - visitor surveys (a good way for local residents to meet more locals)
  - mapping and monitoring (through 'citizen science'), including Waterwatch and Frogwatch which are particularly suited to this riverine Reserve, to older schoolchildren and to retirees
  - historic site conservation
  - interpretation and education programs
  - leading recreational walks and walks for school groups.
- Exploring opportunities for funding community–based activities from government funding programs and local business sponsors.
- Engaging with the ACT Aboriginal community according to agreed protocols and working with them in the design of interpretive material about Aboriginal history and culture (see Chapter 6).
- Supporting the establishment of a 'Friends of Molonglo River Reserve' parkcare group.
- Identifying and involving a noted person of a cultural background who new residents can relate to, and who is a good communicator, to be the initial 'ambassador' for the promotion of the Reserve, its values and ways people can get involved.
- Developing a regular program of media alerts, presentations and announcements to coincide with milestones in the Reserve's development.
- Designing material to engage people's interests and improve their understanding of the Reserve e.g. video camera surveillance of raptor nests or kangaroos. It could also include time lapse photography showing seasonal variations in the woodlands and grasslands, water levels in the river (Hassell 2012) and rehabilitation progress.
- Establishing demonstration sites in the Reserve to provide living examples of why certain management actions are required.
- Developing a teaching guide for the Reserve as part of curriculum development.
- Setting up issue-based workshops, and fostering negotiations or conflict resolution between different stakeholders where there is disagreement about issues that affect the Reserve.

11.4 Policies and actions

NEIGHBOURS	
Objective 18: Achieve productive working relationships with neighbours that contribute to maintaining Reserve values.	
Policy	**Actions**
18.1 Establish and maintain good neighbour relationships.	18.1.1 Develop and implement a Good Neighbour Plan that integrates with other relevant community and cooperative rural activities.

COMMUNITY	
Objective 19: Achieve strong community support for the Reserve and active contributions towards its management.	
Policy	**Actions**
19.1 A planned approach will be used to make good use of existing community mechanisms.	19.1.1 Develop and implement a Communication and Engagement Plan on the basis of the principles in the Management Plan. 19.1.2 Develop a MoU with the Molonglo Catchment Group for carrying out collaborative community engagement activities in the Molonglo Valley and the Reserve.

Emerging Communities of Coombs and Wright

12. GOVERNANCE, KNOWLEDGE AND IMPLEMENTATION

12.1 Objectives

Objective 20:
Inform future decision making with a structured, evidence-based process

Objective 21:
Foster the development of new knowledge and its application to management actions for achieving other Reserve objectives.

Picnic shelter at Coombs Riverside

12.2 Governance

The ACT Parks and Conservation Service carries the formal responsibility for managing the Reserve and will draw on the resources, and comply with the requirements, of the ACT Government in doing it. This Management Plan is one of the statutory requirements that contribute towards proper governance and good decision making, in relation to the Molonglo River Reserve. The plan represents agreed directions, approach and an initial set of actions, but there will be considerable additional decision making that is required through the life of the Plan. This section outlines a structured approach for guiding this decision-making.

12.2.1 Community reference group

A Community Reference Group has already been established to provide advice to the ACT Government during development of the Issues Papers and the Management Plan for this Reserve. The value of having an established group of community members from a range of different stakeholder perspectives able to share those perspectives with management and with each other is recognised. It gives management a capacity to pre-test reactions to management proposals, increases transparency and helps to fulfil community expectations about being involved in decision-making about, in this case, a place that is important to them.

For these reasons it is proposed to continue to support a Community Reference Group throughout the life of the Plan.

12.2.2 Adaptive management

The Management Plan sets out objectives for realising the desired values of the Reserve in the long term, and the policies and main actions that will work towards them in the life of this Management Plan. Scientific research and past management experience has helped to narrow the range of socio-ecological responses expected from management actions, and that knowledge has underpinned this plan. However uncertainties will still remain, both for the ecosystems in their current state and as they respond to rehabilitation efforts and future drivers of change (e.g. increased human use, vegetation management for fire protection, removal of grazing, alteration in surface and groundwater hydrology, disturbance from infrastructure and climate change). 'Adaptive management' is an approach that has been developed to help reduce uncertainty, structure management interventions so that they focus on the most important questions, maximise the rate of learning and better assure the outcomes desired (Allen et al. 2011).

Issue Box 12.1 Adaptive management

A formal 'adaptive management' approach is more than the trial and error learning informed by research findings that land managers have always practised. Its core is an iterative learning loop of:

- setting clear objectives (in the light of values and legislative context)
- making hypotheses about how management interventions will achieve them
- testing those hypotheses in management scale experiments by measuring before, during and after the interventions
- evaluating the results and
- adjusting the management (or objectives).

It is also integral to the approach that stakeholders are involved in establishing the values and objectives, and that managers and scientists work together collaboratively throughout.

The longest running use of formal adaptive management is in Kruger National Park. In practice, implementing full management scale experiments has not often been feasible, but the structured approach has brought some conservation successes, and contributed to altering the focus from monitoring and managing individual species (e.g. elephants) to the state of the ecosystem as a whole (van Wilgen et al. 2011). A comparison of the management of Kruger and Kakadu National Parks (Parr et al. 2009) concluded that the adaptive management framework used in Kruger provided it with a much more easily understandable management framework and base upon which biodiversity conservation performance could be measured. Across the two reserves generally, achievement of outcomes was most related to having: adequate resources dedicated to management and monitoring, clear objectives with performance indicators, and considered application of management actions.

A key innovation in the way in which objectives have been set in Kruger National Park is that they are defined in terms of thresholds of potential concern (TPC) (Biggs and Rogers 2003). These are points that if crossed would mean the ecosystem has undergone a significant change in its structure and function, and from which it might not be possible to recover. In conservation management, this would usually mean a significant conservation outcome is in jeopardy. If monitoring indicates that a value is approaching a threshold then management intervenes aggressively to avoid it being crossed. When the value is safely distant from a threshold, variations from time to time are considered to be due to the operation of natural feedback processes

and natural variability, and it does not receive focussed management action. A corollary to avoiding the crossing of thresholds is the deliberate crossing when the objective is to take the ecosystem to a different state. This could be the case in the areas in the Reserve where significant rehabilitation is required to improve conservation outcomes and achieve ecosystems that are more resilient to e.g. weed invasion.

The underpinning theory for using thresholds of potential concern to simplify and focus monitoring and management efforts comes from the study of resilience in linked social-ecological systems (Section 2.2; Walker and Salt 2012). This approach has been trialled and adopted in New South Wales in the development of regional natural resource management plans (Natural Resources Commission 2011). Thresholds of potential concern have also been developed and tested as a tool for managing wetlands in the Lowbidgee (Rogers et al. 2013) and proposed for freshwater protected areas and their rivers (Kingsford et al. 2011). The sample state and transition model for box gum woodlands (Appendix 1) is related to the same theory. Here thresholds are less easy to describe quantitatively, and the focus is on achieving changes in the key drivers of the state of the ecosystem e.g. introducing fire and removing grazing from native pastures (State 2) if the objective is restore them to grassy woodlands (State 1).

