



ACT
Government

Territory and Municipal Services

AUGUST 2014 - 2017

ARBORETUM WOODLAND CONSERVATION AREA OPERATIONAL PLAN

ARBORETUM WOODLAND CONSERVATION AREA

NATIONAL ARBORETUM

About this Plan

This Plan has been developed to help guide on-ground works and activities that will implement key components of the Molonglo Valley Plan for the Protection of Matters of National Environmental Significance (ACTPLA 2011; NES Plan), the Molonglo Adaptive Management Strategy (TAMS 2013), Molonglo River Reserve Plan of Management (*in prep*), the ACT Nature Conservation Strategy 2013-2023 (ESDD 2013), the ACT Strategic Bushfire Management Plan (ESA 2009), the ACT Weeds Strategy 2009-2019 (DECCEW 2009), the ACT Pest Animal Management Strategy 2012-2022 (ESDD 2009) and numerous ACT action plans, strategies and policies.

The Plan is designed to be used in conjunction with the Molonglo River Reserve and Offset Areas Ecological Management Guidelines (TAMS *in prep*), the Molonglo Development Fire Management Strategy (TAMS *in prep*), the Ecological Guidelines for Fuel and Fire Management Operations (ACT Government 2012), the BOP and the eWOP. The Plan is the primary planning tool for providing for adaptive management approaches based on the results of monitoring, evaluation and review. Justification and further information on management protocols and methods identified in the Operational Plan are found in the above documents.

This Plan will be put into effect through works programs, which will be reviewed and updated annually.

Background

The NES Plan identifies Patch GG as an offset site. In 2012 Patch GG was incorporated into the National Arboretum as a forest exhibit in accordance with the NES Plan Action 11 and on 10 February 2014 Patch GG was transferred to TAMS. The Arboretum Woodland Conservation Area comprises NES Patch GG1, GG2, N1, N2 and N3.

The Conservation Area consists of parts of Blocks 6 and 7, Molonglo Valley and is bordered by the National Arboretum to the south, the Glenloch Cork Oak Plantation to the east and rural leasehold land and William Hovell Drive to the north and west (Figure 1). Suburbs are to be developed to the west of the conservation area as part of the Molonglo Stage 3 development.

Conservation Values

The Arboretum Woodland Conservation Area (69 ha) protects one listed Heritage site, 56 ha of critically endangered Yellow Box -Blakely's Red Gum Grassy Woodland (BGW) in varying condition, potential Superb Parrot habitat, declining woodland bird habitat and potential Pink-tailed Worm-lizard habitat (Figure 2). The remaining 13 ha supports non-listed BGW, mixed native and exotic grassland with a high abundance of St John's Wort and exotic annuals.

Land Use History

Prior to 2012 the Arboretum Woodland Conservation Area was part of the rural property 'Glenloch'. The conservation area has experienced a long grazing history with evidence of pasture improvement within patches N (Eco Logical 2013). The area is currently strategically grazed, under the instruction

of PCS staff, for positive ecological outcomes and fire mitigation only. Fencing and watering points are indicated in Figure 3.

Over 40% (31ha) of the Arboretum Conservation Area was burnt in January 2003. The fire primarily affected the southern section of the Conservation Area bordering the National Arboretum (Figure 4).

Ecological Values

Connectivity

The Arboretum Woodland Conservation Area provides a potential corridor between the Belconnen Woodlands and the lower Molonglo River (via the National Arboretum), as well as a potential link to the east-west woodland/forest corridor formed by The Pinnacle, Mount Painter, Aranda Bushland and Black Mountain Reserve (Figure 1 and 5). The current regional linkage value for the conservation area is low and the local linkage value is moderate (ACTPLA 2014), though the value will increase as the Arboretum Woodland matures and its habitat value improves (Figure 5).

The existing connectivity across broadly linked paddock trees in the rural land between the Arboretum Woodland to the Molonglo River will be modified once the urban areas are developed.

Ecological communities

There is one threatened vegetation community in the Arboretum Woodland Conservation Area (Figure 2; Table 1).

Table 1: Threatened ecological communities in the Arboretum Woodland Conservation Area

Ecological Community	Cwlth*	ACT**	NSW***	Area	NES Patches
White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland)	Critically endangered	Endangered	Endangered	56 ha	GG1, GG2, N2

Flora

No threatened or regionally rare plant species have been recorded within the Arboretum Woodland Conservation Area.

Fauna

The Arboretum Woodland provides habitat for several threatened and declining species. Although Pink-tailed Worm-lizard have not been found within the conservation areas there is a small area of potential habitat. It provides a low link for birds and other fauna between Belconnen Woodlands and the Molonglo River and beyond. Threatened or declining fauna in the Arboretum Woodland Conservation Area are listed below.

Table 2: Threatened or declining fauna in the Arboretum Woodland Conservation Area

Scientific Name	Common Name	Cwlth*	ACT**	NSW***	Notes
<i>Aprasia parapulchella</i>	Pink-tailed Worm-lizard	Vulnerable	Vulnerable	Vulnerable	0.45 ha of potential habitat

Scientific Name	Common Name	Cwlth*	ACT**	NSW***	Notes
<i>Lalage sueurii</i>	White-winged Triller		Vulnerable		
<i>Chthonicola sagittata</i>	Speckled Warbler			Vulnerable	Regionally declining
<i>Stagonopleura guttata</i>	Diamond Firetail	Near threatened		Vulnerable	Regionally declining
<i>Aphelocephala leucopsis</i>	Southern Whiteface				Regionally declining

*Australian Government Environment Protection and Biodiversity Conservation Act 1999

**Nature Conservation Act 1980 (ACT)

***National Parks and Wildlife Act 1974 (NSW)

Canberra Ornithologists Group

A full list of flora surveyed in the Conservation Area is included in Appendix A.

Cultural Heritage Values

Identified heritage places and objects

There is one listed Aboriginal Place of significance (Figure 6; Site name: CLB4(B4)) located in Patch N1 (refer to <http://prdapp008/app/flex/heritageaudit/index.html>).

Visitor and Community Awareness

Recreation activities

Currently there is no public access to the Arboretum Woodland, as it has only recently been withdrawn from leasehold.

Conservation Area access

Entrances to the Conservation Area are from the National Arboretum northern boundary access track.

The Arboretum Woodland will be designated dog-free and the suburbs to be developed to the west of the Conservation Area will require cats to be contained.

Interpretation and information

Currently there are no information signs within the Conservation Area

Key Stakeholders

Community involvement

PCS will consult and engage with community groups to assist and implement conservation management works within the Arboretum Woodland.

Southern Tablelands Ecosystems Park (STEP inc.)

- Regional Botanic Garden, education and conservation centre demonstrating southern tablelands species within the National Arboretum and adjacent to the Arboretum Woodland Conservation Area (Tony Lawson: secretary@step.asn.au)

Land management, monitoring and research

Parks and Conservation Service (TAMS)

- Land management
- NES vegetation and habitat condition monitoring (Figure 7)
- Golden-sun Moth translocation research project (Figure 7; Clare McInnes: 02 6205 4680)

National Arboretum (TAMS)

- The Arboretum Woodland Conservation Area is an exhibit within the National Arboretum
- Maintenance of Arboretum boundary fences adjacent to Patch GG and N (ph: 02 6205 5082)

Conservation Planning and Research (EPD)

- Implementation of Action Plans for Box-Gum Woodland and Pink-tailed Worm-lizard
- Geodatabase management for threatened and rare species

Rural neighbours

- Western border (Rural lease): Mr Neville Stuart (ph: 02 6251 1008; mob: 0409 447 418; email: glenloch@inspired.net.au)
- Western border (Grazing licence): Molonglo Cattle Group (Graeme Haynes: 0407 919 661; Ryan Walsh: 0411 030 281; Noel Davis: 0407 910 919)

Infrastructure

ACTEW

- Water main maintenance in Patch GG (Figure 3; ph: 13 21 93)

Management Objectives

Although not within the Molonglo River Reserve, the draft Statutory Plan of Management identifies the following objectives relevant to the Arboretum Woodland Conservation Area:

GEOLOGY, LANDFORMS, SCENERY AND SOILS

- 3.** Ensure that no land remains close to or below a critical threshold for landscape function in the long term.
- 4.** People are able to access, view and enjoy a diversity of scenery that is dominated within the Reserve by natural features.

