

Plan of Management
'Wallaroo'
850-882 Mulgoa Rd, Mulgoa, NSW



'Wallaroo' is a 38 hectare property to be conserved forever for the single purpose of the protection and restoration of our native biodiversity. The site includes critically endangered Cumberland Plain Woodland, endangered Cumberland Riverflat Eucalypt Forest and habitat for threatened and declining species.

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6 June 2016

Acknowledgements

This Plan sets out the restoration plan for property purchased under contract of the Federal Department of Environment (DOE) with support from the NSW Nature Conservation Trust (NCT). The DOE has additionally provided funding for some initial works on the property.

The CLC acknowledges with gratitude the assistance of the DOE and NCT in securing this piece of the wild in Western Sydney, and look forward to working with them in the restoration of its flora & fauna.

The Plan of Management has been made possible by the contributions of many people and organisations. In particular we wish to acknowledge and thank the contributions of:

Wayne Olling, President - CLC

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Linda Brown, Supervisor - Conservation Volunteers Australia

Darren Barrass, Managing Director - Friendly Fred's Tree Service

And most of all to the CLC volunteers who have made this possible - our greatest thanks.

Acknowledgement of Country

We begin this plan by Acknowledging Country and respect to Elders past and present.

The Darug Aboriginal people, in particular the Mulgoa clan, managed this land for thousands of years. In turn their Country provided for them with game, fish and plant food. Mulgoa is said to be the Darug word for the 'Black Swan'.

The Darug remain the Traditional Custodians of the Mulgoa area and take great pride in their rich cultural history.

In restoring Wallaroo we acknowledge Country and respect the Darug's heritage past and present.



'Wallaroo' protects a section of critically endangered Cumberland Plain Woodlands

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‘Wallaroo’ - our first step

Cumberland Land Conservancy (CLC) is a volunteer owned & operated not-for-profit organisation dedicated to acquiring land for conservation. We focus on the ‘Cumberland Plain’ of Western Sydney, one of the most heavily cleared landscapes in Australia.

CLC differs from public landowners by having a single land management objective – the conservation and recovery of our native flora & fauna. As recreation and development pressures mount on our public reserves this management becomes all the more distinct and critical.

The CLC undertakes significant education programs to help deliver our core business of conservation. In our two years of operation the CLC has run 14 local conservation workshops training 363 local residents in restoring our flora and fauna. Most of these workshops are commercial partnerships with local councils and NSW TAFE, contributing much needed income to support the CLC work.

Our first property ‘Wallaroo’ is a 38 hectare property at Mulgoa purchased with assistance from the Australian Government and the NSW Nature Conservation Trust (NCT) in early 2016. ‘Wallaroo’ is currently held in Trust by the NCT for dedication to CLC.

The site protects critically endangered Cumberland Plain Woodland, derived native grasslands, over 1 km of Cumberland Riverflat Eucalypt Forest along Mulgoa Creek and a range of threatened and declining native species.



Figure 1 - ‘Wallaroo’ was named after the mob of native Wallaroo which call the site home

The site offers a valuable opportunity to maintain a corridor link between the conserved lands of Mulgoa Nature Reserve, along Mulgoa Creek and on to the Blue Mountains.

Management Vision

The CLC vision for 'Wallaroo' is to conserve and recover the native biodiversity of the landscape to the greatest extent practicable, delivering innovative adaptive management by community for the sole benefit of our flora & fauna.

The one hundred year vision for Wallaroo is to restore as much as possible an example of the Cumberland Plain's native flora and fauna. In practice:

- Existing habitat will be maintained
- Tree and shrub cover will expand while maintaining suitably open structure for grassy woodland biodiversity
- Native groundcovers will spread and diversify
- Native wildlife will increase in abundance and diversity; and
- Exotic plants and animals will be reduced in abundance, distribution and impact

Indigenous Darug peoples have inhabited the area known as the "Cumberland Plain" for over 50,000 years. The land is the sacred core of aboriginal religion and the bond between the land, people and spirituality is fundamental to human existence. The use and management of resources over this period have shaped the Cumberland Plain, as have recent Western land management practices.

The answers to management today will only be found in a deepened awareness and understanding of the landscapes history and ecological processes. CLC will pursue the protection, functionality and maintenance of the biodiversity of the flora and fauna of 'Wallaroo' through education, science and observation.

Purpose & Implementation of this management plan

The Management Plan sets out the CLC vision, identifies recovery opportunities and proposes restoration actions for the management of 'Wallaroo'.

The Management Plan details what CLC will do in partnership with our members, local community and our wide range of government, research and corporate partners to actively and adaptively restore the natural values of the property.

This Plan of Management will commence on transfer of land ownership to the CLC.

The Management Plan is a living document designed to guide the restoration efforts of the CLC and our partners. The plan will be formally reviewed on an annual basis by the CLC committee; however individual actions and targets will be reviewed on a constant basis through the process of adaptive management.

The CLC recognizes the critical role of scientific monitoring and evaluation (MERI) in directing and assessing management actions. For this reason the Plan has taken the rare step of engaging **quantitative** fauna & flora baseline surveys to be undertaken prior to works (refer Appendixes). This will allow the impact of our work on fauna & flora to be assessed directly. These baseline surveys are approaching completion as this first edition of the POM is finalized, and their results will be incorporated in subsequent editions.

Partnerships

CLC works closely with government, universities, community groups and local businesses to restore our environment. Some key partners include:

- WSI Richmond TAFE (research partner)
- Southern Cross University (research partner)
- Western Sydney University (research partner)
- NSW Office of Environment & Heritage (government partner)
- Federal Department of Environment (government partner)
- Greater Sydney Local Land Services (government partner)
- Conservation Volunteers Australia (NGO partner)
- Nepean Christian School (community partner)
- Mulgoa Landcare Group (community partner)
- Penrith Waste Services (commercial partner)
- Friendly Fred's Tree Services (commercial partner)

Site description

Introduction

'Wallaroo' is located on Mulgoa Road just south of Penrith, NSW. Access is via the entrance to the Penrith Waste Services centre. The site is illustrated in Figure 2.

The property consists of two adjoining Lots (Lots 3//221778 & 5//221778) forming an L-shape. In the west the site fronts Mulgoa Road with Mulgoa Creek running through the western portions of the lot. To the north following Mulgoa Creek is Nepean Christian School which includes an

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informal conservation area along the creek and behind (east of) the school. To the east over the hill is Penrith Waste Facility which drains away from the site. To the south are a series of large private bushland properties. The site is approx. 38 hectares in extent.

‘Wallaroo’ was named after the mob of wallaroos that call this site home. Larger than a wallaby and smaller than a kangaroo, the Common Wallaroo (*Macropus robustus*) is one of the many woodland species protected by this reserve.

As typical for the Cumberland Plain, the property has been subject to extensive clearing and fertilisation in the past which includes substantial degraded areas. The property has very high management needs.

The Cumberland Plain is one of Australia’s most abused landscapes, first cleared as the food bowl for Sydney Town in the early 1800s and since the 1980s increasingly cleared to accommodate the city’s explosive population growth. Adding to this history of abuse the fertile grassy woodlands of the Cumberland Plain are inherently more susceptible to weed and feral animal species than the better-conserved sandstone surrounds.

As testament to this past the remains of farming infrastructure (vineyard posts, dams) and portions of an abandoned bulldozer can still be seen at ‘Wallaroo’. These provide a first-hand revelation of the landscapes story.



Figure 2 - Wallaroo Site Map

Easements, Access & Services

The site has one legal easement being DP639050 Right of Carriageway in favor of Wallaroo against the Penrith Waste Services property.

Two gates are present. An old gate is present on Mulgoa Road and is in poor maintenance. A derelict culvert bridge crosses Mulgoa Creek nearby and may be upgraded to provide access to these portions of Wallaroo from the main property.

The principle (second) gate is located beside and just inside Penrith Waste Services entrance gate. This provides safe access to the site.

Penrith Waste Services (PWS) have requested CLC to consider realignment of Wallaroo access by creating a new gate slightly further west, thereby creating a Wallaroo entrance independent of the PWS gates. PWS have offered to undertake access works on their property and at their cost. CLC will consider these options which are further discussed under the management principles and schedule.

Transmission lines (125 kW low voltage) cross the Riverflat Forest; they run North-South and mostly on the western side of Mulgoa Creek. There is no legal easement for these services and their history is unclear. The transmission lines generate a duty of care to Wallaroo and are considered in the site management actions.

The property is not serviced by sewer or water. Adequate water supply for management purposes is available year-round in the farm dams and in Mulgoa Creek during good seasons.

Fencing

Property boundary fencing is in moderate condition where present.

The north and south boundaries are fenced with chain wire in good condition. These fences provide a barrier to native wildlife, however they also provide a barrier to domestic stock, pets and foxes. For the present these fences will be retained.

Rural style (picket & wire) fencing is located along the northern side of the site adjoining the entrance road for Penrith Waste Services. This fencing is in moderate repair. As this section does not provide risk of stock, person or vehicle access to 'Wallaroo' it will be retained in its current state pending discussions of alternative site access.

Short sections of fencing are present within the property along Mulgoa Creek. This is an aborted attempt to fence the creekline from stock. These fences should be considered for removal as resources permit.

The opposing creek bank on the southern side of Wallaroo borders private property and is not fenced. This is a problem for management on the site. Steep creek banks generally exclude stock

however roaming stock are occasionally present at Wallaroo and require relocation to this property. CLC will continue to negotiate with this landowner to fence their side of the creek.