Rogers et al. (2013) make the point that TPC are not the same as indicators used for the purpose of reporting on condition and trend in monitoring programs. TPC are much more focussed towards specified goals and management interventions, and are based on conceptual models that link actions with responses at specific sites. In the Kruger experience, shifting resources from monitoring indicators (e.g. elephants) to TPC in the ecosystem supporting them was very challenging. Other authors have also commented on the importance of the social context, values and structures in governing what can and needs to be achieved in park management, and the need for governance to be adaptive as co-learning occurs (e.g. Kingsford et al. 2011).

An adaptive management strategy has already been developed and approved for the threatened habitats in the Reserve that are covered by the NES Plan (ACT Planning and Land Authority 2013). This includes areas inside the Reserve, as well as some offset areas outside the Reserve. The strategy spells out the monitoring responsibilities and a process for evaluating the results. Progress towards NES Plan outcomes is also reported annually to the Commonwealth Government.

12.2.3 Management considerations

An adaptive management approach to the areas covered by the NES Plan is already in place (ACT Government 2013d). This covers the most critical conservation objectives but represents less than half the area of the Reserve (Chapter 5). Many other Reserve objectives fall fully or partially outside this area, and a system for monitoring their progress and developing and applying new knowledge to their achievement is required. Progress towards these objectives will be reviewed mid-term in Year 5 of the Plan and actions adjusted accordingly. A second review in Year 10 will inform the sequel to this Plan. The Operational Plans will be used for planning specific monitoring activities.

The baseline information is good for the ecosystems and species of national significance in the urban section and Kama but variable in coverage for all others areas across the Reserve. There is a lack of good baseline data about the natural assets and their condition across the Molonglo River Reserve as a whole – in part because this is the first time that this particular area has been the focus of a set of conservation objectives. There is an opportunity to enlist community volunteers in the monitoring activities associated with adaptive management. The developing practice of 'citizen science' and the capacity provided by GPS, digital capture and reporting into central databases like the Atlas of Living Australia make this a feasible way of complementing knowledge developed by professionals.

The adaptive management strategies referred to so far focus on the ecological conservation objectives for the Reserve. The same principles broadly apply to all other objectives and these will be included in the review of progress of the whole Management Plan at mid-term and near its conclusion.

12.3 Knowledge

For its size, the ACT is richly endowed with research groups active in areas directly or closely relevant to the management challenges in the Reserve. Groups include the ACT Government's Conservation, Planning and Research Group in the Environment and Planning Directorate, the Institute of Applied Ecology at the University of Canberra, the Fenner School at ANU, and CSIRO. These research organisations also include social scientists with interests in understanding interactions of social and ecological systems, an area of potential value for this Reserve, considering the close proximity of urban and conservation land.

Current knowledge about the ecosystems of the Reserve and the management actions required to rehabilitate and protect them has been brought together in the Ecological Management Guidelines (Sharp et al. 2015). However, the Reserve (and similar places in the ACT) would also benefit in the longer term from research on more fundamental questions focused around:

- climate change and its impacts; adaptation options for conservation, including reviewing the nature of conservation objectives in a changing climate
- social behaviours, policies and conservation
- restoration ecology and/or the creation of novel ecosystems to fulfil specific objectives in the Reserve e.g. conservation and fire protection; conservation and recreation management
- relationship between conservation measures within the Reserve and conservation measures at the regional scale
- development of best control measures for weeds that are especially invasive in the Reserve, such as African Lovegrass.

12.3.1 Management considerations

Research that addresses management questions relevant to Reserve objectives or wider ecological or socio-ecological issues is encouraged. Major management considerations include the following.

The best value for the Reserve from research efforts will come from research efforts channelled to the questions most relevant to Reserve objectives. These will largely fall out of the adaptive management process and potential research projects can then be scoped collaboratively between researchers and managers. As with relationships with neighbours and communities, establishing on-going relationships with researchers enables more efficient, committed and fruitful collaborations when they are needed.

Sites in the urban section will have high visibility and a high potential for public education, but will be more at risk from unwitting misuse or deliberate vandalism. Scientists' activities in places of high visibility need to be clearly indicated so that the reasons for their behaviour are understood and not mimicked (e.g. turning over rocks looking for Pink-tailed worm-lizards, taking plants for identification). Reserve management will help protect sites but managing such risks needs to be built into the experimental design.

Research projects must involve minimal risk to conservation objectives in the Reserve. Licences that must be obtained under existing legislation include: taking or killing animals or picking native plants (*Nature Conservation Act 2014*) and banding birds or bats (*Nature Conservation Act 2014* and the Australian Bird and Bat Banding Authority). Projects that involve broader vegetation and ground disturbance should require the same mitigation measures as construction projects (Chapters 4 and 9).

With a rich research community at hand, and the Molonglo Valley development designed with sustainability, including biodiversity conservation as an objective, a research project that evaluates the effectiveness of those measures over time would be a potential and valuable project.

Holdens Creek Hill boardwalk detail

12.4 Policies and actions

GOVERNANCE	
Objective 20: Inform future decision making with a structured, evidence-based process.	
Policy	**Actions**
20.1 Strategic Consultation with the community will be proactive and planned.	20.1.1 Appoint a community consultative committee and hold regular meetings to exchange feedback and develop joint, proactive responses to emerging issues.
20.2 Adaptive management principles will be applied to Reserve management.	20.2.1 Implement the NES Adaptive Management Strategy that includes the NES matters applying within the Reserve. 20.2.2 Fill gaps in the baseline data for the whole of the Reserve, including using citizen science activities where appropriate. 20.2.3 Review progress of all objectives in the Management Plan in year 5 (for adjustment) and year 10 (to inform the subsequent plan).

RESEARCH	
Objective 21: Foster the development of new knowledge and its application to management actions for achieving other Reserve objectives.	
Policy	**Actions**
21.1 Work strategically and collaboratively with key researchers.	21.1.1 Assess research proposals that require access to the Reserve on the basis of their relevance, ecological impact and management support required. 21.1.2 With research partners, seek opportunities for funding of research projects of mutual interest. 21.1.3 Synthesise new knowledge and ensure it reaches Reserve staff and community stakeholders.

12.5 Implementing the Management Plan

The primary responsibility for implementing the Management Plan lies with the land manager, the ACT Parks and Conservation Service.

A number of the policies and actions require collaboration with other government directorates and agencies, community organisations, adjacent landholders, private organisations, schools, universities and commercial interests. In these cases, the responsibility for initiating and facilitating the actions still rests with the land manager.