ECOLOGICAL CONSERVATION

- 5.** The population size of threatened species increases and the extent of listed dryland threatened communities is at least maintained and their condition improved.
- 6.** Maintain the diversity of all other native species and improve the ecological condition of the dryland matrix.
- 8.** Achieve fire protection for people and property in ways that also effectively protects threatened habitat and other ecological conservation values.
- 9.** Connectivity within and outside the Reserve is addressed and improved.

ABORIGINAL CONNECTIONS

- 10.** Respect, promote and protect Aboriginal use, past and current, of the land and waters of the Lower Molonglo River.

SETTLEMENT HISTORY

- 11.** Protect, promote and respect the European cultural heritage in the Reserve.

RECREATION

- 13.** Residents in Molonglo 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.

INFRASTRUCTURE AND OPERATIONS

- 16.** Avoid or minimise the impact on Reserve values of building and maintaining infrastructure and facilities in or nearby the Reserve.
- 17.** Suitable access and associated infrastructure is available for fire management.
- 18.** Minimise harm to people and the environment from Reserve operations.

NEIGHBOURS AND COMMUNITIES

- 19.** Achieve productive working relationships with neighbours that contribute towards its management.
- 20.** Achieve strong community support for the Reserve and active contributions towards its management.

GOVERNANCE, KNOWLEDGE AND IMPLEMENTATION

- 21.** Inform future decision making with a structured, evidence-based process.
- 22.** Foster the development of new knowledge and its application to management actions for achieving other Reserve objectives.

The NES Plan

Management of the Arboretum Woodland Conservation Area is to be implemented in accordance with the requirements of the *Molonglo Valley Plan for the Protection of Matters of National Environmental Significance* (ACTPLA 2011; NES Plan) and the Molonglo Adaptive Management Strategy (TAMS 2013). The NES plan identifies that conservation activities are based around two processes: avoidance and mitigation of impacts on Matters of National Environmental Significance (MNES); and on-ground management to provide maintenance and improvement of MNES values.

The Operational Plan is a management planning tool that provides detail about on-ground works and activities and will be the primary mechanism for providing for adaptive management approaches based on the results of monitoring, evaluation and review. Operational Plans should be read together with the *Molonglo River Reserve and Offset Areas Ecological Management Guidelines* (TAMS in prep).

A *Monitoring Procedures Manual* (Sharp and Milner 2014) has also been prepared for the Molonglo. The manual provides a step by step guide to ongoing vegetation and habitat condition monitoring in Molonglo.

The objectives are consistent with requirements for management of the Arboretum Woodland as an offset site as defined in the NES Plan (ACTPLA 2011), as follows:

Develop a management plan for Patch GG (Arboretum Woodland) to provide for the maintenance and enhancement of the ecological condition of:

- NES Action 12. Box-Gum Woodland within the reserve.

Implement the management plan for Patch GG (Arboretum Woodland) to provide for the maintenance and enhancement of the ecological condition of:

- NES Action 13. Box-Gum Woodland.

Pp 37-38, NES Plan: The management plan for the Arboretum Woodland Conservation Area is to incorporate:

- Protection of MNES values.
- Appropriate fire management and biomass control to achieve/maintain environmental condition targets.
- Control of access to achieve/maintain environmental condition targets.
- Weed management, priority given to reducing weed species that have the greatest adverse ecological impact.
- Feral animal management to avoid native animal predation and rabbit grazing.
- Management of hydrological processes.
- Restoration of the ecological attributes lost within the lower Molonglo Valley
- Appropriate condition monitoring against the objectives for management.

Management Challenges and Principles for the Arboretum Woodland

Challenges	Principles (from the 'Molonglo River Reserve and Offset Areas Ecological Management Guidelines')
1. Biomass management	<ul style="list-style-type: none"> • Biomass management will include planned burns¹, strategic grazing² and selective slashing (mostly along management tracks and around the boundary) to maintain diversity of structure, habitat and composition for threatened species and communities. Particular guidelines include: <ul style="list-style-type: none"> ○ Maintain biomass of the lowers strata within BGW between 1.5-4 t/ha on average measured in autumn. ○ Biomass removal should not be undertaken if the lower strata biomass level is below 1.5 t/ha. ○ Maintain approximately 70% groundcover to minimise erosion but still retain open spaces to allow for recruitment of forbs and other non-dominant species. ○ Impacts of rabbits, grazing by livestock or other fire fuel management actions will be addressed before consideration is given to controlling kangaroo abundance. ○ Utilise stock grazing to enhance habitat and species diversity and if other methods of biomass management are not appropriate or possible. ○ Graze at high intensity for short periods between late summer and early winter, to reduce opportunity to selectively graze disturbance sensitive species. ○ Undertake burns no more frequently than ten years apart in woodland and three to five years apart in grassland and five years in Pink-tailed Worm-lizard habitat, or according to the <i>Ecological Guidelines for Fuel and Fire Management Operations</i> if these are modified. ○ Burn in mosaics, with no two areas burnt in the same or successive years and no more than 25% of patches at one time. ○ Undertake low intensity patchy burns resulting in low impacts on woody vegetation. ○ Maintain a buffer of at least 20 m around Pink-tailed Worm-lizard habitat during control burns if undertaken outside the recommended fire frequency. ○ Manage a buffer zone around hollow bearing trees during burn operations. ○ Slash at a minimum height of 100 mm along tracks and boundaries for visibility and provision of a fire break. ○ Remove clippings if they are likely to smother established plants. ○ Use a hand-held brush-cutter if required to reduce biomass in rocky areas. ○ Enhance natural regeneration of saplings and shrubs or undertake plantings, outside of asset protection areas.
2. Fire fuel mitigation and wildfire suppression	<ul style="list-style-type: none"> • BOP activities must be conducted in accordance with the <i>Ecological Guidelines for Fuel and Fire Management Operations</i>, the <i>Molonglo River Reserve and Offset Area Ecological Management Guidelines</i>, the <i>Molonglo Development Fire Management Strategy</i> and Management Principles identified within Challenge 1 (Biomass Management). • Avoid fire suppression that may impact habitat within the Conservation Area. • Chemical fire retardant, fire fighting foam or wetting agents should not be used in the Conservation Area.

¹ Planned burns may include burns undertaken solely for ecological purposes, or burns for wildfire mitigation where these are not in conflict with meeting ecological outcomes.

² Strategic grazing will include consideration of the advantages and disadvantages of all forms of biomass removal (see Sharp et al., in prep.), levels of biomass, restrictions on the use of planned burns, frequency, intensity and timing of grazing.