Expansive areas of vineyard fence lines and associated wire piles are present in the southern exotic pasture area. These materials will be removed; this work is already progressing.

Bridges

An existing culvert-type creek crossing is present (refer Figure 2 - Wallaroo Site Map). This culvert is currently highly degraded and unsafe. Unless upgraded the western side of the property will remain isolated with access from Mulgoa Rd only.

Connectivity & Landscape Context

The site context is illustrated in Figure 3.

The property is located in the Sydney Basin Region - Cumberland Subregion (IBRA), within the Hawkesbury-Nepean Catchment.

The property is predominantly zoned RU4 (Rural) with E2 (Environmental Conservation) along the creek according to the Penrith Local Environmental Plan 2010.

A covenant is being negotiated with the NSW Nature Conservation Trust and will protect the entire property in perpetuity.

The Cumberland Plain IBRA subregion is one of the most cleared and highly fragmented ecosystems in Australia with almost all remaining stands unsecured on private land. While only 13% of the region's native vegetation remains a mere 7% of Cumberland Plain Woodland remains, this community being the target of more intensive agriculture and subsequently housing than other vegetation types.

A growing population expected to reach in excess of 2 million people by 2019 places particular pressure on remaining vegetation and natural areas in Western Sydney.

Habitat corridors are particularly important in this context of urbanisation. Wallaroo is not identified on the Office of Environment & Heritage Priority Conservation Lands under the Cumberland Plain Recovery Plan 2011, however it is identified as a Priority Core Area under the subsequent Biodiversity Investment Opportunity (BIO) map. The conservation of Wallaroo is a significant outcome for the BIO program delivery by the Office of Environment & Heritage.

In real terms the property forms a corridor between Mulgoa Nature Reserve and the Wearn BioBank in the north, via Nepean Christian School, to the Cumberland Plain Woodland in private properties to the south. There is some limited connectivity to the Blue Mountains National Park via rural properties to the west.

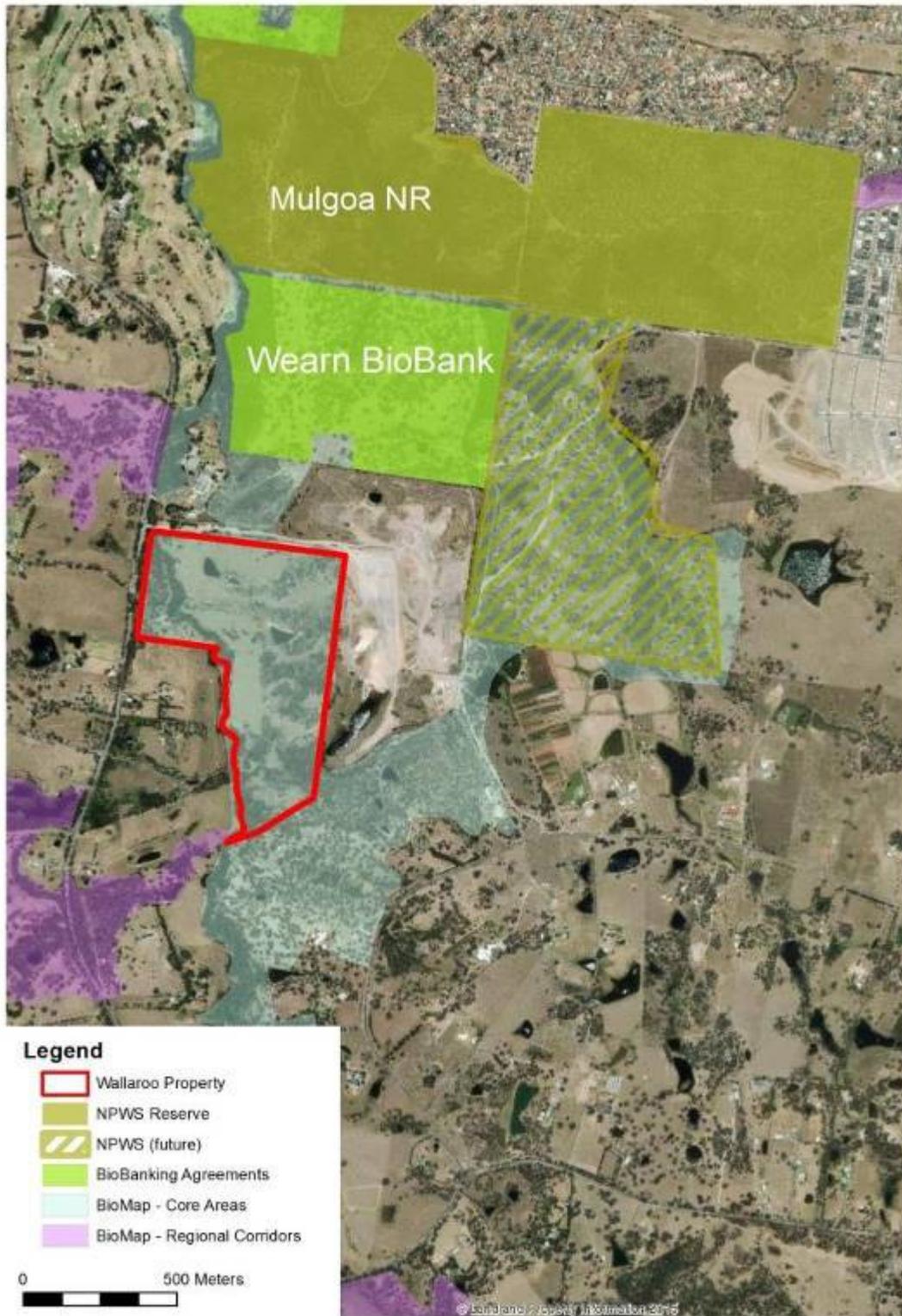


Figure 3- Site Context

CAR Contribution

The conservation of 'Wallaroo' contributes to the national conservation estate.

The CAR criteria (comprehensiveness, adequacy and representation) for national ecosystem conservation are currently very low for Cumberland Plain Woodlands with just 1% of the original extent remaining in conservation tenure.

The conservation of the 38 hectare Wallaroo property complements Mulgoa Nature Reserve and the Wearn BioBank to the north, adding to a local conservation network for Cumberland Plain Woodlands exceeding 400 hectares.

Climate

The Cumberland Plain basin is characterised by reduced rainfall and heightened temperature extremes in relation to the surrounding temperate sandstone plateaus.

The nearest Bureau of Meteorology station is Orchard Hills Treatment Works (Site number: 067084) located approximately 4 km to the east. Climate data (Figure 2 Figure 4 & Figure 5) demonstrate cold, dry winters and hot summers.

Mean climate data for the region are indicated in Figure 4 and Figure 5 below.

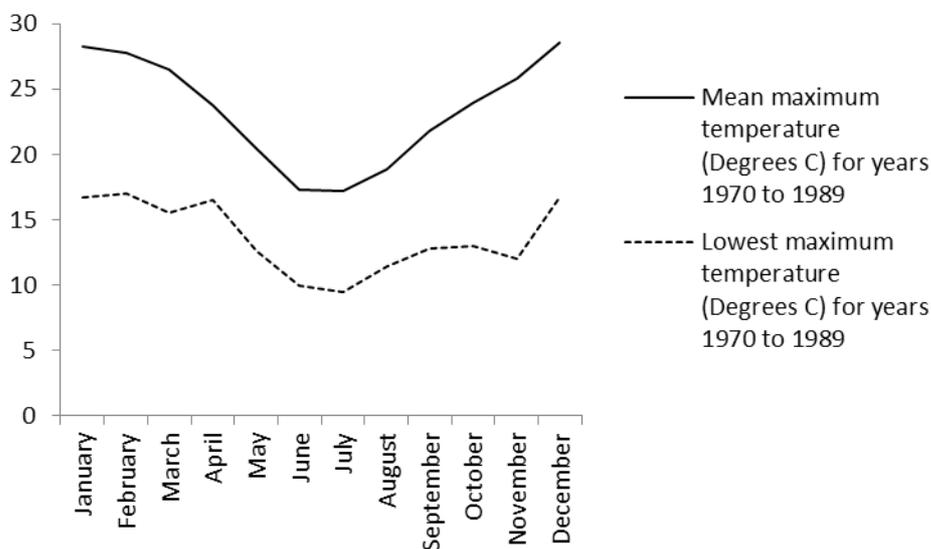


Figure 4 - Mean max/min temperatures

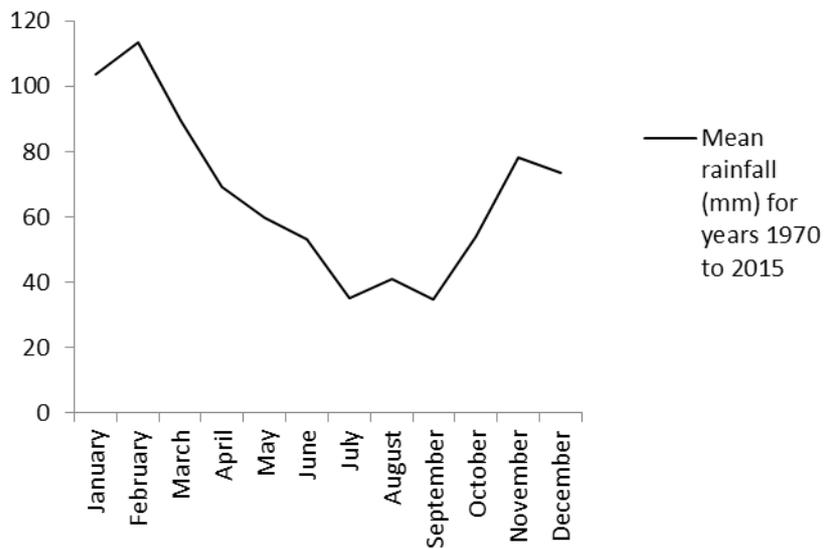


Figure 5 - Mean rainfall (mm)

The climate in Western Sydney is extremely vulnerable to both global and local (urban heat island) climate changes. Major changes to climate have already occurred and further changes are expected. These changes are impacting the local biodiversity. Climatic changes and associated biodiversity impacts are considered under Threats & Management Options.