The land manager is also required to the report to the Minister on implementation of the plan at least once every 5 years, and to review the plan, including consultation with the public, every ten years from its commencement (Section 12.5 ACT *Nature Conservation Act 2014*).

Holdens Creek
Hill Lookout

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Smooth Flax Lily *Dianella longifoli*

APPENDIX 1. A STATE AND TRANSITION MODEL FOR BOX GUM GRASSY WOODLANDS

This diagram, from Rawlings et al. (2010), illustrates what causes changes in Box Gum Grassy Woodlands and what is needed to reverse them. A similar pattern applies to Native Temperate Grasslands, but without trees. The former pine plantations broadly correspond to State 4.

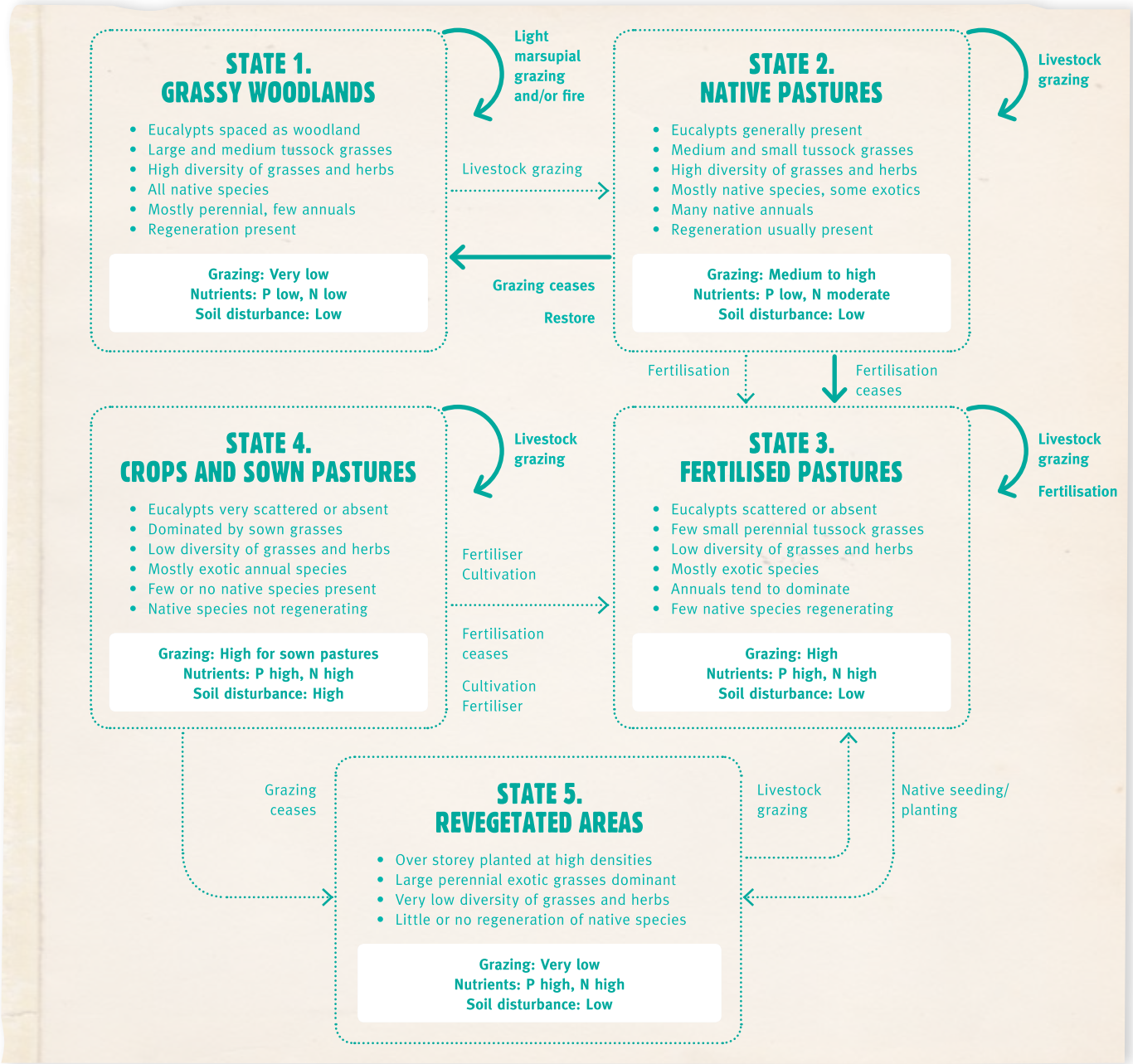

Figure 3.1 The box gum grassy woodland State and Transition Model. The model has five states, each listing the characteristics typical for that state. Arrows between boxes represent the transition or change between states and the management activities that cause the transition. Thick arrows represent a more difficult transition. Circular arrows describe the mechanisms for maintaining a given state.

APPENDIX 2. PROPOSED NEW PLACE NAMES IN THE URBAN SECTION OF MOLONGLO RIVER RESERVE

Aboriginal names – areas have been shown as potential places for the use of Aboriginal names based on initial consultation with the PCS Senior Indigenous Ranger and the RAOs and considering the location of artefacts. The places and names are to be determined based on further consultation with the local Aboriginal community. Naming of sites in the rural section may be considered at a later date.

Landscape Zone	Place Name	Feature	Origin
Overall Reserve Name	Mura-mura, Yealambidgee, Moolingoolah, Daen Woorak	Overall Reserve	ABORIGINAL • Mura-mura – means pathways. Representative of the use of the river corridor as a pathway from ancient times through to more recent history. • Yealambidgee – chain of waterholes – represents the water course pathway rather than the land pathway • Moolingoolah – place name from which Molonglo was derived (Jackson-Nakano 2001). Moolinggoolah is recorded as the early translation of the Aboriginal name for the river, which has become Molonglo. Moolinggoolah was the recorded spelling of Molonglo by Surveyor Harper, recorded in Cambage 1921. It must be noted that Moolinggoolah was the name given to Aboriginal people who lived around Lake George, and may not have been used by people living in the Canberra district. • Daen Woorak – Aboriginal Swimming Places
1 – Eastern Narrows	Bold Hill Park	Park	HISTORICAL Existing name of the Hill in common use. No evidence found to show origins of name. Appears on survey maps from 1914.
	Clos Crossing	Crossing	HISTORICAL Existing name in common use. No firm evidence on origins of the name.
	Darters Reach	Interpretive Node	ECOLOGICAL Area commonly used by darters. Section of willows to be retained for darter habitat until suitable native habitat available from restoration work.
	Johnstons Park	Gateway Park	HISTORICAL In the late 1820s Robert Johnston was squatting on land adjacent to the reserve. Johnston's hut, along with John Taylor's, was the first recorded European settlement in the Lower Molonglo.
	Hoddles Rest	Park	SURVEYING Robert Hoddle was one of the early European surveyors who produced maps of what is now the Canberra region. Hoddle painted delicate watercolours of the area depicting the open woodland and in some instances local Aboriginal people.
	Llewellyn Crossing	Crossing	COMMUNITY Llewellyn's Crossing has social significance to the equestrian community who have used the tracks through the forests of the Lower Molonglo for several generations. Mrs Bobby Llewellyn established the first riding school in Canberra which was active throughout the 1940s.
	Possible feature/ place Aboriginal Place Name	Park	ABORIGINAL Ngalla Point – Ngalla – tree (Ngunnawal LALC n.d.:30) Native woodland restoration area.