3. Enhancement of habitat values	<ul style="list-style-type: none"> • Areas dominated by weeds may require long-term strategic control involving reduction in nutrient levels, removal of weeds, control of secondary weed invasion, revegetation and enhancement of other habitat attributes. • Restoration through enhancement of habitat attributes such as groundflora, canopy cover, shrub layer, logs and rocks may be appropriate.
4. Invasive plants	<ul style="list-style-type: none"> • Listed weed species include, St John's Wort, Sweet Briar, Hawthorn, Boxthorn, Blackberry, Paterson's Curse, Bathurst Burr and Thistle • St John's Wort and Sweet Briar is common and widespread. Weed control should target St John's Wort and woody weeds. • Exotic annual grass cover is high in several locations and the further spread of the weeds should be limited. • With increased visitation weeds such as African Lovegrass, Chilean Needlegrass, Fireweed and Serrated Tussock may invade. Strict vehicle hygiene should be observed at all times as the threat of potential weed incursion from utility, contractor and authorised vehicles are very high. • African Lovegrass poses a significant ecological and fire hazard threat to the Conservation Area. New incursions to be treated immediately and soil disturbance minimized to reduce potential for invasion. • Treatment of weeds at Conservation Area entry points, along management tracks and walking trails and within infrastructure easements should be a priority of the Conservation Area's weed control activities. • Woody weeds may be providing habitat for declining woodland birds. Phased woody weed control and a mid-storey shrub regeneration or replacement program will reduce impacts on the bird community. • Weed management programs should consider the use of multiple control techniques (incl. herbicide application, manual removal, shading, strategic grazing, ecological burns, nutrient manipulation etc)
5. Invasive animals	<ul style="list-style-type: none"> • Pest animal issues from uncontained suburban pets may become an issue within the Conservation Area as suburbs are developed to the west. • Predation by foxes and cats pose a significant threat to threatened and declining woodland birds and to threatened lizard species. • Rabbit abundance is low. Deer, feral pigs and feral goats have been observed in low numbers in the nearby Molonglo River Reserve. Feral rabbits, deer, goats and pigs threaten flora and fauna habitat and may also compete with native fauna for resources. • Indian Mynas and other invasive introduced birds may impact native species and habitat as urban development builds up adjacent to the Park. • All pest control programs should be conducted in coordination with neighbouring landholders. • Pest management programs should consider the use of multiple control techniques (incl. baiting, trapping, fumigation, shooting, exclosure fencing etc). • Ripping of rabbit burrows should be avoided to minimise soil disturbance. • Neighbouring suburbs to be cat containment areas.

6. Infrastructure: vehicles and track maintenance	<ul style="list-style-type: none"> • Strict vehicle hygiene should be observed at all times, as the threat of potential weed incursion from utility, contractor and authorised vehicles are very high. • All vehicle access (including quad bikes) is to be excluded from Pink-tailed Worm-lizard habitat areas and managed in other areas to avoid soil compaction. • Low-impact vehicles, such as quad bikes, should be used to undertake management activities off the management trail network. • There are no formal management tracks or trails within the Conservation Area. • Illegal vehicle access should be monitored and procedures put in place to reduce unauthorized access.
7. Infrastructure: utility	<ul style="list-style-type: none"> • ACTEW currently maintains a water main through the Box-Gum Woodland community. Maintenance should be undertaken within best-practice guidelines and in accordance with the code of practice.
8. Adjacent roads, urban areas and rural leases	<ul style="list-style-type: none"> • Weed incursions from vehicle access and increased recreational access may be a source of weed seeds. • The rural areas to the west and north may be a source of weed invasion
9. Visitor and community awareness	<ul style="list-style-type: none"> • Access to the Arboretum Conservation Area is limited to the National Arboretum and Cork Oaks entrance. • The Arboretum Woodland Conservation Area is an exhibit within the National Arboretum • There are no formal management trails or walking tracks. • Passive recreational pursuits are undertaken on the Conservation Area, generally only by dedicated naturalists with particular interest in the Conservation Area. • Walking tracks to be excluded from PTWL habitat areas • Dogs are not permitted in the Conservation Area. • There may be a significant increase in visitation and subsequent pressures once residential areas in the vicinity of the Conservation Area are established. • As the suburbs are developed, illegal entry of dogs into the Conservation Area may become an issue. • The Arboretum Conservation Area may be subject to firewood or rock collection. • Firewood collection, rock collection and rock-rolling may become an issue as recreation increases.
10. Scientific studies and monitoring	<ul style="list-style-type: none"> • NES vegetation and habitat condition monitoring (locations on Figure 7) • There is potential for scientific studies to be undertaken within the Conservation Area, including: <ul style="list-style-type: none"> ○ Revegetation techniques ○ Woodland bird monitoring (COG) ○ Impacts of biomass on kangaroos, vegetation and other fauna (CPR)
11. Community Engagement	<ul style="list-style-type: none"> • The Southern Tablelands Ecosystem Park (STEP) is a regional botanic garden, education and conservation centre demonstrating Southern Tablelands species and ecosystem recovery. The Park is run by volunteers and is located within the National Arboretum Canberra and directly adjacent to the Arboretum Woodland Conservation Area. • There is no ParkCare group associated with the Arboretum Woodland Conservation Area. As residential areas are developed in the vicinity of the Conservation Area, consideration should be given to establish and appropriately resource a ParkCare group. • Community engagement is limited to specific identified opportunities for volunteers through STEP and small-scale, passive, low-impact recreation.

12. Documentation	<ul style="list-style-type: none">• Documentation of the Conservation Area values need to be provided to all stakeholders to facilitate appropriate visitor behavior.• Documentation of the attributes and records of actions, activities, research and maintenance are required to implement adaptive management.• Monitoring results need to be collated and reviewed.
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Management Actions

Refer to the management principles above and the *Molonglo River Reserve and Offset Areas Ecological Management Guidelines* (TAMS in prep.). Funding source reference: Molonglo recurrent (Mr); Molonglo Capital Works (Mcw); NES recurrent (NESr); NES Capital Works (NEScw); refer to Appendix C for funding schedule and estimates. Highlighted Actions indicate that they are unique to the Conservation Area.

Strategies	Actions	Who	Source
1. Manage biomass to maintain optimal structure and diversity	1.1 Develop a biomass management program that includes burning, slashing and stock grazing and that takes into account kangaroo grazing pressure.	R3, Ecologist, CPR	Mr, NESr
	1.1.1 Consider conditions (timing, seasonal constraints and specific requirements of threatened species and communities) under which biomass management is implemented.		
	1.1.2 Collate and map existing information on location of weed patches, location of rare species, potential Superb Parrot habitat trees and other site attributes (e.g. gates, fences, dams).		
	1.1.3 Review monitoring results, effectiveness of previous management strategies and Biodiversity Triage Matrix to identify strategies and priorities for the forthcoming year.		
	1.1.4 Identify, map and monitor condition of areas that are under pressure from kangaroo grazing and camping.		
	1.1.5 Liaise with relevant agencies and organisations, including the Vertebrate Pest Officer, Rural Programs Officer, Fire Management Officer, Environmental Weeds Officer, and CPR.		
	1.1.6 Identify appropriate areas, timing, intensity, density and type of stock that can be used if grazing is to be applied.		
	1.2 Implement the integrated biomass management program.	R3, GSO, FMU, Rural landholder	Mr
	1.2.1 Monitor biomass levels to determine whether biomass reduction activities should be applied.		
	1.2.2 Undertake regular inspections to ensure there is no damage to vegetation and Pink-tailed Worm-lizard habitat. If impacts are detected undertake immediate reparation work to improve condition before effects of impacts become major.		
	1.2.3 Undertake planned management according to the biomass management program.	R3, Ecologist	Mr, NESr
	1.3 Monitor the integrated biomass management program.		
	1.3.1 Monitor change in condition based on benchmark attributes: plant species diversity, cover and habitat diversity, revegetation success and targeted monitoring of declining woodland bird populations and habitat (see <i>Monitoring Procedures Manual for Molonglo Offset Areas</i>).		
	1.3.2 Monitor biomass annually in autumn to guide biomass management actions required in the forthcoming year.		
	1.3.3 Monitor grazing impacts by kangaroos to determine impacts on biomass and species diversity.		
	1.3.4 Review the program after five years or when scientific research and/or monitoring results indicate that the objectives of this plan are not being met through the biomass management program		