Climate & Urban Heat Island Changes

A trifecta of global climate change, Urban Heat Island effects and direct carbon impacts are **already and severely** impacting the regions biodiversity (Figure 6 - Average Summer Maximum temperatures to 2007 (BOM 2008).

These impacts are expressed far more severely in Sydney’s west than in other areas of the region (Eco Logical Australia 2010)

The Bureau of Meteorology *East Coast South Projection Summaries* (BOM 2016) indicates the following carbon-driven climate changes for Western Sydney:

- Average temperatures & extremes will continue to increase in all seasons (very high confidence).
- Decreases in winter rainfall are projected (medium confidence).
- Increased intensity of extreme rainfall events is projected (high confidence).
- A harsher fire-weather climate in the future (high confidence).

These changes are compounded (actually exceeded) by the impact of western Sydney’s urban sprawl. The associated Urban Heat Island effect is recognised in the Federal Listing Advice for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (2011). Penrith Council’s ‘Cooling the City’ Strategy (January 2016) also notes the extreme consequences of the urban heat island effect. The dominant impact of UHI is increased maximum (extreme) temperatures.

Already the combination of UHI and Global climate changes have raised Western Sydney peak temperatures by an **average of 7 degrees Celcius**. The local ‘background’ rate from global changes is Sydney CBD where maximum summer temperatures have risen 0.28 degrees per decade since the 1960s. By comparison Western Sydney has risen 0.65 degrees per decade – over twice this rate. This corresponds to a rise from an average 130 summer days over 25°C to over 160 days.

Continuing urbanisation of Western Sydney, and continuation of the current treeless development models are likely to result in extreme climate conditions at Wallaroo in the near future.

Figure 6 below shows the to-date increases in maximum temperatures for Western Sydney. Figure 7 shows the predicted increase factoring both UHI and global climate factors.

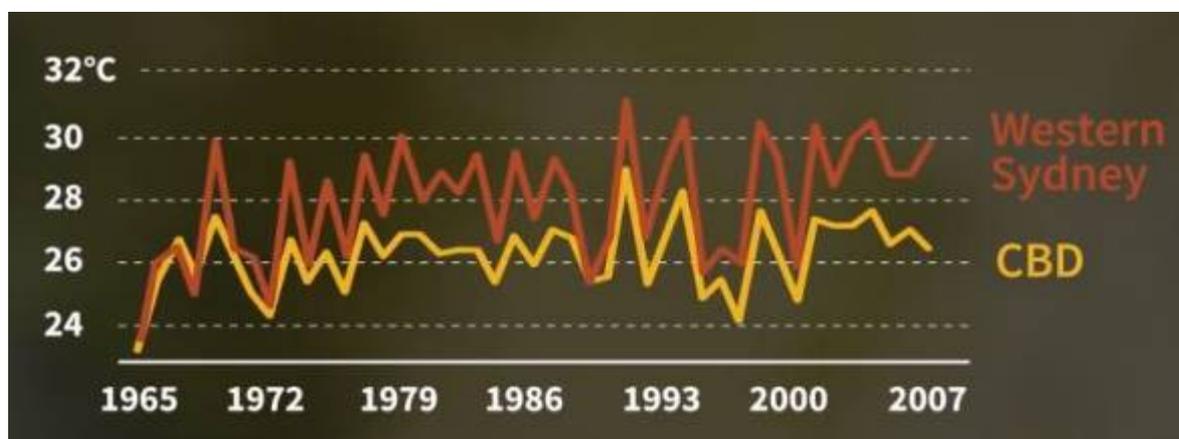


Figure 6 - Average Summer Maximum temperatures to 2007 (BOM 2008)

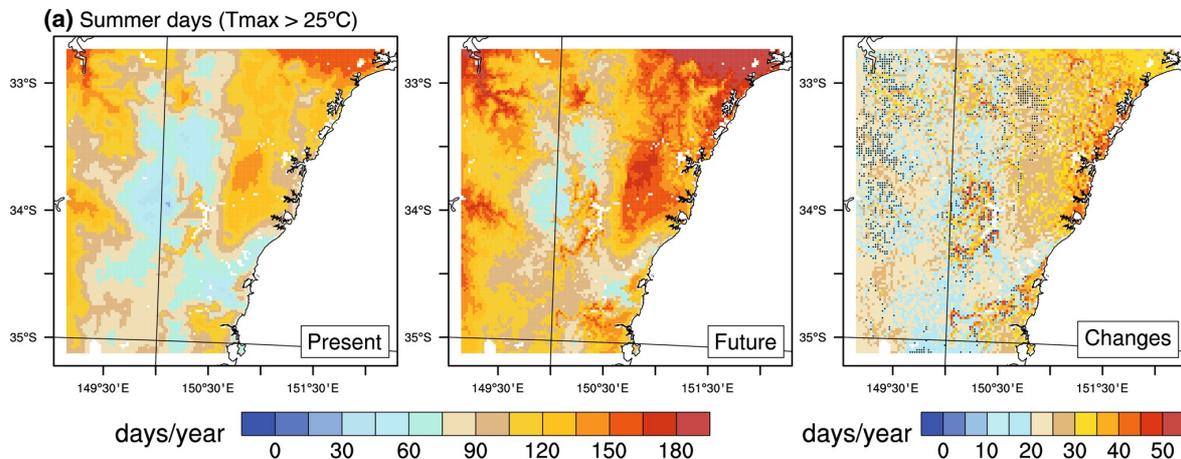


Figure 7 - Predicted summer extremes (Argueso et al 2014)

Geology, landform and soils

The site is located on the Cumberland Plain Mitchell Landscape with Hawkesbury - Nepean Channels and Floodplains along Mulgoa Creek.

The Cumberland Plain consists of early/middle Triassic Period deposits laid down by what were extensive floodplains and swamps draining central NSW (prior to the elevation of the Blue Mountains). These deposits formed the Wianamatta group of shales and sandstones. Subsequent to elevation of the Hornsby and Blue Mountains plateaus most of these fertile sediments have eroded away to expose the 'sandstone' country. This left a 'sunken' basin of older more fertile geologies in Western Sydney.

'Wallaroo' lies on the Mulgoa soil landscape (Bannerman and Hazelton 1990). These are shallow soils of loam, sand and clay of low to moderate fertility, with moderate to high erosion potential.

Adjacent to Mulgoa Creek there are alluvial soils of deep brown to yellow sands and loam of generally low fertility, although these are not mapped.

Hydrology

The shale soils impede any significant near-surface flows at the site. Surface flows run generally east to west draining to Mulgoa Creek which runs generally South to North. At least a dozen small farm dams have been constructed by previous landowners and the larger dams hold water year-round. These are a significant resource for local fauna and will be retained.

Ecological Communities

The 'Wallaroo site consists of approximately 23 hectares of intact native vegetation with the remainder exhibiting previous clearing and/or pasture modification and three large dams.

The majority of vegetation present is the Commonwealth listed and critically endangered 'Cumberland Plain Shale Woodlands' (CPW) and specifically Shale Hills Woodland. Also present on site is the NSW listed endangered community River-flat Eucalypt Forest which abounds Mulgoa Creek from the northern boundary meandering its way to the south eastern corner.

A vegetation map is provided in Figure 8.

Each ecological community is discussed in more detail below.



Figure 8 – Vegetation communities

Cumberland Plain Woodland (CPW - 16.8 hectares)

- 4.5 hectares low condition (Shale Hills formation)
- 12.3 hectares high condition (Shale Hills formation)

CPW is present along the eastern rolling hills. Like most of western Sydney this bushland consists of regrowth estimated at approximately above 70 years with some individual trees estimated at over 100 years. The overall condition of this woodland is found to be good with a high diversity level present.

The exposed surface geology has produced a range of minerals which favour varying *eucalyptus* species. The southern area is dominated by the 'Grey Box' *Eucalyptus molucanna*, the centre is dominated by 'Forest Red Gum' *E. tereticornis* and the northern section is dominated by 'Narrow-leaved Ironbark' *E. crebra*. This in turn produces a larger range of habitats and food sources for a great number of fauna. In particular there is a diversity of flowering seasons across the three dominant eucalypt species, providing a longer period of nectar availability for fauna.

The diversity of these Eucalypts and underlying soil profiles has allowed for a high diversity of groundcover flora. Groundcovers are generally dominated by grasses and dryer habitat specialists, however patches of both 'Vanilla Lily' *Arthropodium milleflorum* and 'Chocolate Lily' *Dichopogon fimbriatus* indicate that more diverse flowering forbs are likely to be present. Removal of grazing is likely to result in a wider diversity of native groundcovers becoming apparent.