Landscape Zone	Place Name	Feature	Origin
	Southwells Crossing	Crossing	HISTORICAL Existing name in common use. Thomas Southwell was a prominent landholder at Weetangera who ran a carting business, taking stores to and from the gold fields at Kiandra during the 1860s and 70s.
	Tommy's Torment	Interpretive Node	HISTORICAL A remarkable woman, Margaret McTavish, escaped her father in the 1860/70sin disguise as a man under the name Tommy. For several years she drove bullock teams between Sydney and the Limestone Plans. Reputedly she worked for Thomas Southwell, during which time she was injured and her disguise lost. The shocked Southwell dismissed her immediately.
	Twelve Mile Bend	Gateway Park	HISTORICAL Twelve Mile House was the name of Richard Moore's (junior) farm on the southern bank of the Molonglo River in the late 1800s – 1913. The house was located in the area of the proposed park.
2 – Misery Point	Possible feature/ place Aboriginal Place Name	Park	ABORIGINAL Suggestion – Gamburra Point Gamburra – Flowers (Ngunawal)
	Aboriginal Place Name	Park	ABORIGINAL Suggestion – Wuggar dhaura Wuggar is the Ngunawal word for fish, and was nominated by Buru Ngunawal man Tyrone- Bell. Dhaura is a word meaning ground or place in the Ngunawal language, and serves to anchor the place name in the landscape.
	Barrer Hill Restoration Area	Park and Conservation Area	ECOLOGICAL Named after the ecologist Dr Peter Barrer, responsible for the first ecological mapping of the Lower Molonglo in the 1990s.
	Bulga Crossing	Crossing	HISTORICAL 'Bulga Creek' referred to the broader Yarralumla area, Bulga Creek is a tributary of the Murrumbidgee, south of Mt Stromlo. The families of southern Belconnen and the Lower Molonglo sent their children to the Bulga School during the late 1800s (Brian Blundell Pers. comm). The children would cross the river barefoot on their way. Bulga is reputedly an Aboriginal word for mountain. Discussions with the RAO representatives did not corroborate or disclaim this.
	Riverview Homestead	Park	HISTORICAL Is the archaeological site of *Riverview*, the property at which early pastoralists Emily and Isaac Blundell lived from 1873- 1913.
	Box-Gum Woodland	Park and Conservation Area	ECOLOGICAL This is a temporary name reflecting the ecological community of this area. Use of the proposed name is to be approved by the family of the person to be honoured.
	Misery Point		LANDSCAPE FEATURE Existing name in current use. Origins of name unknown however shown on several surveying maps from the early 1900s.
	Holdens Creek Gateway Park	Gateway Park	HISTORICAL Existing name in common use. No firm evidence on origins of the name.
	Mowatt Park	Park	HISTORICAL Mowatt (1803 – 1891) was a prominent land holder in NSW who purchased 2,500 acres in 1831 from Henry Donnison which became the Yarralumla estate. Mowatt also owned the land within which the proposed Mowatt Park is located.

Landscape Zone	Place Name	Feature	Origin
	Develin's Run	Gateway Park	HISTORICAL Henry Develin lived on the block south east of Riverview. He was a small landholder, and this commemoration reflects the contribution both he and other landholders such as the Rolfes made to the Lower Molonglo in the second half of the nineteenth century. There is the possibility that Develin died at Misery Point, which adds significance to this nomination.
3 – Coppins Crossing	Possible feature/ place Aboriginal Place Name	Park	ABORIGINAL Maka dhaura – lizard place Maka-maka is recorded as the name used for lizard by Ngunawal people living near Yass in the mid 1800s (Koch and Hercus 2009:152).
	Coppins Crossing	Bridge	HISTORICAL Existing name in common use. John Coppin and his wife Catherine Sheedy lived in Coppins Hut, an excavated heritage site on the southern bank of the Molonglo.
	Coppins Crossing Park	Park	HISTORICAL As above. Appropriate due to proximity of park to the crossing.
	Kallenia Park	Park	HISTORICAL Kallenia was the name of an extensive property run by Augustus Gibbes that extended across both north and southern sides of the Molonglo. The Kallenia Rivers Woolshed still stands today, it comprises an historic woolshed constructed from the upright slabs which once formed Coppins Hut, prior to its dismantling and removal (BIOSIS 2012b:29).
	Sturt Park	Gateway Park	HISTORICAL Recognises the role of Charles Sturt in exploration of Australia and the region, and Sturt's land grant along the Molonglo.
4 – Western Gorges	Possible feature/ place Aboriginal Place Name	Park	ABORIGINAL Possibly referencing water, river, pools etc.
	Catherine Park	Park	HISTORICAL This name reflects John Coppin's wife Catherine Sheedy. The Coppin's association with this part of the river is well known, but Catherine Sheedy's history is less well documented. This name provides the opportunity to recognise the role of women in the small farms that were spread along the Molonglo.
	Cravens Creek Park	Gateway Park	HISTORICAL In 1836 Captain Edmund Harrison Cliffe purchased some 4200 acres on the southern side of Molonglo, the property was called 'Craven Estate'. The name Cravens Creek has survived and this park name links into the existing creek name.
	Deep Creek Park	Gateway Park	HISTORICAL Deep Creek is an existing creek name that appears on survey maps from the early 1900s (1915, 1918) and is mentioned by Samual Shumack writing in 1927.
	Eagle Bend	Park	ECOLOGICAL Two known wedge tailed eagle nesting sites exist in the Reserve. The name provides the opportunity to raise awareness of this iconic species.
	Butters Bridge	Crossing	ENGINEERING Approved. To commemorate Sir John Henry Butters CMG MBE (1885-1969) Chartered Engineer; Administrator of Australia's Federal Capital; Company Director.