2. Minimise the impacts of wildfire	<p>2.1 Co-ordinate, in accordance with <i>Strategy 1</i>, the <i>BOP</i> and the <i>Molonglo Development Fire Management Strategy</i>, an integrated fuel management program for the ecological and cultural heritage assets.</p> <p>2.1.1 Manage fire and fuel to protect and enhance the Conservation Area's ecological values, considering the protection of habitat features, control of herbaceous biomass, promotion and protection of natural regeneration, habitat diversity, fire thresholds for species and communities and post-fire weed control.</p> <p>2.1.2 Meet with the Fire Management Officer to discuss district requirements for BOP and finalise budget for forthcoming year.</p>	R3, Ecologist, FMU	Mr, NESr
	<p>2.2 Implement the integrated fuel management program for the ecological and cultural heritage assets.</p> <p>2.2.1 Undertake fuel management inside the conservation area to achieve ecological outcomes as defined in the objectives.</p> <p>2.2.2 Maintain a slashed boundary track around the perimeter and along trails within the Conservation Area that are wide enough to support fire trucks. Note: a high voltage powerline may be repositioned to the edge of the Arboretum woodland Conservation Area. The 40m easement required for this powerline should remove the need for slashing around the perimeter of the Conservation Area.</p>	R3, GSO, Ecologist, FMU, Rural landholder Contractor	Mr, Mcw, NESr, NEScw
	<p>2.3 Monitor the fuel management program against condition of the ecological and cultural heritage assets.</p> <p>2.3.1 Use the results of the condition monitoring program to determine whether fire fuel management is impacting threatened species and communities and modify it if required (see <i>Monitoring Procedures Manual for Molonglo Offset Areas</i>).</p>	R3, Ecologist	Mr, NESr
3. Enhance habitat values	<p>3.1 Develop a restoration program for the Conservation Area, with priority to areas where weed control may result in bare ground and/or reinvasion by weeds.</p> <p>3.1.1 Identify and map areas where enhancement of habitat is required.</p> <p>3.1.2 Investigate how to reduce annual introduced species in Patch N and reduce likely high nutrient levels, and restore using indigenous woodland species.</p> <p>3.1.3 Identify weedy patches in Patches N and GG and determine if they should be replanted with indigenous grassland or</p>	R3, Ecologist, CPR	Mr, NESr

	<p>woodland species, as appropriate.</p> <p>3.1.4 Assess whether nesting boxes should be established for Superb Parrots.</p> <p>3.1.5 Develop a restoration program to improve woodland bird habitat.</p> <p>3.1.6 Seek to maintain landscape connectivity over the long term by ensuring that there is no more than a 100m gap between trees, leading from the Arboretum Woodland to the Molonglo River and from Arboretum Woodland to the Cork Plantation and then to Aranda Bushland and Black Mountain. The connectivity distance between the Arboretum Woodland and the next nearest 10ha patches of woodland habitat should not exceed 1.1km.</p> <p>3.1.7 Liaise with government ecologist (CPR)</p>		
	<p>3.2 Implement the restoration program.</p> <p>3.2.1 Undertake regular inspections to ensure there is no damage to vegetation and Pink-tailed Worm-lizard habitat. If impacts are detected undertake immediate reparation work to improve condition before effects of impacts become major.</p> <p>3.2.2 Enhance natural regeneration across all of the Conservation Area, through grazing management and control of scattered weeds.</p> <p>3.2.3 Enhance habitat diversity through restoration of fallen timber, hollows, rocks and structural diversity of the vegetation (incl. shrub layer and canopy cover), utilising materials from developed areas where appropriate.</p> <p>3.2.4 Revegetate areas left bare from weed control.</p> <p>3.2.5 Undertake a revegetation program in Patch GG2 and N in conjunction with a weed control program.</p> <p>3.2.6 Do not plant tall shrubs and trees within 20 m of Pink-tailed Worm-lizard habitat in Patch GG1.</p> <p>3.2.7 Timber removal for water main maintenance to be retained as coarse woody debris within the woodlands.</p> <p>3.2.8 Undertake immediate remediation works and site rehabilitation if habitat has been disturbed.</p> <p>3.2.9 Adapt restoration effort in line with guidance from research projects undertaken within or which are relevant to the Arboretum Woodland.</p>	R3, Ecologist, Contractor	Mr, Mcw, NESr, NEScw
	<p>3.3 Monitor the restoration program (see <i>Monitoring Procedures Manual for Molonglo Offset Areas</i>).</p> <p>3.3.1 Monitor the success of revegetation to determine whether appropriate species have been used and whether follow-up planting is required.</p> <p>3.3.2 Monitor whether there has been any change in utilisation of habitat resulting from revegetation, especially bird abundance and/or diversity.</p>	R3, Ecologist	Mr, NESr
4. Reduce the impact of invasive plants	<p>4.1 Develop an integrated weed management program for the Conservation Area.</p> <p>4.1.1 Map the distribution of environmental weeds.</p> <p>4.1.2 Review monitoring results, effectiveness of previous management strategies, Weed Management Priorities Table</p>	R3, Ecologist	Mr, NESr

	<p>and Biodiversity Triage Matrix to identify strategies and priorities for the forthcoming year.</p> <p>4.1.3 Meet with Environmental Weeds Officer to discuss district requirements for EWOP and finalise budget for forthcoming year.</p> <p>4.1.4 Engage stakeholders and coordinate with neighbours in the planning and implementation of upcoming control programs.</p> <p>4.1.5 Prioritise treatment of invasive weeds at Conservation Area entry points, along management tracks and walking trails and within infrastructure easements.</p> <p>4.1.6 Prevent the incursion of new pest plants through the strategic placement and design of park developments, visitor management, fencing, surveillance, staff training, community education and rapid response following reports of new pest plants.</p>		
	<p>4.2 Implement an integrated weed management program.</p> <p>4.2.1 In Pink-tailed Worm-lizard habitat undertake species specific spot spraying and cut/paint methods for shrubs and trees.</p> <p>4.2.2 Undertake in-house control and map areas controlled.</p> <p>4.2.3 Undertake field contract supervision and map areas controlled.</p> <p>4.2.4 Review the effectiveness of the program and identify follow-up actions.</p> <p>4.2.5 Undertake follow-up actions.</p> <p>4.2.6 Undertake site rehabilitation.</p> <p>4.2.7 Coordinate volunteers to assist with control, follow up and site rehabilitation.</p> <p>4.2.8 Maintain and monitor vehicle hygiene by ensuring vehicles are clean of mud, soil, dry vegetation or seeds to limit the spread of weeds.</p>	R3, GSO, Contractor	Mr, Mcw, NEScw
	<p>4.3 Monitor the distribution and abundance of environmental weeds within the Conservation Area.</p> <p>4.3.1 During routine patrols, collect data on distribution and abundance of environmental weeds.</p> <p>4.3.2 Undertake pre-treatment distribution mapping.</p> <p>4.3.3 Undertake post-treatment distribution mapping.</p> <p>4.3.4 Coordinate volunteers to assist with data collection.</p> <p>4.3.5 Record all mapping data in the Reserve Weed Management folder on ArcGIS.</p> <p>4.3.6 Monitor weed control to identify whether there has been a change in native plant diversity as a result of weed control.</p> <p>4.3.7 Involve stakeholders in the monitoring program.</p> <p>4.3.8 Monitor bird species abundance to determine if they have been impacted by removal of woody weeds.</p>	R3, GSO, Ecologist	Mr, NESr