CPW on the site is largely weed free. Those weeds present are mostly exotic grasses which link back to the past grazing practices.

Regenerating patches of 'Blackthorn' *Bursaria spinosa* are a response to past management and carbon & climatic changes. These will require management if woodland biodiversity is to be maintained.

Derived Native Grasslands (DNG)

Portions of the CPW are present as Derived Native Grasslands and not to be confused with exotic pasture.

The potential regeneration and expansion of this community is evident right across its range and over time is expected to expand significantly.

Cumberland Riverflat Eucalypt Forest (CREF - 5.4 hectares)

Cumberland Riverflat Eucalypt Forest is present along Mulgoa Creek and it's floodplain including the isolated wedge of land along Mulgoa Road. The Cumberland River-flat Eucalypt Forest is significant by providing connectivity along the length of Mulgoa Creek.

The vegetation varies across its length with a mixture of key canopy species present. Close to the water's edge is 'swamp Oak' *Casuarina glauca* and along its banks is 'Roughed-barked Apple' *Angophora subvelutina*. There is a shift in dominant *eucalyptus* species with 'Cabbage Gum' *E. amplifolia* in the northern end and 'Forest Red Gum' *E. tereticornis* dominant in the southern section most likely associated with soil moisture availability. The average canopy age across this community is in excess of 100 years.

Within this community there are examples of old growth habitat trees that would be estimated at being in excess of 250 years, one is a specimen of 'Roughed-barked Apple' *Angophora subvelutina* and the other is a specimen of 'Forest Red Gum' *E. tereticornis*

Native midstorey (where present) is represented by Grey Myrtle *Backhousia myrtifolia* with more extensive areas of exotic shrubs (e.g. Privet). A vine component is present including native 'Snake Vine' *Stephania japonica*. The understorey is dominated by native grasses, particularly 'Weeping Meadow Grass' *Microlaena stipoides*.

The diversity of this area is medium to high with very good regeneration potential. This is becoming more evident now that the grazing practices have ceased.

Typically for this community weeds are a major threat to integrity and biodiversity. This area has a number of the most aggressive weeds found within the region including 'Trad' *Tradescantia fluminensis* and 'Cat's Claw Creeper' *Macfadyena untuis-cati*.

Alluvial Woodland (0.5 hectares)

A small remnant of Alluvial woodland is present along a tributary of Mulgoa Creek. This vegetation is dominated by She-oak *Casuarina glauca*. This is an allelopathic species and the community naturally has limited abundance and diversity of other native flora. This community has not been separately mapped and is too small for specific habitat management.

Rural Dams (0.8 hectares)

Three large dams and over a dozen smaller ones are present on site. Each has good to excellent emergent macrophytes (water plants) and fringing reeds/sedges. These dams support a range of native frog (e.g. *Litoria fallax*) and bird species (e.g. Eurasian Coot) and an important part of the biodiversity present. They also provide critical drought refuge for a wide range of fauna.

The Vulnerable (NSW) Fishing Bat *Myotis macropus* forages on the larger dams on the site. This species relies on old trees or artificial roosts (including culverts) to roost. Fishing Bats' will receive targeted restoration management at 'Wallaroo'.

Exotic pasture (14.5 hectares)

A central belt of exotic ('improved') pasture is present. This area has been subject to more intense grazing and nitrogen/phosphorus addition. Patches of this pasture are presently recovering despite continued cattle grazing with regenerating wattles, native *Bursaria*, and native grasses present.

Although this vegetation is predominantly non-native this open fertile structure provides habitat for a range of declining woodland birds. Of particular concern are Rufous Songlark (present during the survey of this area) and at least two pairs of Jacky Winters. Adjoining properties have additionally observed the Varied Triller, Red-rumped Parrot, and Brown Songlark in similar habitats.

These 'Shale Birds' are a key part of the Cumberland Plain fauna and are in dramatic regional decline. Bird species such as these rely on fertile, short grasslands and may be threatened by revegetation or reduced-disturbance management.

The exotic pasture also provides habitat for macrofauna including macropods and potentially wombats. Regular disturbance by fire, grazing or slashing will be required to maintain 'green pick' feeding habitat for these species.

Fauna

The site has been subject to an intensive 'benchmark' fauna survey in partnership with Southern Cross University. These surveys are detailed in the relevant Appendices, while the following provides a general introduction to the fauna.

Mammals

The majority of native mammal species are now extinct on the Cumberland Plain. This includes major 'guilds' and the ecosystem services they provide. Medium sized burrowing mammals (e.g. Bettongs) became extinct in the 1800s just prior to the introduction of foxes. Native small ground mammals (such as Bandicoots, *Antechinus* and Bush Rats) declined with expanding fox activity from the 1900s but only became extinct relatively recently (approx. 2000-2015). Exotic Black Rats are present.

The largest mammals are the Macropods represented by the Common Wallaroo (a communal rough-herbage specialist of infertile woodlands), Swamp Wallaby (a solitary browser of riverflat forest) and very occasional Eastern Grey Kangaroos (a communal soft-herbage specialist). Eastern Grey Kangaroos may return permanently if exotic pasture is appropriately managed (regularly slashed or burnt) to sustain adequate structure and green pic. Currently the pasture is rank and provides little habitat value for native mammals.

There is also the potential for Common Wombat to recolonise the site from a nearby captive release site. This species is critical as the only burrowing mammal remaining in the region. Current

studies of the release site indicate the soil turnover from burrowing provides food for a wide range of other native species.

Arboreal marsupials remain intact with the exception of the regionally extinct Brush-tailed Phascogale. The Brush-tailed and Ring-tailed Possums and Sugar Glider are each found in all habitat types on site. There is a moderate possibility of Feathertail Glider at the site, however this species has not yet been detected.

The diversity of Eucalypts on site presents a high probability of visitation by Grey-headed Flying Fox. These nectar-feeding megabats are key pollinators. Urban encroachment and roost destruction ('disturbance') has resulted in severe regional declines over the last 10 years.

A wide diversity of microbat species are present including significant shale/woodland specialists. Five declining woodland specialist species are present of which four are listed as Vulnerable (NSW). This makes 'Wallaroo' an important site for microbat conservation.

The Little bent-wing bat (*Miniopterus australis*) and Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) are Vulnerable (NSW) migratory species with moderately broad habitat preferences. The East-coast free-tailed bat (*Mormopterus norfolkensis*) and Eastern free-tailed bat (*Mormopterus ridei*) are specialists of woodland edges in shale-habitats. These species rely on the patchy canopy of the site and could be at risk from inappropriate revegetation.

The Fishing Bat (*Myotis macropus*) is Vulnerable (NSW) and a specialist aquatic feeder, skimming insects and small fish from the surface of open water. It feeds at the larger dams on site. Local roost sites are unknown.

Introduced predatory mammals are present including Black Rat, Domestic Cat and Red Fox. These are a greater threat to native species than the exotic flora (weeds) and deserve management priority. Exotic grazing species include the European Hare, Rabbit, Fallow Deer and occasionally Cattle. These species may have a negative effect on restoration efforts and through competition with native fauna.

Birds

The site supports a wide variety of avifauna, initial surveys recording 76 species with a total greater than 100 expected in due course.

Wetland species

A range of wetlands on the site support a corresponding diversity of birdlife. Riverine species such as Azure Kingfisher are present along Mulgoa Creek, while permanent dams provide suitable habitat for waterfowl including a breeding pair of Australasian Grebe. Rallidae species and Australian Reed Warbler occur in smaller ephemeral wetlands and associated vegetation.

Woodland birds and migrants

Most woodland species occur on the eastern side of the property. Summer migrants include White-throated Gerygone, Channel-billed Cuckoo, Sacred Kingfisher, Dollarbird and Rufous Whistler with Rufous Fantail as a passage migrant. In winter altitudinal migrants such as Golden Whistler and Rose Robin also use this habitat.

Endangered and declining 'target' species

Two species of conservation concern are present. The Varied Sitella has been listed as Vulnerable by the NSW Scientific Committee. Small semi-nomadic groups can be found throughout the Cumberland Plain Woodland at Wallaroo.

While not a 'listed' species the Jacky Winter is a species of conservation concern. Global and especially local populations have declined sharply over recent years. Loss of habitat through revegetation is a major factor in this species decline in Western Sydney, with excessive canopy revegetation targeting any 'available' structurally open woodlands and grasslands in the region.

Although not yet recorded, the location and vegetation structure of the site has the potential to support 'red-breasted' robins (Flame, Red-capped and Scarlet), White-bellied Cuckoo-shrike, Speckled Warbler, and Painted Button-quail.

Species historically recorded in the area but now locally extinct include Southern Whiteface, Hooded Robin, Diamond Firetail, Brown Treecreeper and Turquoise Parrot.

Introduced/problematic species

Introduced species (Common Blackbird, Red-whiskered Bulbul, Spotted Dove and Common Myna) are present in small numbers. A Noisy Miner colony occupies the open woodland on the eastern side of the property, and biodiversity levels also appear lower in the southern section where there is a colony of Bell miners.

Significant & Threatened biodiversity

This section summarises the regional, state and national conservation status of Threatened biodiversity and other significant ecological assets.