Landscape Zone	Place Name	Feature	Origin
	Finch Central	Interpretive Node	ECOLOGICAL Finch Central is a name adopted by members of the Canberra Ornithologists Group that was suggested through consultation with the Molonglo Bush on the Boundary group. A range of small woodland birds occur in Canberra, many of these species rely on habitat corridors, such as the Molonglo River Corridor.
	Gocentas Trails	Walking Tracks	COMMUNITY Gocentas Trails has social significance from recreational use of the river corridor by Rally car drivers. Dieter (Fred) Gocentas (1921 to 2013) is described by his peers as a 'brilliant' rally co-driver, who was an integral part of the Canberran and broader Australian rally driving community from the 1960s right through to 2012 (Lomas 2013; Rally Sport 2013). Suggested by the Canberra Rally Drivers.
	Limestone Crossing	Crossing	GEOLOGICAL Limestone Crossing is below the old Limestone Quarry, and adjacent to the limestone Lower Molonglo Geological Site known as G2.
	Opik Park	Park	GEOLOGICAL Opik Park is adjacent to the Lower Molonglo Geological Site. Armin Öpik was a Professor of geology who spent much of his working life in Canberra (from 1949) and contributed to recording numerous geological features at a time (through 1950s-60s) when the city was undergoing rapid change. Suggested by the Geological Society of Australia – ACT Branch.
	Blewitt's Park	Gateway Park	HISTORICAL Blewitt's has associations with a range of themes in the Molonglo valley, ranging from the early pastoralists, to the forestry industry through to recreational use of the area.
	Wombat Corner	Park	ECOLOGICAL Wombat Corner recognises the presence of wombats along the Molonglo in a formal park name.

Double-barred Finch
Taeniopygia bichenovii

APPENDIX 3. ACT AND COMMONWEALTH LEGISLATION MOST RELEVANT TO THE MOLONGLO RIVER RESERVE

Legislation	Provisions
Animal Diseases Act 2005	Provides for the control of endemic and exotic diseases of animals.
Animal Welfare Act 1992	Primary purposes are to promote vertebrate animal welfare and control activities that cause suffering to animals. Includes the gazetted code of practice for culling kangaroos and wallabies: Animal Welfare (Humane Shooting of Kangaroos and Wallabies) Code of Practice 2013.
Australian Capital Territory (Planning and Land Management) Act 1988 (Cwth)	Primary object is to provide for the planning of the Australian Capital Territory and the management of land in that Territory. The National Capital Plan is established under the Act and this plan provides the planning framework for a portion of the reserve.
Crimes Act 1900	Consolidates statutes related to criminal law.
Domestic Animals Act 2000	The identification and registration of certain animals including dogs and cats, setting out the duties of owners, carers and keepers. Includes provisions for the declaration of cat curfews in nominated areas.
Emergencies Act 2004	Primary object is to protect and preserve life, property and the environment. The Act requires the preparation of a Strategic Bushfire Management Plan for the ACT. It also establishes the ACT Rural Fire Service as the body responsible for operational planning and fire response in rural areas.
Environment Protection Act 1997	The regulatory framework to help reduce and eliminate the discharge of pollutants into the air, land and water. Environmental protection policies are established under the Act, which also sets water quality standards. This Act therefore governs the quality of the water that can be released from the Lower Molonglo Water Quality Control Centre.
Environment, Protection, Biodiversity and Conservation Act 1999 (Cwth)	Provides for the protection of matters of national significance and provides the assessment and approval framework where activities may have a significant impact on those matters.
Firearms Act 1996	Provides for the use of firearms by park personnel.
Fisheries ACT 2000	Objects are to conserve native fish species and habitats and to sustainably manage ACT fisheries.
Heritage Act 2004 and amendments in Heritage Legislation Amendment Bill 2013	Establishes a system for the recognition, registration and conservation of natural and cultural heritage places and objects. A list of these places is maintained on the ACT Heritage Register.
Litter Act 2004	Provides for the control and regulation of litter including dumping.
Nature Conservation Act 2014	The protection and conservation of native plants and animals, declaration of threatened species and ecological communities, and authority for areas reserved for conservation of the natural environment.
Pest Plants and Animals Act 2005	Main objects are to protect the land and water resources of the ACT from threats from pest plants and animals and to promote a strategic and sustainable approach to pest management.
Planning and Development Act 2007	Predominant legislation governing the planning, development and management of land in the ACT. It includes the requirement for Land Management Agreements (Section 283) between the ACT Government and rural leaseholders.
Public Health Act 1997	Provides for the protection of the public from public health risks, including those relating to water quality.
Public Unleased Land Act 2013	Provides for temporary roads, temporary closure of roads and use of public places.
Prohibited Weapons Act 1996	Prohibits the possession of certain dangerous weapons and other articles.
Stock Act 2005	Contains regulations for the control of stock and ruminants.
Trespass on Territory Land Act 1932	Provides for the regulation of straying stock, illegal camping, and unauthorised occupation of public or private land.
Water Act 2007 (Cwth)	Main objectives are to promote and co-ordinate effective planning and management for the equitable, efficient and sustainable use of the water and other natural resources of the Murray–Darling Basin.
Water Resources Act 2007	The sustainable use and management of ACT water resources; the protection of aquatic ecosystems and aquifers from damage and, where practicable, reversal of past damage. The ACT water resources strategy and environmental flow guidelines for streams are established under this Act.

APPENDIX 4. MOLONGLO DEVELOPMENT PRINCIPLES AND POLICIES THAT SHAPE THE RESERVE

Extracted from the Structure Plan for Molonglo and North Weston (ACT Government 2010a).

4. PRINCIPLES FOR THE DEVELOPMENT OF MOLONGLO AND NORTH WESTON FUTURE URBAN AREA

4.1 Sustainable development principles

1. The development will accord with the principles for sustainable development contained in the Statement of Strategic Directions.

4.4 Environmental principles

15. The landscape setting and values of Molonglo and North Weston will be recognised and incorporated into the urban design of the area. Boundary hills and significant internal ridges within the urban fabric will be excluded from inappropriate development.

17. Water sensitive urban design principles will be adopted at all levels of the development (block, neighbourhood, catchment) to minimise potable water consumption and manage water quality in the Molonglo River and its receiving waters.

19. Aboriginal and European heritage places will be recognised and significant sites conserved in public open space.

20. Bushfire risk assessments and management plans will be prepared consistent with relevant Government guidelines for bushfire mitigation.

21. Critical natural habitats and connectivity will be protected (i.e.: Kama property on the southern side of William Hovell Drive).

4.5 Landscape and open space principles

23. Development will be planned to respond to the topography of the area by minimising cut and fill, responding to key features (eg: views, vistas, ridges and drainage lines) and minimising the visual impacts of development.

24. Appropriate buffer areas will be provided in areas situated adjacent to existing development and existing major roads.

25. The river corridor is recognised as an important natural asset to the ACT and region. It will be planned as an integral part of the National Capital Open Space System by providing for continuity of recreation use with surrounding open space and the Murrumbidgee River corridor.

26. The environmental quality, landscape setting, natural and cultural values of the river corridor will be reinforced by the provision of an open space corridor on each side of the Molonglo River.

27. Provision will be made along the river corridor for a balanced range of recreational activities appropriate to the characteristics of the river and adjacent land, and in a manner that reinforces and protects the natural and cultural values of the river corridor.

30. Provision will be made for open space links between Stromlo Forest Park, Molonglo River corridor and the Canberra International Arboretum and Gardens suitable for equestrian, cycling and pedestrian use.