5. Reduce the impact of invasive animals	<p>5.1 Develop an integrated pest animal management program for the Conservation Area.</p> <p>5.1.1 Map the distribution of damage and/or habitat of pest animals.</p> <p>5.1.2 Review monitoring results, effectiveness of previous management strategies, Invasive Animal Management Priorities Table and Biodiversity Triage Matrix to identify strategies and priorities for the forthcoming year.</p> <p>5.1.3 Meet with the Vertebrate Pest Officer to discuss district requirements for pest species and finalise budget for forthcoming year.</p> <p>5.1.4 Utilise methods that minimise soil disturbance, particularly in Pink-tailed Worm-lizard habitat.</p> <p>5.1.5 Engage stakeholders and coordinate with neighbours in the planning and implementation of upcoming control programs.</p>	R3, Ecologist	Mr, NESr
	<p>5.2 Implement an integrated pest animal management program.</p> <p>5.2.1 Undertake in-house control and map and report on results.</p> <p>5.2.2 Undertake field contract supervision and map and report on results.</p> <p>5.2.3 Undertake follow-up actions.</p> <p>5.2.4 Undertake site rehabilitation.</p> <p>5.2.5 Coordinate volunteers to assist with control, follow up and site rehabilitation.</p> <p>5.2.6 Enforce responsible pet ownership (dog control and containment of domestic cats in neighbouring areas).</p>	R3, GSO, Contractor	Mr, Mcw, NEScw
	<p>5.3 Monitor the distribution and abundance of pest animals within the Conservation Area.</p> <p>5.3.1 Undertake pre-treatment distribution mapping.</p> <p>5.3.2 Undertake post-treatment distribution mapping.</p> <p>5.3.3 Coordinate volunteers to assist with data collection.</p> <p>5.3.4 Record all mapping data in the Reserve Pest Species Management folder on ArcGIS.</p> <p>5.3.5 Engage stakeholders in the monitoring program.</p> <p>5.3.6 Review the effectiveness of the program and identify follow-up actions.</p>	R3, GSO, Ecologist	Mr, NESr
6. Control vehicle movement and impacts	<p>6.1 Ensure all stakeholders entering the site comply with strict hygiene requirements, including ensuring vehicles are clean before entering the site to reduce the threat of weed introduction and spread.</p> <p>6.2 Inform all stakeholders to remain on authorised tracks only.</p> <p>6.3 Identify and undertake any specific trail maintenance requirements.</p> <p>6.4 During routine inspections monitor for illegal access and the establishment of any unauthorised tracks.</p> <p>6.5 Use only low impact vehicles (e.g. quad bikes) for off-track access.</p> <p>6.6 Maintain vehicle tracks and associated infrastructure.</p> <p>6.7 Limit vehicle access when soil is moist or wet.</p> <p>6.8 Avoid off-track access when weeds are seeding to minimise weed spread.</p> <p>6.9 Slash no lower than 100 mm using a flail mower along designated</p>	R3, GSO	Mr

	tracks.		
7. Reduce impacts of management of utility infrastructure	7.1 Infrastructure maintenance should be undertaken within best-practice guidelines for endangered species and communities.	R3	Mr
	7.2 Manage infrastructure-related disturbance through the licensing and approvals process. 7.2.1 Licensed works must adhere to the code of practice. 7.2.2 Works proposals may require a referral under the EPBC Act. 7.2.3 Under the <i>Planning and Development Act 2007</i> , an Environmental Impact Statement (EIS) may be required for any works that could impact the soil, vegetation or threatened species.	R3	Mr
	7.3 Undertake site inductions for all personnel working within the conservation area to identify values and their specific management requirements. 7.4 Supervise infrastructure-related works and site rehabilitation closely during implementation. 7.5 Monitor infrastructure-related disturbance after completion and ensure follow-up rehabilitation is undertaken if required.	R3, D&D, Ecologist,	Mr, NESr
	7.6 When providing conditions of approval – ensure conditions are unambiguous and prescriptive e.g. rehabilitate site with 1g native seed mix per sq m) and ensure >80% ground cover before handover.	R3	Mr
8. Ensure activities in adjacent land does not impact the Conservation Area	8.1 Liaise with organisations, businesses and lessees responsible for land management in areas adjacent to the conservation area. 8.2 Participate in the planning and development process for works on land adjacent to the conservation area. 8.3 Monitor works, landscaping and land management activities on adjacent land to ensure the values of the conservation area will not be impacted.	R3	Mr
9. Enhance visitor and community awareness	9.1 Manage organised recreational activities. 9.1.1 Review the nature and scale of recreational activities that are compatible with maintaining the values of the conservation area. 9.1.2 Provide information to users and inform all stakeholders to remain on authorised tracks only. 9.1.3 Maintain recreation tracks and associated infrastructure. 9.1.4 Supervise recreation activities. 9.1.5 Monitor organised recreation events and ensure conditions are adhered to and provide feedback to users and others. 9.1.6 Maintain security to prevent accidental or malicious damage to infrastructure, indigenous, European and natural values. 9.1.7 Use the review of compatible recreation activities to guide good visitor behaviour.	R3	Mr
	9.2 Promote awareness of values to visitors and other stakeholders 9.2.1 Publish and promote profiles of the ecological and other values in the Conservation Area. 9.2.2 Maintain and update interpretive signage.	R3, D&D	Mr, Mcw

	<p>9.2.3 Provide updated information about the conservation area on signage and websites and in written form.</p> <p>9.2.4 Seek direct contact with conservation area users.</p> <p>9.2.5 Facilitate and undertake guided walks, community and school talks.</p> <p>9.2.6 Undertake site inductions for all personnel or organisations undertaking organised activities within the conservation area to identify values and their specific management requirements.</p>		
10. Encourage and support scientific studies	10.1 Maintain links with existing and potential research organisations.	Ecologist	NESr
	10.1.1 Consult Conservation Planning and Research (EPD) in relation to any changed management activities in Pink-tailed Worm-lizard and Superb Parrot habitat		
	10.2 Maintain a library of research and monitoring relevant to the Conservation Area, including contacts, specific requirements, maps of locations and reports and papers.	Ecologist	NESr
	10.3 Facilitate the planning, coordination and implementation of research projects.	Ecologist	NESr
	10.3.1 Encourage and support scientific studies that aim to enhance the protection of MNES and other significant flora, fauna communities.		
	10.3.2 Identify opportunities for research and monitoring programs that evaluate the effectiveness of management practices in situ.		
	10.4 Review the implications of research and monitoring results for management.	R3, Ecologist	Mr, NESr
11. Encourage and support community engagement	11.1 Develop a volunteer program	R3	Mr
	11.1.1 Maintain a list of volunteers who wish to be involved in projects		
	11.1.2 Identify works projects suitable for volunteers.		
	11.2 Support and encourage CVA and other volunteers to participate in the conservation of the ecological and cultural heritage values of the Conservation Area	R3, Ecologist	Mr, NESr
	11.2.1 Co-ordinate and supervise volunteers while undertaking work in the Conservation Area.		
	11.3 Consider establishing, guiding and resourcing a Parkcare or Friends group once there are enough volunteers willing to assist in a ParkCare group.	R3	Mr
12. Document values	12.1 Maintain records of actions undertaken and other relevant information	R3, D&D, Ecologist	Mr, NESr
	12.1.1 Maintain a comprehensive database of the ecological and cultural heritage values of the Conservation Area.		
	12.1.2 Provide annual reports on management implementation.		
	12.1.3 Update wildlife atlas records and vegetation database with data on rare species		