Listed threatened species and communities presently confirmed present at the property are:

- Cumberland Plain Woodland (16.8 hectares; Critically Endangered - Fed)
- Cumberland Riverflat Eucalypt Forest (5.4 hectares; Endangered - NSW)
- Varied Sitella (a woodland bird; Vulnerable – NSW)
- Little bent-wing bat (a microbat; Vulnerable – NSW)
- Eastern Bentwing-bat (a microbat; Vulnerable – NSW)
- East-coast free-tailed bat (a microbat; Vulnerable – NSW)
- Fishing Bat (a microbat; Vulnerable – NSW)

Additional Threatened biodiversity likely to be present but not yet detected on site include:

- Cumberland Plain Land Snail *Meridolum corneovirens* (Endangered - Fed)
- *Marsdenia viridiflora* var. *viridiflora* (Endangered population - NSW) is present in adjoining properties and likely to be present on the site
- Glossy Black-Cockatoo (Endangered – Fed). Occasional in region; site includes 0.5 hectares of preferred habitat dominated by *Casuarina glauca*
- Regent Honeyeater (Critically Endangered – Fed). An occasional visitor in the Mulgoa region including recent breeding attempts; site includes approx. 4 hectares of preferred habitat dominated by flowering Ironbarks and dense Mistletoe on *Eucalyptus tereticornis*
- Swift Parrot (Endangered – Fed). Swift parrot are a migratory visitor. The Mulgoa region is frequently a stronghold during the mainland season (depending on regional flowering patterns). Last season (2014) Swift Parrot were photographed feeding in Eucalyptus located less than 50 m from the site in the adjoining Mulgoa Tip and are highly likely to feed at the subject site in suitable seasons.

Cultural Values

The site has cultural value to the Dharug Indigenous peoples and to the broader local community.

Indigenous Darug peoples have inhabited the area known as the “Cumberland Plain” for over 50,000 years. The land is the sacred core of aboriginal religion and the bond between the land, people and spirituality is fundamental to human existence. The use and management of resources over this period have shaped the Cumberland Plain, as have recent Western land management practices.

No Aboriginal Places or Aboriginal sites are recorded for the property on the AHIMS database. Any Aboriginal sites located during works will be actively protected.

The CLC has strong connections with the broader local community. The community identify with the goals of protecting Wallaroo and see this as important local wildlife habitat and green space.

The ‘Wallaroo’ property was acquired for conservation purposes and will not be managed to provide recreational or cultural services. The CLC will provide educational and conservation activities in partnership with local community to maintain cultural links with the site.

Planning Controls

The site is zoned RU4 Rural uses. It is envisaged that rezoning to E2 will occur when Local Environment Plans are updated.

Bushland to the south (private) and north (Mulgoa Nature Reserve) are part of the Cumberland Plain Priority Conservation Lands (PCL). These lands were identified through the multi-species Cumberland Plain Recovery Plan by the NSW Office of Environment & Heritage as priorities for conservation investment.

The PCLs have subsequently been informally restructured by the Biodiversity Investment Opportunities Map (BIO Map). Similar to the PCLs, the BIO map seeks to direct biodiversity investment funding to the strategic locations of greatest benefit. The ‘Wallaroo’ property and adjoining Priority Conservation Lands to the north and south are mapped as the Mulgoa regional biodiversity corridor under the BIO Map.

These controls are shown in Figure 3- Site Context.

Relevant Regulatory Controls

The management of Wallaroo is subject to a range of regulatory controls, including but not limited to that considered below. The CLC Land Management Sub-committee will keep up to date with any changes to legislation and ensure all necessary requirements are met.

Legislation	Relation to Wallaroo and its management
National Parks and Wildlife Act 1974 (NSW)	Nature conservation and licencing for activities causing harm to protected or threatened species
Nature Conservation Trust Act 2001 (NSW)	NCT Conservation Covenant agreements
Threatened Species Conservation Act 1995 (NSW)	Protection of threatened species, populations and EECs (anticipated to be revoked shortly)
Local Land Services Act 2013 (NSW)	Declared pest declarations & control obligations

Noxious Weeds Act 1993 (NSW)	Responsibilities to control declared noxious weeds;
Rural Fires Act 1997 (NSW)	Directions for hazard reduction burn procedures
Native Vegetation Act 2003 (NSW)	Not applicable to Penrith LGA (anticipated to be revoked shortly)
Environmental Protection and Biodiversity Conservation Act 1999 (Federal)	Protection of the environment and Matters of National Environmental Significance

Alignment with State & Federal Threatened Species programs

Alignment with State programs

Threatened Species management in NSW has recently shifted from the legislated recovery objectives to a new managed-loss approach. Threatened species are now managed under the Saving our Species (SOS) program. This focuses on investment-based management at the fewest most cost-effective sites (site-managed species) or the most cost effective non-regulatory actions (landscape-managed species).

Threatened species at Wallaroo are mostly designated as Landscape Managed species in SOS although a few are awaiting designation and/or complete Species Action Statements.

The CLC management intent for threatened species is science-based recovery. This complements and extends beyond the SOS program goals.

Relevant actions in the Species Action Statements (or their replacement) and relevant reporting to the SOS database will be considered in threatened species management at Wallaroo.

Alignment with Commonwealth programs

Subsequent to Bilateral agreements Commonwealth oversight of Threatened species recovery is principally delegated to NSW, and no species present at Wallaroo have Commonwealth Recovery Plans.

The property has been purchased with assistance from the Commonwealth Government Cumberland Plain Initiative. The restoration actions contained in this management plan deliver, complement and extend the conservation priorities of the Cumberland Plain Initiative program.

Threats & Management Options

This section summarises the condition of assets, threats, management response/restoration options, and detailed management goals for Wallaroo. A summarised activity matrix is provided in the Management program/schedule.

Climate risk factors cannot be managed at Wallaroo with the exception of techniques to raise general resilience. For this reason they are covered in the site description above.

Management Framework

The Management Framework for 'Wallaroo' is detailed in the Management Vision Purpose & Implementation and Partnership sections at the beginning of this plan.

The site will be protected by a conservation covenant in perpetuity. The nature of this covenant is presently being negotiated.

The site will be owned by the Cumberland Land Conservancy Inc (CLC). The CLC are a community-owned landowner with the sole purpose of the conservation & recovery of nature. The CLC operates under an elected Committee and associated Land Management subcommittee including a President, Public Officer, Communications Officer and Science Officer. The committee and their Terms of Reference are available online at www.cumberlandlc.org.au

This Plan of Management has been drafted with assistance from the CLC membership including local public representation.

Interim/Immediate Management Issues & Actions

Immediate Management Issues have generally been addressed at Wallaroo.

Domestic stock were removed prior to sale and negotiations are underway with one neighbouring landowner in regard to occasional wandering stock.

Key management options include:

- **Remove unwanted management infrastructure including minor internal fencing (under consideration)**
- **Negotiate access with Penrith Waste Services to provide a long-term access gate (as detailed in the relevant section; Public access is by arrangement only)**

Access, Trails, Fences & Infrastructure

Built Assets & Services

There are no residences, built assets or services located on the site.

Access

At present access is via Penrith Waste Services on Mulgoa Rd. Keys to gates are held by CLC Committee members. Penrith Waste Services are negotiating with CLC to provide independent access to Wallaroo at PWS costs.

- **If necessary consider install monitoring camera at the access site, however in the interim PWS security is sufficient for the property.**

Limited informal parking is available offsite with Penrith Waste Services. The CLC have been requested to avoid use of this area over the long term.

- **Define and maintain a section of exotic pasture to provide long-term access.**
- **Acquire and locate a small lockable shipping container or similar facility to serve as a dedicated storage area as required for feral animal control regulations and practical necessities.**

Currently the Emergency Assembly Area is the informal PWS car park opposite. Once dedicated site access has been arranged the Emergency Assembly Area will be relocated to the abovementioned parking area.

- **Develop a WHS & Sign-in booklet with Landcare NSW (completed) and install in waterproof box on site (completed by donation from Tahmoor Anglican Mens Shed).**
- **Establish & maintain an access trail network as necessary for management operations (including fox control and boundary fence maintenance). The draft trail network is indicated in Figure 9 - Slashing Map.**
- **Restrict vehicle use to trails and where possible use soft-foot plant (e.g. tractor) to avoid soil compaction or erosion.**

The trail network has been designed to avoid sensitive or native vegetation areas. The network will be assessed and modified as necessary as part of adaptive management on the site

Easements/Services

Transmission lines (125 kW low voltage) cross the Riverflat Forest; they run North-South and mostly on the western side of Mulgoa Creek. There is no legal easement for these services and their history is unclear. The transmission lines generate a duty of care for Wallaroo.

- **Regularly maintain areas beneath transmission lines by slashing to avoid unsuitable growth or fuel accumulation. Works will be undertaken in the best manner possible to reduce exotic species cover, maintain/restore habitat and avoid ingress of exotic species (especially the spread of grass seeds on machinery).**

Timber extraction & firewood

The site has historically suffered from firewood collection by previous landowners. At present the limited access through Penrith Waste Services ensures a very low risk of firewood theft.

Alternative access arrangements will ensure this risk level is maintained wherever possible (for example via signs, cameras or other methods).

- **No firewood is to be harvested on site.**
- **Continue to obtain clean native logs rescued from arboriculture works in the region to assist in the return of terrestrial woody habitat.**

Rubbish

- **Remove all rubbish (fencing & wire), prioritising materials posing a WHS risk e.g. to slashing operations. Where suitable donate to PWS**
- **Retain the historic tractor and plough as examples of site heritage**

Erosion, Salinity, Acidity & Mining

No erosion, salinity, acidity or mining related works are currently required.