4.6 Urban design principles

31. Subdivision design and road layout will maximise access to 'special places' to enhance the character of Molonglo and North Weston and contribute to a 'sense of place'. Special places include Stromlo Forest Park, the Canberra International Arboretum and Gardens, the group and local centre, neighbourhood activity nodes, active and passive open spaces, riparian (creek and drainage) corridors, riverside parks and other open space corridors.

5. POLICIES FOR THE DEVELOPMENT OF THE MOLONGLO AND NORTH WESTON FUTURE URBAN AREA

5.3 Environment protection

40. Important hills and ridgelines which form the skyline of the Central National Area are to be generally excluded from development. These include the east side of the main ridgeline to the west of Tuggeranong Parkway (generally from Dairy Farmers Hill to the Molonglo River).

42. Leading practice bushfire risk management is to be implemented in all stages of planning (including concept plans and/or estate development plans) in accordance with the Territory's Strategic Bushfire Management Plan.

44. Areas with high conservation value will be protected from development where possible, and the impact of adjacent urban development minimised through suitable mechanisms including the provision of appropriate buffers. A wildlife corridor with associated high value woodlands and grasslands will be provided from the Belconnen Hills to the slopes of Mount Stromlo generally through the 'Kama' property (Blocks 1419 and 1020 District of Belconnen) and Spring Valley Farm (Blocks 402 and 404 District of Stromlo).

46. Buffers for bushfire protection, and to manage urban edge-effects, are to be provided between the identified 'Kama Nature Reserve' and urban development to the east, pending further assessment. The extent of any buffer is to be clearly identified in the relevant future concept plans. Any buffer implemented is to be located outside the boundaries of 'Kama' (Block 1419 District of Belconnen).

47. The lower Molonglo River gorge and Murrumbidgee River corridor are to be managed to protect bird habitats, and high value woodlands and grasslands.

5.7 Open space and recreation

60. Strong recreational links are to be facilitated in Molonglo and North Weston from Lake Burley Griffin to the Molonglo River, and between Stromlo Forest Park and the Canberra International Arboretum and Gardens.

66. Major passive open space areas are to be provided in conjunction with significant drainage lines, lake side reserves, together with prominent hills including Misery Hill and the smaller hill to its south east, and will generally be edged by streets, not back or side fences.

67. That part of the National Bicentennial Trail between Uriarra Road in the west to the concrete causeway over the Molonglo River in the east will be replaced by a suitably located mixed use off-road trail, linking Stromlo Forest Park and the Canberra International Arboretum and Gardens.

68. Bridle trails are to be incorporated into the development where required. Where provided, mixed use trails will link to existing equestrian facilities including the National Bicentennial Trail, the Pegasus Disabled Riding School, Forest Park Riding School, the public Equestrian Park in Yarralumla, pony clubs and agistment facilities. The trails will also connect to recreation trails in Canberra International Arboretum and Gardens and Stromlo Forest Park.

5.9 Stormwater management

72. A stormwater management strategy will be adopted to control stormwater runoff from the Molonglo and North Weston urban development. This strategy will also seek to improve the water quality of Woden and Weston Creek where possible. A pond on Weston Creek (located between the Cotter Road and the Molonglo River) is to be provided within the urban open space zone. The pond will treat stormwater run-off from the existing Weston Creek district (including North Weston) and a small part of the Molonglo urban development.

74. The Weston Creek pond will be suitably landscaped to provide a high amenity and passive recreation feature.

5.11 Transport

80. Shared paths (bicycle/pedestrian) will provide access to key features within Molonglo and North Weston including the river corridor, commercial centre and small commercial centre, local centres, Stromlo Forest Park and the Canberra International Arboretum and Gardens, generally in accordance with *Figure 2*. The paths will also connect to existing shared paths that link Molonglo with the City and the districts of Belconnen, Weston Creek and Woden Valley.

83. At least two road crossings of the Molonglo River are to be provided, one for the north-south arterial road and the other for the east-west arterial road.

APPENDIX 5. ACTIONS AGREED IN THE NES PLAN THAT MUST BE ADDRESSED IN THIS MANAGEMENT PLAN

The NES Plan (ACT Planning and Land Authority 2011) includes actions that fall outside the boundaries of the Reserve e.g. the total requirement for 234 ha of Box-Gum Woodland to be protected includes an area (Patch GG) adjoining the National Arboretum and will be managed by the Arboretum. The actions listed here are only those that depend on this Management Plan for their achievement.

In cross-referencing to the NES Plan, only the following patches fall within the Reserve: A, B, and O in Kama and Q, R, S, K, T and part of D (17.2 ha) mostly on the southwestern side of the river in the urban section. Their combined area is 245 ha.

Conservation outcome	Agreement (beginning with action no.)
BGW (a) Impacts to Box-Gum Woodland will be limited to a maximum of 110 ha and a range of measures will be implemented to minimise this area of impact.	3. Design the infrastructure that will occur in the river corridor to minimise impacts to Box-Gum Woodland.
	4. Develop, implement and independently monitor Construction Environmental Management Plans (CEMPs) to ensure that unforeseen direct or indirect impacts from construction activities within the development area and the river corridor are avoided.
BGW (b) Three offset sites will be established within the strategic assessment area (Kama Nature Reserve, Molonglo River Park, Patch GG) that will provide for the long term protection of 234 ha of Box-Gum Woodland. The three offset sites will be adaptively managed to maintain and enhance the ecological condition of the Box-Gum Woodland that occurs there.	5. Develop a management plan for the Kama Nature Reserve to provide for the maintenance and enhancement of the ecological condition of Box-Gum Woodland within the reserve (approximately 117 ha).
	6. Implement the management plan for the Kama Nature Reserve to provide for the maintenance and enhancement of the ecological condition of Box-Gum Woodland within the reserve.
	7. Establish a buffer outside the Kama Nature Reserve between the reserve and the proposed development area, and allow for appropriate uses consistent with nature conservation uses of the reserve. The buffer will be developed to ensure that fire management is undertaken outside of the Kama Nature Reserve and will provide protection against urban edge effects.
	9. Develop a management plan for the Molonglo River Park to provide for the maintenance and enhancement of the ecological condition of Box-Gum Woodland within the park (approximately 73 ha).
Improving and applying the knowledge about the management of Box-Gum Woodland.	10. Implement the management plan for the Molonglo River Park to provide for the maintenance and enhancement of the ecological condition of Box-Gum Woodland within the park.
NTG (a) No direct or indirect impacts to Natural Temperate Grassland.	23. Establish and manage an off-site restoration project, as an indirect offset, for Box-Gum Woodland.
NTG (b) Adaptive management of the Natural Temperate Grassland that occurs within the Kama Nature Reserve to maintain and enhance its ecological condition.	24. Protection of the Natural Temperate Grassland within the Kama Nature Reserve.
	25. Develop a management plan for the Kama Nature Reserve to provide for the maintenance and enhancement of the ecological condition of Natural Temperate Grassland within the reserve.
	26. Implement the management plan for the Kama Nature Reserve to provide for the maintenance and enhancement of the ecological condition of Natural Temperate Grassland within the reserve.
PTWL (a) Impacts to high and moderate quality PTWL habitat will be limited to a maximum of 27 ha and a range of measures will be implemented to minimise this area of impact.	27 Same as 7.
	29. Amend the East Molonglo river corridor boundary in stages 2 and 3 respectively with a view to reducing impacts to high and moderate quality PTWL habitat. This process will ensure that connectivity within the river corridor is maintained.