	<p>12.2 Maintain and promote monitoring programs.</p> <p>12.2.1 Undertake annual monitoring of vegetation condition, bird diversity, Superb Parrot and Pink-tailed Worm-lizard, impacts of weed control on the native diversity and revegetation success.</p> <p>12.2.2 Review monitoring results annually for identification of issues that require short-term management.</p> <p>12.2.3 Analyse monitoring results and provide reports every five years and consider implications for management.</p> <p>12.2.4 Assist with the coordination and implementation of CPR and COG monitoring programs.</p> <p>12.2.5 Promote and assist with monitoring of other species within the Arboretum Woodland Conservation Area.</p>	Ecologist	NESr
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Maps³

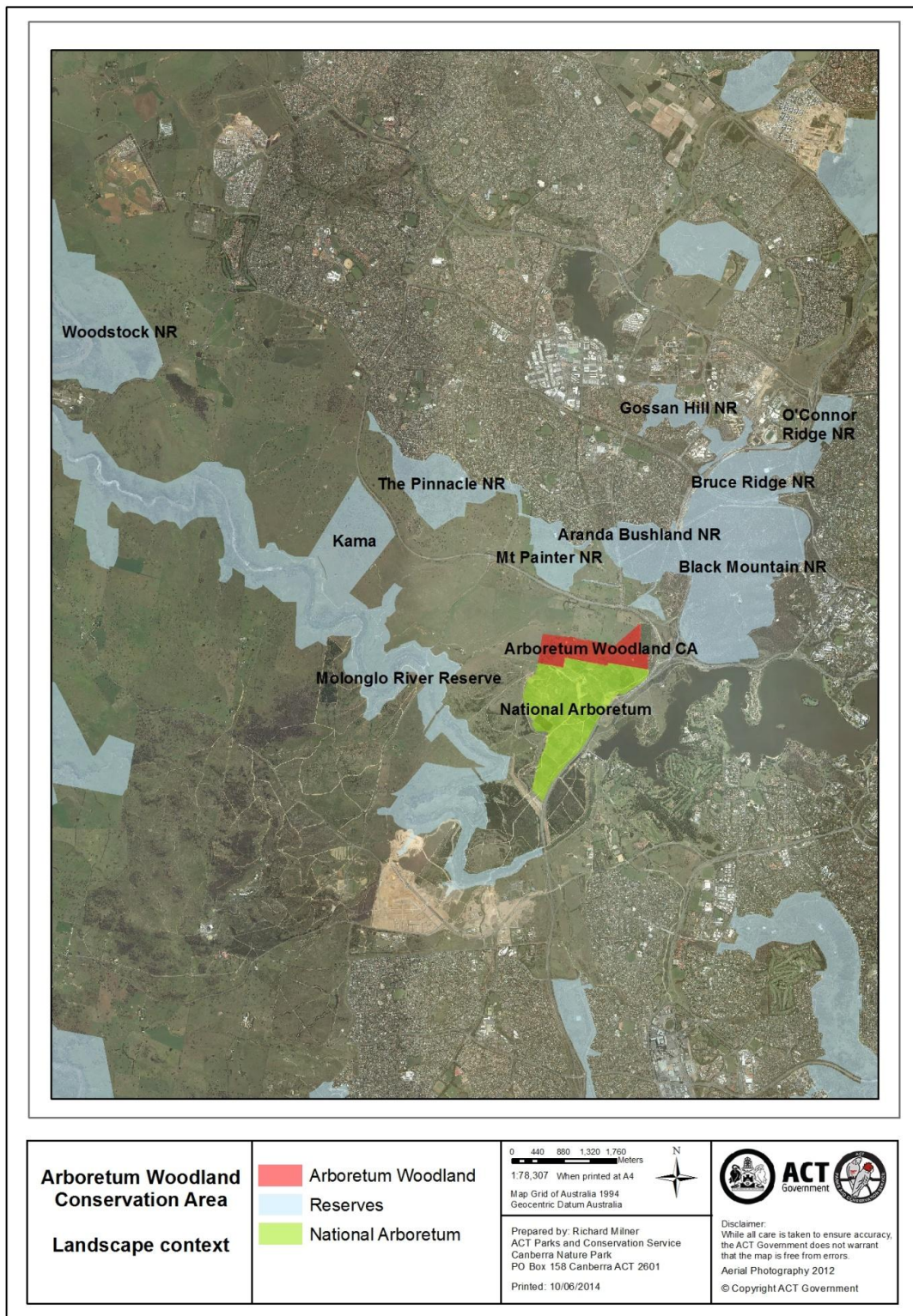


Figure 1. Arboretum Woodland Conservation Area landscape context

³ Information provided in the following maps may change as more information becomes available. Users should refer to (insert hyperlink) for current spatial data.



Figure 2. Arboretum Woodland Conservation Area ecological values and NES Patches



Figure 3. Arboretum Woodland Conservation Area physical assets and infrastructure