Fire Management & History

Fire is a key component of Grassy Woodland ecology and active fire management (ecological burns) is key to managing and restoring biodiversity on the property.

The fire history of the site is unknown as the Cumberland Region RFS do not provide fire history mapping. However the region is well known for Catastrophic grade fires crossing the Nepean River during summer seasons. For this reason some fire breaks between habitats may be advisable.

The CLC will comply with any regulatory responsibilities in regard to fuel management.

- **Develop & implement Fire Management Plans to restore native biodiversity and manage fuel loads**
- **Extinguish fire in hollow logs & old trees during management burns to maintain habitat structure**
- **Where necessary install slashed firebreaks before undertaking burns**

Individual plans for each burn will be developed and implemented in consultation with Western Sydney Cumberland Bushfire Management Committee, the Mulgoa Rural Fire Service (RFS) and CLC Scientific Officer.

These plans will be developed with a focus on:

- Suitable ecological fire regimes, meeting the requirements for each community,
- Reduce the threat of wildfire impact across 'Wallaroo'

- Fire threat from 'Wallaroo' to the surrounding properties
- As a tool for supporting areas for specific weed control and regeneration potential
- Promote a range of varying habitats

Fires for weed and pasture management

- Fire will be used as a tool, along with slashing to control grassy weed cover and density
- To reduce fuel loads in the DNG and offer buffer of protection to the CPSW and CREF.
- It will be applied as a strategic tool in and around the edge of the CPSW and CREF to support weed treatment and maximise natural regeneration potential

Pasture management

Exotic pasture requires active management to maintain structure (e.g. green pick and interstitial spacing for fauna) and control weeds. Some pasture margins may have potential for active recovery to native species, however the majority cannot be restored.

Broad-acre pasture tree planting in the Cumberland Plain has been shown to provide no improvement to native flora (Wilkins et al 2003) and has resulted in local extinctions of many grassland/open-woodland fauna (e.g. Jacky Winter, Brown Quail, Western Sydney Parklands). Scalping and seeding pasture may provide some improvements however long-term results in the Cumberland Plain are unknown (Greening Australia, unpublished). For these reasons exotic pasture will be maintained as grassland areas – **without canopy cover**.

Pasture height is also critical to native fauna and requires management. Shorter grass leaves interstitial spacing between tussocks and many woodland insectivores feed only in this space including Rufous Songlarks, Jacky Winter, Peaceful Dove, Pipit's, and Scarlet & Flame Robins.

Longer grass benefits a different but smaller guild of woodland species including Golden-headed Cisticola and Brown Quail. While grass is currently rank/long these species are not currently encouraged.

Long grass is also unsuitable feed for macrofauna including macropods and wombats. Long grass reduces 'green pick' and (rather ironically) results in fewer native herbivores than short grass (e.g. 80% decrease in Wallaroo's at neighbouring BioBank site when grass exceeded 2 foot).

- **Exotic Pasture will be managed to:**
 - **maintain a diversity of grass height (long/short)**
 - **maintain structurally open fauna habitat on the site**

- **provide fire breaks where necessary between habitats**
- **reduce seed development of problematic weed species**

Slashing

The scale and position of exotic pasture on site, and budget constraints, prohibit grazing management to maintain structure. Strategic slashing with follow-up control of annual weeds will be a major tool in managing the pasture through:

- Buffering specific edges of the CPSW and CREF from fire
- Fire breaks zones across the site
- To create mosaic fire patterns across the site
- Slashing to support native species establishment and weed control
- Timing slashing to reduce seed development of problematic weed species

A draft slashing map is provided below:



Figure 9 - Slashing Map

Revegetation strategies

It is fundamental to any bushland recovery program that following primary weed control there is sufficient time to pass for natural regeneration processes to occur. This may follow directly from the existing seed bank or, as for some plant species, recruitment from dispersal from the outside such as birds and the wallaroos. However, on close assessment of the vegetation communities within 'Wallaroo' it is apparent that some intervention such as planting may be warranted. For each community at 'Wallaroo' individual assessment will be made for both short and long term recovery goals.

Cumberland Riverflat Eucalyptus Forest (CREF):

Within the CREF there is great potential for natural regeneration to occur now that the stock has been removed. However, in fill plantings of some species will prove valuable for habitat improvement 'Grey Myrtle/Iron Wood' *Backhousia myrtifolia*; although it is currently present the population is low. For example Small leaved Privet *Ligustrum sinensis* is slowly removed a habitat void will exist for Ring-tailed Possums that could take many years to recover unless in filling occurs.

Erosion control along the creek line is another problematic area that will benefit from planting of 'Lomandra' *Lomandra longifolia* the cattle activities in seeking water from the creek have decimated the low lying areas, which are now bare and exposed to active erosion even in minor rain events.

There is a narrow area adjacent to the creek on the eastern side, where there is a large infestation of Tree of Heaven and currently no Eucalyptus or associated canopy species are present. The time for natural canopy to establish would be estimated at decades and therefore the added benefit of assisted revegetation of canopy trees in this area would create an expansion of the corridor width.

Some areas of the floodplain have canopy patches of middle aged to senescing specimens of the Wattle *Acacia parramattensis*. They certainly are impeding exotic grass competition and the native grasses appear to be flourishing with the aid of the canopies presents. So this Acacia species will be utilised as a way of competing against the weed grasses and in the short to longer turn allow valuable logs to be added to the ground as habitat for various organisms.

- **Consider plantings of *Backhousia* and *Lomandra* to replace Privet and control erosion throughout CREF**

Shale Hill Woodland (SHW) i.e. Cumberland Plain Shale Woodlands (CPSW or CPW)

The existing immature SHW is healthy woodland with a high level of diversity. It lies across the eastern boundary and is expected that it will regenerate and expand its range now that the stock

has ceased grazing. There are no obvious signs that revegetation is needed at this time. Ongoing monitoring will occur.

Derived Native Grasslands (DNG)

The DNG on the hills and slopes could/should be enhanced by the strategic plantings of suitable *Eucalyptus* canopy trees. These trees should be planted as a combination of individual trees or as small patches of *Eucalyptus* canopy and include the short lived 'Parramatta Wattle' *Acacia parramattensis*, as a way of protecting the emerging canopy, increasing available nutrients and the potential for logs in the development of ground habitat. Over time observation and monitoring of these DNG will be incorporated in line with fauna and other habitat values.

- **Consider plantings of *Eucalyptus* and *Acacia parramattensis* in DNG areas**

Pasture

The pasture will be enhanced by the strategic plantings of 'stepping stone' small patches of *Eucalyptus* canopy with 'Parramatta Wattle' *Acacia parramattensis* while maintaining sufficient open structure for grassy-habitat fauna. A buffer of tree & shrub vegetation along the northern property boundary may also be beneficial.

- **Consider plantings of *Eucalyptus* and *Acacia parramattensis* as stepping stones in pasture while maintaining habitat for grassy-habitat fauna**
- **Consider planting a buffer of tree & shrub vegetation along the northern property boundary**

Seed Collection

Any revegetation on the site will require local seed collection. Considerations for such collection follow.

Codes of practice

The 'Flora Bank Code' of practice guidelines for community-based collectors and suppliers of native seed will be adhered to. Only professional and registered NRM compliant traders or organisations with strict codes of practice will be engaged. An appointment of a CLC member with the appropriate qualifications could also be considered.

Provenance seed collection

The seed collection requirements at 'Wallaroo' for any required revegetation will be based on an individual species and their provenance and genetic considerations with a similar soil type range and the composition of species that occur in the various plant communities at 'Wallaroo'. The

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Mulgoa Valley and specifically either side of, and up or down stream along Mulgoa Creek and within the Mulgoa creek catchment are identified as appropriate.

Licensing, permits and permission

Within the range identified for potential seed collection, where licensing will be required is Mulgoa Nature Reserve, managed by National Parks and Wildlife Service and Gow Park, managed by Penrith City Council. Permission will be sought for private properties that fall into the 'provenance area stated above.

Invasive & overabundant flora

General

A 'Weed' is simply a plant 'overabundant or out of place', a plant not performing a beneficial ecological function. Before removing weeds one needs to be mindful of the potential habitat value being offered in the recovery process for local fauna. This can prove to be a critical factor in implementing a successful ecological weed control plan.

Non-indigenous species, 'native' species outside their natural range or habitat (e.g. 'White Cedar' *Melia azadarach* in dry woodland areas), or native species in unsuitable abundances (e.g. broad-acre dominance by 'Blackthorn' *Bursaria spinosa* following soil disturbance) can be problematic in the recovery of an ecosystem.

The general purpose of restoration at Wallaroo will be to maintain and enhance native vegetation cover, functionality and ecosystem processes. This will occur through direct action on the ground and our monitoring programs before and after weed control.

Therefore the following goals will need to be achieved:

- The cover of noxious weeds is significantly reduced, controlled or where possible eradicated from the site
- The cover of environmental weed species is significantly reduced, controlled or where possible eradicated from the site.
- Weed controls will be undertaken in a manner that does not degrade the conservation values of 'Wallaroo'
- Containment leading to eradication of any new weed incursions; this will be achieved through our long term monitoring plan and direct action strategies. In the event that a new incursion occurs, we will be ready to act in accordance with appropriate regulatory bodies.