Conservation outcome	Agreement (beginning with action no.)
PTWL (b) Two offset sites will be established within the strategic assessment area (Kama Nature Reserve and the Molonglo River Park) that will provide for the long term protection of 66 ha of high and moderate quality PTWL habitat. These areas will be adaptively managed to maintain and enhance the ecological condition of the PTWL habitat that occurs there.	30. Design the infrastructure that will occur in the river corridor to minimise impacts to high and moderate quality PTWL habitat.
	31. Develop, implement and independently monitor Construction Environmental Management Plans (CEMPs) to ensure that unforeseen direct or indirect impacts from construction activities within the development area and the river corridor are avoided.
	32. Develop a management plan for the Kama Nature Reserve to provide for the maintenance and enhancement of the ecological condition of all PTWL habitat within the reserve (approximately 6 ha which includes 3.33 ha of high and moderate quality habitat).
	33. Implement the management plan for the Kama Nature Reserve to provide for the maintenance and enhancement of the ecological condition of all PTWL habitat within the reserve.
	34. Same as 7.
PTWL (c) Continued protection of 28.1 ha of high and moderate quality PTWL habitat within the Lower Molonglo Nature Reserve. These areas will be adaptively managed to maintain the ecological condition of the PTWL habitat that occurs there.	36. Develop a management plan for the Molonglo River Park to provide for the maintenance and enhancement of the ecological condition of high and moderate quality PTWL habitat within the park (approximately 62 ha).
	37. Establish a 20 m buffer around high and moderate quality Pink-tailed worm-lizard habitat (other than, for example the areas to be impacted by the bridge crossings and strategically placed walking tracks) within the East Molonglo river corridor. Manage these areas to ensure the maintenance of their conservation value. Management measures (as outlined in Section 3) will be incorporated into the management plan for the river corridor.
	38. Implement the management plan for the Molonglo River Park to provide for the maintenance and enhancement of the ecological condition of high and moderate quality PTWL habitat within the park.
	40. Continued implementation of the Management Plan for the Lower Molonglo Nature Reserve to provide for the maintenance of the ecological condition of the high and moderate quality PTWL habitat that occurs there (approximately 28.1 ha).

Molonglo River riffles

Also relevant are agreements:

NES Plan	Agreement
Page 10	Development of the "Molonglo River Park" Concept Plan as an offset site along the East Molonglo River. This Plan will establish management zones within the Park, specifically identifying areas to be designated for conservation as well as identifying recreation areas and resolving public access. The Plan will also be complementary to the management approaches developed for the area of the river corridor adjacent to Coombs as required in relation to EPBC referral 2009/5050.
Page 11	Development and implementation of a management plan for the river corridor with a focus on providing long-term outcomes for Box-Gum Woodland and the Pink-tailed worm-lizard. This management plan will then inform a statutory Plan of Management for the East Molonglo River Corridor.
Page 11	Implementation of a number of research projects to improve the knowledge relating to the conservation of Pink-tailed worm-lizard and Box-Gum Woodland.
Page 12	Within the strategic assessment area fire management will be aimed at the protection of both built assets and MNES values. This will be achieved through the identification of appropriate asset protection zones and the application of hazard reduction techniques that will both: • ensure that the standards for fuel loads in the SBMP are met; and • protect MNES values through the use of sympathetic management techniques.
Page 17	It is also important to note that under Division 3.3 of the Nature Conservation Act 2014Nature Conservation Act 2014, Pink-tailed worm-lizard has been declared a vulnerable species and Natural Temperate Grassland and Box Gum Woodland are declared endangered communities. The effect of these statutory declarations is that these species and communities need to be managed in accordance with a prescribed Action Plan, prepared by the Conservator for Flora and Fauna.
Page 20	"Ecological condition" for Box-Gum Woodland will be measured using a peer reviewed, repeatable and scientifically robust methodology for examining and comparing the condition of woodland and derived grassland patches over time.
Pages 41-43	Develop an Adaptive Management Strategy to set out the framework for achieving the NES Plan's commitments through monitoring, evaluation, experimental design, reporting, auditing and continuous improvement processes. The Strategy will inform the content and timing of specific management plans and actions to ensure a consistent, integrated and efficient application of adaptive management principles and practices to achieve long term conservation outcomes for MNES. The approved Adaptive Management Strategy will be submitted for approval by the Minister (Commonwealth) or delegate.

APPENDIX 6. BASIC AREAL STATISTICS FOR THE RESERVE

Estimates based on the boundaries proposed in Section 3.1 and calculated from the data used to provide the maps in this Plan. Totals may not add due to rounding errors.

The perimeter of the Reserve is 49 km.

Attribute	Area (ha)	Proportion
Whole of Reserve (Figure 3.1, p34)	**1280**	
Rural section	740	58%
Urban section	540	42%
Vegetation communities (Figure 6.1, p68)		
Box Gum Grassy Woodland	196	15%
Mixed native & exotic grassland	483	38%
Callitris endlicheri Tableland Woodland	137	11%
Casuarina cunninghamiana Tableland Riparian Woodland (includes the river and aquatic vegetation)	224	18%
Eucalyptus pauciflora-E. rubida Tableland Woodland	69	5%
E. dives-E. bridgesiana Tableland Woodland	7	1%
E. macrorhyncha-E. rossii Tableland Forest	25	2%
Natural Temperate Grassland	45	4%
Remnant pines	70	5%
Tableland Shrubland	24	2%
Total	**1280**	**100%**
Pink-tailed worm-lizard habitat (found across several of the vegetation communities listed above) (Figure 6.1, p68)		
In rural section (excluding buffers)	177	14%
In urban section (including buffers)	145	11%
Total	**322**	**25%**
Ecological management zones (Figure 6.2, p70)		
Threatened	467	37%
Dryland matrix	612	48%
River and riparian*	201	15%
Total	**1280**	

* A small area of PTWL habitat is mapped in this zone and accounted for in the 'threatened' zone

APPENDIX 7. FUEL MANAGEMENT STANDARDS

Relevant excerpts from the ACT Bushfire Management Strategy (ACT Emergency Services Agency 2014b) Refer to the full document for explanation of grassland fire hazard rating.