Figure 4. Arboretum Woodland Conservation Area fire history

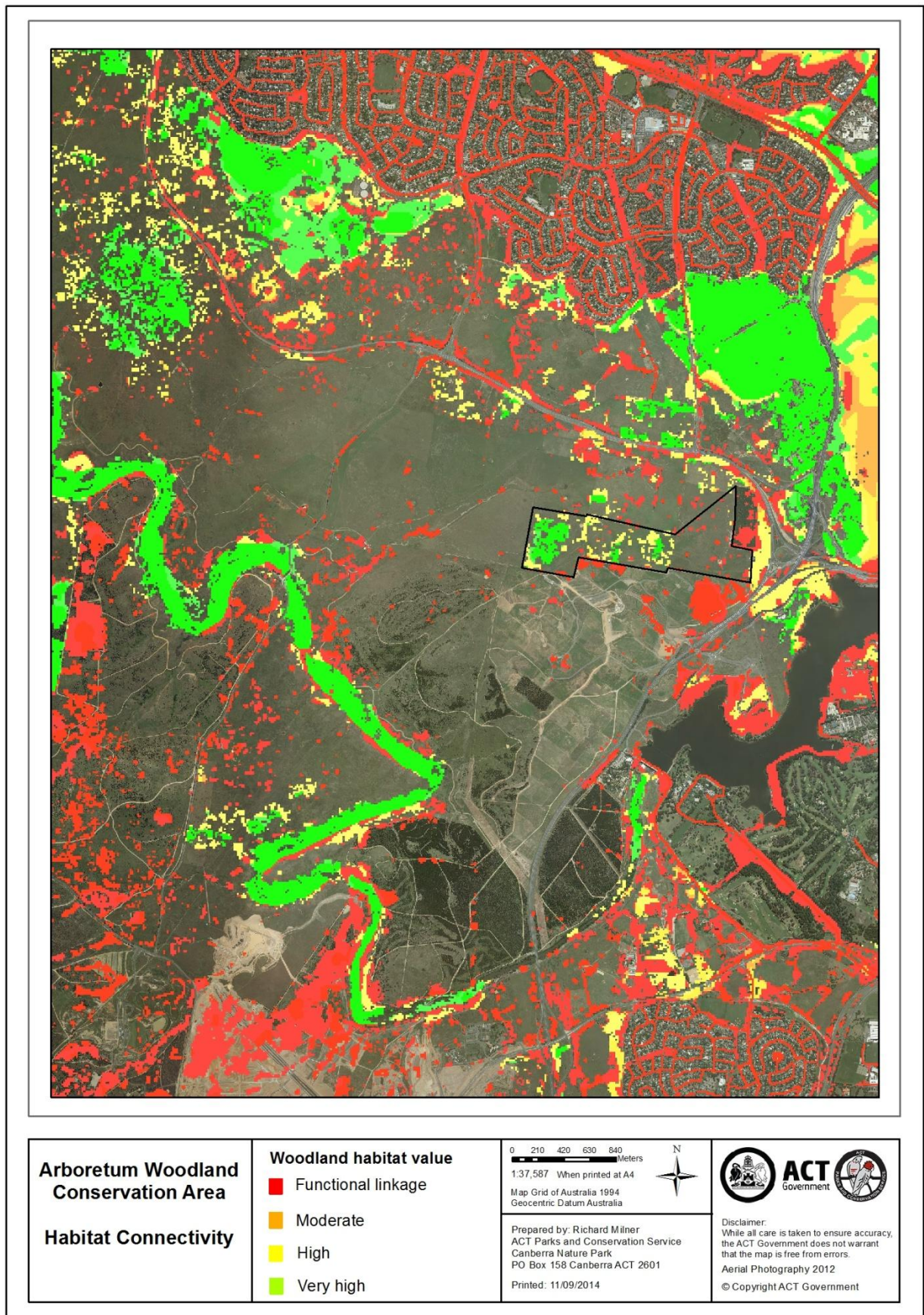


Figure 5. Arboretum Woodland Conservation Area habitat connectivity value



Figure 6. Arboretum Woodland Conservation Area heritage sites

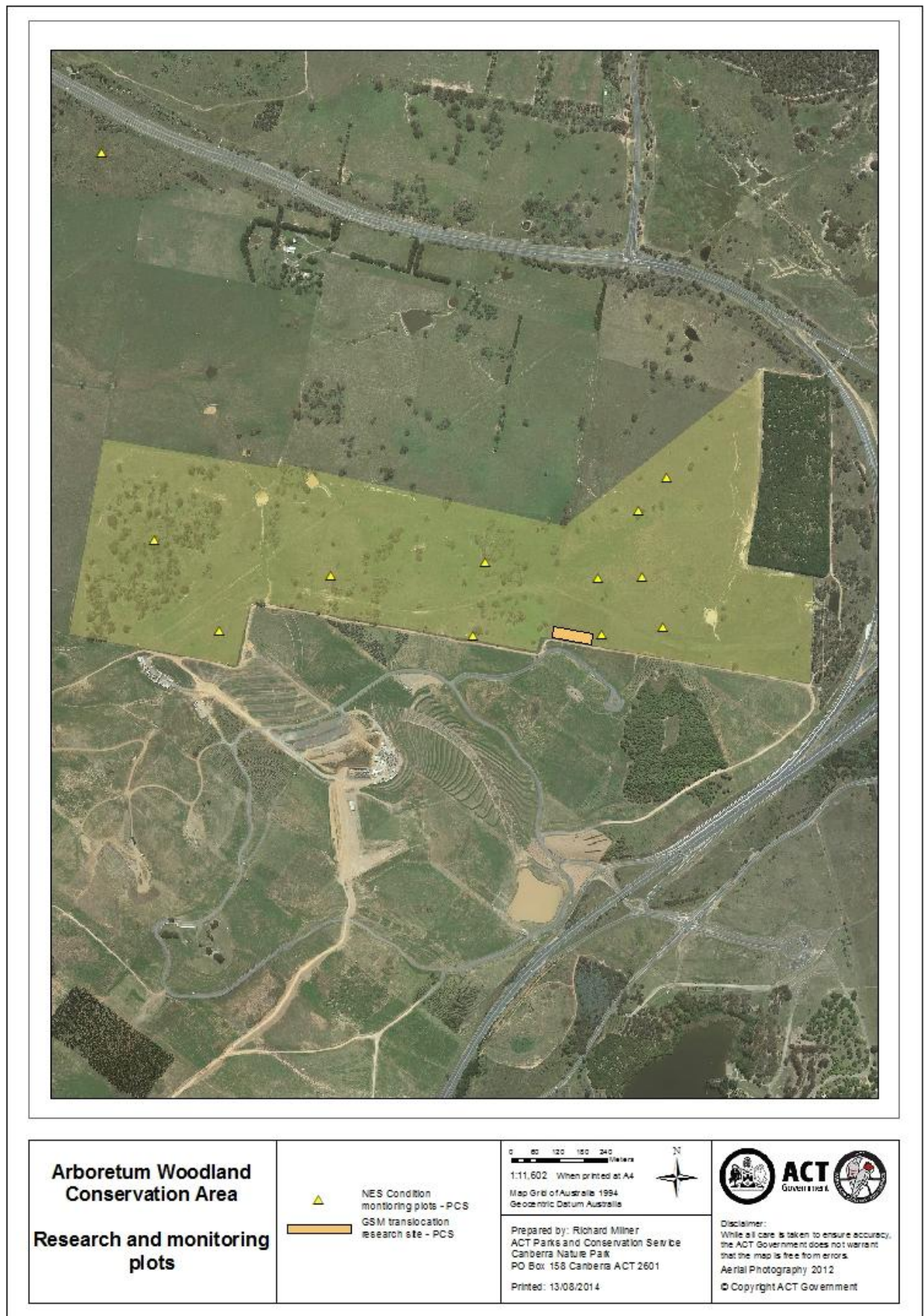


Figure 7. Arboretum Woodland Conservation Area research and monitoring sites.

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Appendix A: Flora Species List

Species present in NES patches (Eco Logical Australia 2013 and NES monitoring 2013).

Native species

Vegetation Patch	GG	N1,3	N2
<i>Acaena ovina</i>	1		
<i>Alternanthera denticulata</i>	1		
<i>Alternanthera nana</i>			1
<i>Asperula conferta</i>	1		
<i>Austrostipa bigeniculata</i>	1	1	1
<i>Austrostipa densiflora</i>			
<i>Austrostipa scabra</i>	1	1	1
<i>Bothriochloa macra</i>	1		1
<i>Bulbine bulbosa</i>	1		
<i>Carex inversa</i>	1	1	1
<i>Chamaesyce drummondii</i>	1		
<i>Chenopodium pumilio</i>	1		
<i>Chloris truncata</i>	1		
<i>Chrysocephalum apiculatum</i>	1		
<i>Convolvulus angustissimus</i>	1	1	1
<i>Crassula sieberiana</i>	1	1	1
<i>Cymbonotus lawsonianus</i>	1		
<i>Cynoglossum suaveolens</i>	1		1
<i>Desmodium varians</i>	1		
<i>Dichondra repens</i>	1		
<i>Einadia nutans</i>	1		
<i>Elymus scaber</i>	1	1	1
<i>Enneapogon nigricans</i>	1	1	
<i>Epilobium billardierianum</i>	1		
<i>Eragrostis brownii</i>	1		
<i>Erodium crinitum</i>		1	1
<i>Eryngium ovium</i>	1		
<i>Eucalyptus blakelyi</i>	1		
<i>Eucalyptus melliodora</i>	1		
<i>Euchiton</i> sp. (native)	1	1	1
<i>Geranium solanderi</i>	1		
<i>Glycine tabacina</i>	1	1	1
<i>Hydrocotyle laxiflora</i>	1		
<i>Juncus filicaulis</i>	1		
<i>Juncus</i> sp. (native)			1
<i>Lomandra bracteata</i>	1		
<i>Lomandra filiformis</i>	1		
<i>Lomandra filiformis coriacea</i>	1	1	1
<i>Lomandra multiflora</i>	1		