Weeds & Wildlife

Many introduced plants at ‘Wallaroo’ offer a supplementary food source for native birds, particularly Frugivores. Fruiting shrubs are generally absent from Cumberland Plain Woodland and RFEF and these birds have emigrated to utilise this new food source. Weed management is therefore likely to result in a shift in the species present. For example eliminating Tobacco plants may result in the loss of Satin Bowerbird and Brown Cuckoo-dove, both of which have been recorded on the site as shown below.

Similarly the fruits of the native overabundant White Cedar are an important food source for species such as the Australasian Figbird, while the grubs that utilise this plant are highly sought after by Yellow-tailed Black-Cockatoos.

- **Pace weed removal activities to avoid fauna stress and manage for a shift in fauna toward locally-adapted species**



Figure 10 – Birds feeding on out-of-area plants

Overabundant native species

Some native species can respond to past disturbance or management changes by becoming overabundant. These native plants can pose a greater threat to conservation values than exotic weeds, but are rarely managed.

In the Cumberland Plain the role of the native shrub *Bursaria spinosa* (Blackthorn) in adversely affecting vegetation structure is well known. Most conservation reserves in the Cumberland Plain are no longer Grassy Woodland but Shrubby Forest and as a result woodland fauna have declined or become locally extinct.

Bursaria spinosa responds to land disturbance after grazing has ceased and fire is excluded. 'Blackthorn' is known to spread rapidly and dominate at the exclusion of an abundant and a diverse ground layer. This has been further exacerbated by the exclusion of suitable fire regimes across most of the 'Cumberland Plain'.

Conversely Blackthorns' value as a nesting site for small birds is similarly well documented. Patches of shrubs are a key part of woodland structure. Thus the management priority for this species is maintaining structural diversity. Monitoring of this species over time will prove of value in determining variation fire regimes in part across the site.

- **Manage *Bursaria* by fire or hand control to ensure structural diversity and maintain grassy woodland (to be a conservation management priority)**
- **Monitor *Bursaria* densities across the site over time by establishing photo points**

While Mistletoe is seen as a parasitic plant it's flowers and fruit are also an extremely important food source for many woodland birds including the critically endangered Regent Honeyeater.

- **Maintain Mistletoe as a fauna habitat feature**

Noxious Weeds

Declared Noxious weeds bear regulatory responsibility for management. Species present at 'Wallaroo' are:

'Fireweed' *Senecio madagascariensis* in the pasture
 African boxthorn, *Lycium ferocissimum* in the Riverflat Forest; and
 Tree of Heaven *Ailanthus altissima* in the Riverflat Forest
 Blackberry *Rubus* sp. in the pasture
 African boxthorn *Lycium ferocissimum* in the Woodlands
 African Olive *Olea europaea subspecies cuspidata* in the Woodlands (individuals only)
 Cat's claw creeper *Dolichandra unguis-cati* in the Riverflat Forest
 Green cestrum *Cestrum parqui* in the Riverflat Forest
 Lantana *Lantana* sp. in the Riverflat Forest
 Privet (Broad-leaf) *Ligustrum lucidum* in the Riverflat Forest
 Privet (Narrow-leaf) *Ligustrum sinensis* in the Riverflat Forest

These species have a capacity to significantly modify the biological aspects of an ecosystem and/or out compete successfully with native species for nutrient and available soil moisture. The

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range of weed control strategies employed across the site will significantly reduce the abundance and spread of each noxious weed species over time.

- **Suppress and/or eradicate all Noxious weeds in accordance to their declaration status**

Environmental weeds

Environmental weeds are plants that invade bushland areas and compete with native plants for space, nutrients and available moisture. In many cases they modify the environment, change light conditions and soil temperature, being factors, which lead, in part, to the exclusion of native species.

Environmental weeds fall into ‘three categories’

- ‘Opportunistic weeds’ – are weeds that react to vegetation and/or soil disturbances, primary weeding of a site, slashing and fire are examples of disturbances. They mainly consist of annuals or biennials; they compete with natives plants in the early stages of natural regeneration by competing for space, nutrients and available moisture. The fast nature of their life cycles allow for large amounts of seed to be produced and can easily spread to other areas such as the wind-blown seed ‘Canadian Fleabane’ *Conyza canadensis* or as an attachment as in ‘Farmers Friend’ *Bidens pilosa*.
- ‘Bushland Invaders’ – these are plants that invade bushland but will not assume dominance. They will generally compete with the existing natives species for space and native ground layer, such as ‘Blackberry Nightshade’ *Solanum nigrum* and ‘Winter Senna’

Senna pendula var *glabrata* are examples.

- Ecosystem transformers – these are plants that, over time, will out compete the native dominants , examples of these can be found impacting at all structural levels in the River-flat Forest. Without intervention the functionality of the ecosystem will be impeded and in due course will collapse. ‘Prime examples which are found within the CREF at Wallaroo are; ‘African Olive’ *Olea europaea* subsp *cuspidata* a small tree, ‘Cat’s Claw Creeper’ *Macfadyena unguis-cati* a vine, with it’s ability spread throughout the native canopy or ‘Trad’ *Tradescantia fluminensis* dominating on the ground.

Methods of Weed Control:

Herbicide

The goal for any vegetation restoration program should be to minimise chemical use in the controlling of weeds. Specific target use and application will be evaluated in each instance on difficult weed species being controlled. Herbicide treatment which incorporates other strategies

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will be the guideline followed at 'Wallaroo'. Glyphosate (Round up Bio-active) will be the herbicide used almost exclusively throughout the site. Some examples of treatment techniques for weeds that will be used on site:

- **Wick wiping**– is an effective way to treat target grasses and flat weeds in amongst native ground layer after slashing.
- **Scrape & paint** – this technique is used on most vines or climbers and also on some persistent woody weeds i.e. 'Cestrum' *Cestrum paraqui*
- **Cut & paint** – this is commonly used on small diameter woody weed stems, with minimal chemical required. Effective on most species.
- **Drill & fill** – this technique is used on large diameter trunks, where complete removal is not required

It should be noted that other herbicides or method for persistent woody weeds (e.g. 'Tree of Heaven' *Ailanthus altissima*) are likely to be required. The selection will be governed by minimal impact to the environment and legal requirements.

Mechanical removal

The most commonly used will be hand removal, either by pulling (seedlings) or crowning of grasses.

Within the grassland areas and specifically adjacent to the other vegetation communities crowning or use of a mattock on weedy grasses will prove effective. This in turn will stimulate the native seedbank, as mechanical disturbance of soil reduces soil compaction (created by past land use) and thereby allowing greater water penetration. It has been used on many CPW communities over the past 20 years, although slower than herbicide it has proven more valuable in stimulating natural regeneration, aiding in the recovery and mimics the effects of missing, foraging fauna.

Biological control

Biological controls are now available for a number of weed species. Important to note biological control of weeds will not remove weeds, but can assist in reducing cover. This is more of a catchment or regional strategy, where economic resources are limited. The recent introduction of Jewel Beetle (2016) for the control of 'Cat's Claw Creeper' *Macfadyena unguis-cati* may well prove to be a valuable tool in the other densely infected regions. Although 'Cats Claw Creeper' *Macfadyena unguis-cati* is present on site eradication is achievable and a strategy using biological control is not likely to be a consideration at 'Wallaroo'

Control Strategies to be used in designated areas.

The general weed treatment/control strategies being developed and implemented will be focused at two levels:

- Firstly, assess weed presence and cover across the entire site, with consideration of the surrounding landscape environment and the potential for weed dispersal within 'Wallaroo'.
- Secondly, the treatment/control strategies will be assessed on an individual plant basis. As some species are limited by abiotic considerations like soil moisture, light etc. Others have a potential to spread throughout the entire site in certain conditions. This will lead to the formalisation of a comprehensive weed control program for the entire site.

Cumberland River-flat Eucalyptus Forest (CREF)

The CREF has typical riparian weed management issues; those associated with moist conditions and localised flooding make it perfect for many 'Ecosystem Transformer' weeds to establish and maintain high populations and degrade the quality of the community.

At this present time and with the removal of stock, the opportunity exists for CLC members to target the 'Ecosystem Transformer's' before they have time re-establish in this recently grazed environment .

The focus will be on a comprehensive weed control program, with immediate attention given to Cat's Claw Creeper *Macfadyena unguis-cati* 'Trad' *Tradescantia fluminensis* and 'Tree of Heaven' *Ailanthus altissima* of which are limited to some extent and should be easily managed at this stage.

'Small leaved Privet' *Ligustrum sinense* is widespread across the site and with obvious signs of seedling germination occurring already will prove a longer proposition to control. 'Small leaved Privet' *Ligustrum sinense* has at this stage the added consideration of stabilising the creek banks and may provide useful habitat for Ringtail Possums.

In the grassland along the edge of CREF canopy cover, the exotic and pasture grasses and associated weeds will be controlled so as to create conditions suitable for the canopy and other native species to spread out, aiding in expanding the width of the creek line vegetation.

Cumberland Plain Shale Woodlands (CPSW or CPW)

The CPSW extends across the eastern boundary but is disparate on the Southern and Northern boundaries. The Southern boundary is well established and links to well establish vegetation

outside 'Wallaroo'. However, the Northern boundary will need to be widened through revegetation as it is very narrow

This CSPW is showing strong signs of expansion into the previously grazed grassland areas down slope.