Table 4 Fuel management standards – Asset Protection Zones

Outer		
Default standards to be applied across at least 70% of the zones as mapped. Where default standards cannot be achieved, the responsible land manager may identify alternative treatments to meet the overall objectives for the zone. Any significant variation on the default standards shall be approved by the ESA.	Forest and Woodland	Overall fuel hazard ≤ moderate
	Grass and open Woodland	Grassland fire hazard[1] ≤ 35% when grassland curing ≤70%

ESA = ACT Emergency Services Agency

Table 5 Fuel management standards – Strategic Fire Fighting Advantage Zones (SFAZs)

SFAZ Type	Vegetation or break type	Fuel management standards
Broad area treatment		
Application of broad-area hazard reduction burning that aims to reduce fuel across multiple landscape elements (ridges, side slopes, gullies) and treat at least 70% of the area identified. Where default standards cannot be achieved, the responsible land manager may identify alternative treatments to meet the overall objectives for the zone. Any significant variation on the default standards shall be approved by the ESA.	Forest and shrubland	Overall fuel hazard ≤ high
	Grass and open woodland	Grassland fire hazard ≤ 50 when grassland curing ≤ 70%
	Identified arterial roads, rural roads and easements	Grassland fire hazard ≤ 35 when grassland curing ≤70%
Linear breaks		
Standards to be applied across at least 70% of zones as mapped. Where default standards cannot be achieved, the responsible land manager may identify alternative treatments to meet the overall objectives for the zone.	Identified arterial roads, rural roads and easements	Grassland fire hazard ≤ 35 when grassland curing ≤ 70%
	Forest greenbreaks	Overall fuel hazard ≤ high
Ridgetop burning treatments		
Application of broad-area hazard reduction burning that aims to reduce fuel, primarily along ridgelines and side slopes aiming to treat in the order of 30–50% of the gross area identified as 'ridgetop burns'.	n/a	Overall fuel hazard ≤ high

Table 6 Fuel management standards – other zones

Zone	Treatment Standards
Landscape Fire Management Zone	Fuel management standards not applied
Agricultural Fire Management Zone	Requirements will be defined in bushfire operational plans, developed through the Farm Firewise program.

[1] The grassland fire hazard is a score deriving from the height of grass (m) and the amount of cover (%). See Section 21.2.1 Explanatory notes

Urban edge
at Wright

APPENDIX 8. ECOLOGICAL FIRE THRESHOLDS FOR VEGETATION COMMUNITIES THAT OCCUR IN THE RESERVE

Table 2-7 from Kitchin (2008)

Community	Fire thresholds (min – max fire interval in years)	Fire threshold guidelines
Forests		
River She-oak Dry Riparian Forest	25–100	A decline in biodiversity is likely if: 1) 2 or more consecutive fires occur with inter-fire intervals of <25 years, and 2) no high intensity fires occur within 50-100 years.
Black Cypress Pine – Brittle Gum Tall Dry Forest	No planned burning	No planned burning until recovery post 2003 fires is fully assessed and established.
Red Stringybark – Scribbly Gum Tall Dry Forest	10–50	A decline in biodiversity is likely if: 1) 3 or more consecutive fires occur with inter-fire intervals of <10 years, and 2) no moderate to high intensity fires occur within 50-100 years.
Woodlands		
Blakely's Red Gum – Yellow Box Grassy Woodland	10–40 (possibly longer)	A decline in biodiversity is likely if: 1) 3 or more consecutive fires occur with inter-fire intervals of <10 years, and 2) no moderate to high intensity fires occur within 40-50 years.
Snow Gum Grassy Woodland	12–50	A decline in biodiversity is likely if: 1) 3 or more consecutive fires occur with inter-fire intervals of <12 years, and 2) no moderate to high intensity fires occur within 50-100 years
Apple Box – Broad-leaved Peppermint Shrubby Woodland	unknown	
Shrublands		
River Bottlebrush – Burgan Rocky Riparian Shrubland	10–30	A decline in biodiversity is likely if: 1) 3 or more consecutive fires occur with inter-fire intervals of <10 years, and 2) no high intensity fires occur within 30 – 40 years.
Grasslands		
Kangaroo Grass – Wallaby Grass – Spear Grass Tableland Dry Tussock Grassland	4–10	There is currently insufficient data to estimate the maximum interval but some evidence indicates it would be approximately 10 years.
Kangaroo Grass – Purple Wiregrass Dry Tussock Grassland	4–10	
River Tussock Tableland Wet Tussock Grassland	Unknown	
Riparian communities		
Tableland Aquatic Fringing Wetlands	No planned burning	

APPENDIX 9. ABORIGINAL SITES IN THE URBAN SECTION OF THE RESERVE THAT HAVE MANAGEMENT REQUIREMENTS

Reproduced from Huys et al. (2013). References refer to the Huys et al. report.

Site Name	Site Type	Management Recommendation
MRC 14	Scarred tree	Salvage collect scar, and re-locate to conservation area.
MRC 15	Scarred tree	Conserve in-situ.
MRC 17	Artefact scatter	Conserve site in-situ
MOL A1/1821	Artefact scatter	Site status is unknown. Requires relocation and management of finds. Site within BIOSIS (2012a/b) survey area.
MOL IF7	Isolated find	Site status is unknown. Requires relocation and management of finds. Most likely salvage collection and re-location of artefact prior to construction work commencing
12B1	Artefact scatter	Within CHMA 2009b study area. Reported to be under several metres of fill. Seek de-classification.
12B3	Isolated find	Site status is unknown. Requires relocation and management of finds. Site within BIOSIS (2012a/b) survey area.
12B4	Isolated find	Site status is unknown. Requires relocation and management of finds. Site within BIOSIS (2012a/b) survey area.
1263	Artefact scatter	Requires relocation and management of finds. Within CHMA 2009b study area. Same sites as 6N1. Reported to have been destroyed. Seek de-classification.
1275	Isolated find	Site status is unknown. Requires relocation and management of finds. Site within BIOSIS (2012a/b) survey area.
1/2 3/6E 1	Isolated find	Site status is unknown. Requires relocation and management of finds. Site within BIOSIS (2012a/b) survey area.
1/5 2/6N 1	Artefact scatter	Within CHMA 2009b study area, however not re-located during that survey. Reported to have been destroyed. Seek de-classification.
Aboriginal cultural area	Special cultural area	Identified and recorded by Biosis (2013). Avoid impacts. See Biosis (2013 for details)
PAD 1 (CHMA 2013)	Potential Archaeological Deposit	Conserve site within Conservation Area
PAD 5 (AASC 2006)	PAD – Medium Archaeological Sensitivity	Identified by AASC (2006). PAD within BIOSIS (2012a/b) survey area. Not test pitted. Further works required.

Marine fossil bearing limestone

Aerial view of
Molonglo River Reserve

ACT Government

THE RIVER RESERVE IS OUR TREASURED FRONT YARD

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