Vegetation Patch	GG	N1,3	N2
<i>Microlaena stipoides</i>	1	1	1
<i>Oxalis perennans</i>	1	1	
<i>Poa sieberiana</i>	1		
<i>Rumex brownii</i>	1	1	1
<i>Rytidosperma caespitosum</i>	1	1	1
<i>Rytidosperma carphoides</i>	1		1
<i>Rytidosperma pallidum</i>	1	1	1
<i>Rytidosperma racemosum</i>	1	1	1
<i>Rytidosperma</i> spp (Austrodanthonia)	1	1	1
<i>Solenogyne dominii</i>	1		
<i>Stackhousia monogyna</i>	1		
<i>Stuartina hamata</i>			1
<i>Themeda triandra</i>	1		
<i>Tricoryne elatior</i>	1		
<i>Vittadinia cuneata</i>	1		1
<i>Vittadinia gracilis</i>	1		
<i>Vittadinia muelleri</i>	1		
<i>Wahlenbergia communis</i>	1		1
<i>Wahlenbergia gracilis</i>	1		
<i>Wahlenbergia luteola</i>	1		1
<i>Xanthium spinosum</i>	1		

Exotic Species

Vegetation Patch	GG	N1,3	N2
* <i>Acetosella vulgaris</i>	1	1	1
* <i>Arctotheca calendula</i>	1	1	1
* <i>Aira</i> sp.	1	1	1
* <i>Avena</i> sp.	1	1	1
* <i>Bromus catharticus</i>	1		
* <i>Bromus diandrus</i>	1		
* <i>Bromus rubens</i>	1	1	1
* <i>Bromus</i> sp.	1	1	1
* <i>Capsella bursa-pastoris</i>	1		
* <i>Carthamus lanatus</i> (Saffron Thistle)	1	1	1
* <i>Cerastium</i> sp.	1	1	
* <i>Chenopodium album</i>	1	1	
* <i>Chondrilla juncea</i>	1	1	1
* <i>Cirsium vulgare</i> (Spear Thistle)	1		
* <i>Conyza</i> sp.	1	1	1

Vegetation Patch	GG	N1,3	N2
* <i>Crataegus mono</i>	1		
* <i>Echium plantagineum</i>	1	1	1
* <i>Echium vulgare</i>	1		
* <i>Eleusine tristachya</i>	1		
* <i>Erodium cicutarium</i>	1		1
* <i>Gamochaeta americana</i>	1		1
* <i>Hirschfeldia incana</i>	1	1	
* <i>Hordeum (Critesion) sp.</i>	1	1	1
* <i>Hypericum perforatum</i>	1	1	1
* <i>Hypochaeris glabra</i>	1	1	1
* <i>Hypochaeris radicata</i>	1	1	1
* <i>Lactuca saligna</i>	1	1	1
* <i>Lactuca serriola</i>	1	1	
* <i>Lepidium africanum</i>	1		
* <i>Lolium perenne</i>	1	1	
* <i>Lolium rigidum</i>	1	1	1
* <i>Lycium ferocissimum</i>	1		
* <i>Marrubium vulgare</i>	1		
* <i>Medicago sp.</i>			
* <i>Modiola caroliniana</i>	1	1	
* <i>Moenchia erecta</i>	1		
* <i>Onopordum acanthium (Scotch)</i>	1		
* <i>Orobanche minor</i>	1		1
* <i>Paronychia brasiliensis</i>	1	1	1
* <i>Paspalum dilatatum</i>	1	1	
* <i>Petrorhagia nanteuillii</i>	1	1	1
* <i>Phalaris aquatica</i>	1	1	
* <i>Plantago lanceolata</i>	1	1	1
* <i>Polygonum aviculare</i>	1	1	
* <i>Prunus sp.</i>	1		
* <i>Pyracantha sp.</i>	1		
* <i>Rosa rubiginosa</i>	1	1	
* <i>Rubus fruticosus</i>	1		
* <i>Rumex crispus</i>	1		
* <i>Salvia verbenaca</i>	1	1	1
* <i>Solanum chenopodioides</i>		1	
* <i>Sonchus asper</i>	1	1	1
* <i>Sonchus sp. (Sow thistle)</i>	1	1	1
* <i>Spergularia rubra</i>	1	1	
* <i>Taraxacum sect. ruderallia</i>	1		
* <i>Tragopogon sp.</i>	1		1
* <i>Trifolium angustifolium</i>	1		
* <i>Trifolium arvense</i>	1	1	1

Vegetation Patch	GG	N1,3	N2
* <i>Trifolium campestre</i>	1	1	1
* <i>Trifolium glomeratum</i>	1		1
* <i>Trifolium subterraneum</i>	1		1
* <i>Trifolium sp.</i>	1	1	
* <i>Verbascum thapsus</i>		1	
* <i>Verbascum virgatum</i>	1	1	
* <i>Vulpia sp.</i>	1	1	1

Vegetation Patch	GG	N1,3	N2
Total native species	55	18	25
Total introduced species	62	40	31
Percentage native species	47%	31%	45%

Appendix B: Summary table of 2013 baseline vegetation condition monitoring

Attributes	N2 M1	N2 M2	N1 N3 M1	N1 N3 M2	N1 N3 M3	N1 N3 M4	GG1 M1	GG1 M2	GG1 M3	GG1 M4	GG2 M1
Native species richness	11	17	8	8	7	8	15	13	13	28	17
Exotic species richness	19	20	22	15	17	21	28	26	19	22	31
No. important species	0	2	0	0	0	1	4	0	1	7	3
Cryptogams % cover	0	0	0	0	0	0	0	0	0	1	0
Bare earth % cover	3	1	3	0	1	1	0	0	2	19	0
Rocks % cover	0	0	0	0	0	0	0	0	0	2	0
Litter/dead vegetation % cover	17	18	11	14	11	15	30	17	34	14	16
Annual exotic grass, forbs % cover	6	7	20	15	10	4	23	8	20	3	12
Perennial exotics < 1m % cover	1	0	8	11	4	1	2	1	5	0	4
Native grasses % cover	23	28	7	2	25	31	29	34	10	23	23
Native shrubs < 1 m tall % cover	0	0	0	0	0	0		0	0	0	0
Other native species % cover	1	0	0	0	0	0		1	1	2	0
Proportion of native to perennial exotic cover	96%	100%	47%	15%	86%	97%	94%	97%	69%	100%	85%
Native overstorey foliage cover %	na	na	na	na	na	na	11.54	0.93	24	12.19	na
Native midstorey foliage cover %	na	na	na	na	na	na	na	0.05	na	na	na
Exotic overstorey foliage cover %	na	na	na	na	4	0.84	1.31	na	na	na	0.05
Exotic midstorey foliage cover %	na	0.37	na	na	0.19	1.2	na	0.18	na	0.34	0.25
No. species regenerating (seedlings, saplings, young adults) (plot)	na	na	na	na	na	na	1	1	0	1	na
Total no. age classes present (plot)	na	na	na	na	na	na	4	2	3	2	na
Proportion of trees regenerating (zone)					100						0
Length of fallen timber	na	na	na	na	na	na	44	50	110	23	na
No. trees with hollows	na	na	na	na	na	na	0	5	1	0	na
No rocks dislodged (PTWL)	na	na	na	na	na	na	na	na	na	10	0

Appendix C: Funding source, schedule and estimates

Funding Source	Code	2014-15	2015-16	2016-17	2017-18
Molonglo Capital Works	Mcw	\$2602K			
Molonglo Recurrent	Mr	\$452K	\$510K		
NES Capital Works	NEScw	\$1025K	\$850K	\$812K	\$792K
NES Recurrent	NESr		\$236K	\$238K	\$265K