The common weeds present are typically exotic and pasture improved grasses, with a mixture of bushland invaders e.g. 'Moth vine' *Araujia sericifera*, 'Bridal Creeper' *Asparagus asparagoides*, 'Asparagus Fern' *Asparagus aethiopicus* and 'African Boxthorn' *Lycium altissima*. There is a presence of 'Cat's Claw Creeper' *Macfadyena unguis-cati*, an Ecosystem Transformer, spreading up from the CREF on the southern boundary; this will be a priority for control.

Derived Native Grasslands (DNG)

The DNG is found throughout the centre of 'Wallaroo' from the northern to southern boundaries. It occurs in what would have previously been CPSW and CREF. As a result of its establishment in these communities, the recovery and weed control focus will be different in some ways. The nature of CREF, being associated with the localised floodplain and more productive farmland, it has limited native grass cover and is heavily dominated by exotic 'African Love Grass' *Eragrostis curvula* and pasture grasses 'Paspalum' *Paspalum dilatatum* 'Rhodes Grass' *Chloris gayana*. Further there are examples of previous long term agricultural activities which have led to direct soil disturbances that in turn have led to a reduction in the native seed bank.

The DNG on the hills and slopes are to a point (excluding dam construction areas) in better condition. They range from dominant native grass cover, mixed exotic and native, through to almost entire exotic cover. The potential recovery of these areas although slow over many years will respond to a range of restoration techniques including mechanical (hand and digging), slashing and hand/chemical weed control, to use of fire and hand/chemical weed control. These areas appear to have some native seed bank present and will be monitored closely as the recovery process gets underway. These areas will require some specific canopy planting, ranging from clumping to individual specimen plantings to aid corridor connectivity and fauna movement.

It's paramount, that these communities will have a **comprehensive and ongoing weed control program** that maximises the natural regeneration potential and focuses on the reduction and further spread of weeds throughout the site.

Invasive & overabundant fauna

The immediate priority for managing invasive fauna is fox control (and associated rabbit control). As resources permit, control of invasive herbivores will also be considered. Principles and proposed actions for invasive fauna control are as follows:

- Where possible engage with neighbouring landowners in feral animal control
- Manage rabbits and foxes concurrently where possible
- Develop & implement a Fox & Rabbit Management Plan including:
 - accreditation of CLC volunteers to lay baits
 - laying baits for continual replacement (year-round control)
 - monitoring of both fox and native species abundance with wildlife cameras
- Where resources permit investigate humane options for Feral Deer control; investigate potential in-kind control e.g. Farm Assist program

Wildlife recovery

Wildlife recovery actions are generally covered in the associated sections of this plan. However some fauna-specific recovery actions are underway and others under consideration for future activation. These include:

- Install coarse woody debris from sustainable sources (e.g. recycled from arboricultural works) to improve habitat for endangered Cumberland Plain Land Snail and other woodland fauna, at approx. 20 tonnes/hectare
- Consider reintroduction of Wombats (if not self-established). Wombats were successfully returned to the Cumberland Plain Woodlands by CLC volunteers in 2015 on a property nearby.
- Consider installation of Habitat hollows and Nestboxes. This should target species specific nestboxes for declining fauna, e.g. smaller holes for Musk/Little Lorikeets rather than encourage Rainbow Lorikeets.
- Investigate options for construction & installation of Fishing Bat roost sites adjoining the larger dams



Figure 11 - Wombats were successfully returned to the Cumberland Plain Woodlands by CLC volunteers in 2015 and may soon arrive at 'Wallaroo'

Bird-specific management options

Many of the declining fauna species at Wallaroo are birds. Intensive bird monitoring has been occurring since the Avian survey of December 2015. Specific actions to recover target bird species include:

- Manage pasture cover to maintain/restore habitat values (refer relevant section)
- Manage Bursaria cover maintain/restore habitat values (refer relevant section)
- Maintain some areas free of tree canopy to assist native species (also applies Freetail Bats)
- Consider installation of perch poles in grassland to support robins and other hawking species
- Consider installation of artificial rafts for waterbirds
- Consider encouragement of flat exposed mud to assist wading birds in any wetland vegetation planning

Biosecurity

Many pathogens including *Phytophthora cinamomi* and Chitrid are already 'endemic' in the Cumberland Plain i.e. present at all parts of the landscape. However certain management actions may reduce risk of new incursions or high volume pathogen loads which may result in symptoms.

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- **Where possible house plant & tools on-site to avoid new incursions**
- **Consider installing a dedicated cleaning area near the container shed**
- **Check all vehicles & plant on entry and exit to the site; if need be clean prior to entry. This is particularly relevant to slashing machinery entering the site**
- **Woody debris for habitat supplementation may be brought on site but must be inspected and free of foliage or root base materials**

WHS, Insurance & Licencing

NPWS Licencing

The NPW Act (1999) Part 7 and Part 8A require licencing for activities which result in harm or picking protected or listed (vulnerable, endangered, critically endangered) species or communities.

No licence is required to practice standard best-practice bush regeneration, monitoring or pest control. Nonetheless OEH does issue licences for these activities should CLC wish.

In the event that the CLC undertakes any activities which may harm or pick protected or listed entities the necessary licences must be acquired prior to any works. Such activities could include seed collection, live-capture wildlife survey, scalping/soil translocation works or culling of overabundant native wildlife.

ACEC Licencing

Animal Care & Ethics licencing may be required for some future project activities. Survey and activities to date have been undertaken under approved licences.

WHS

CLC has developed a comprehensive Work Health & Safety system including work inductions & log-in sheets. Tahmoor Community Mens Shed has donated a custom built permanent waterproof box for housing the WHS materials for CLC.

- **Install the WHS book and require all site visitors to undertake the necessary induction and abide by its requirements**

Insurance

CLC activities on Wallaroo are fully insured through the CLC Landcare Group.

Engagement, Education & Recreation

The CLC will continue to engage with the local community in delivering conservation and restoration at 'Wallaroo'.

The funding and conservation of the site has already been publicly announced with an associated Ministerial visit and local media coverage.

Public information about visiting the property will be provided after transfer of tenure to the CLC.

- **Visitors to access the site for conservation, restoration & education purposes only. No visitation activities are to be permitted which compromise conservation values or restoration activities or their potential**
- **CLC will collaborate & inform our neighbours of our activities on a regular basis, including any actions relevant to their property (e.g. fox control). Where possible restoration projects will be cross-tenure**
- **CLC will engage the general and NRM communities with regular education & engagement activities including Bushcare, spotlighting and similar activities**
- **CLC will investigate opportunities to install red-post markers or similar to mark trails on site, and development of a site map/brochure**
- **Permanent entry gate signage will advise of private land status and provide contact details for access arrangements ('please enter' or similar signage is known to encourage inappropriate uses in Western Sydney)**
- **No dogs are to be permitted on site (excepting biodiversity purposes e.g. wildlife survey dogs; and guidance assistance dogs)**
- **No bikes or non-management vehicles to be permitted on site. All management vehicles to be soft wheeled (e.g. 4wd, tractor) no caterpillar plant.**

Landowner costs & responsibilities

LLS Rates

CLC are responsible for paying Local Land Services rates for regional agricultural support services; no exemptions for non-agricultural properties including conservation covenants are provided.

- **Lodge a change of details with LLS and receive the PIC (property identification code) on land acquisition**

- **Lodge Annual Land & Stock Return with LLS every year to avoid additional charges – due 31 August each year**

Estimated cost: \$105 per year

Stamp Duty

CLC has been formally excused stamp duty on the transfer of this property.

Land Tax

The Commonwealth Land Tax Management Act 1956 Part 3 - Sect 10 proportionally exempts NCT covenants from land tax – in this case 100% of the property will be exempt.

Local Government Rates

CLC have approached Penrith City Council regarding rates exemption; Penrith Council is awaiting ownership transfer to process this exemption. NCT covenants are discretionally exempted from rates under the current legislation.

- **CLC to advise Penrith Council when covenant issued and land tenure transferred in order to access rates exemption**

Monitoring

Vegetation monitoring

The CLC has an extensive vegetation monitoring program initiated in partnership with Conservation Volunteers Australia. This is detailed in Appendix 5 – Vegetation Monitoring (Quadrat) Methodology.

- **Monitor flora values and their restoration according to the Vegetation Monitoring Program (Appendix 5).**

This program will be supplemented by photo monitoring points where suitable

Wildlife monitoring

The CLC has an extensive fauna monitoring program initiated in partnership with Southern Cross University. This is detailed in Appendix 3 – Fauna Monitoring Methodology.

A separate Bird monitoring program is undertaken by CLC volunteers as detailed in Appendix 4 – Bird Monitoring Methodology.

- **Monitor fauna values and their restoration according to the Fauna and Bird Monitoring Programs (Appendix 3 & 4).**

These programs will be supplemented by community observations and community activities including spotlighting nights.

Management program/schedule

Key milestones for the deployment of this management plan include:

- Transfer of the property tenure & issuing of a conservation covenant - **TBC**
- Adoption of the management plan - **TBC**
- Delivery of \$40,000 restoration funding & associated management targets – **September 2016**

Objective	Action / Targets	Financial		Monitoring / Reporting	Milestones (2015-16)			
		Costs	In-kind		Immediate	Sept 2016	June 2017	Ongoing
Access, Trails, Fences & Infrastructure								
Access	Negotiate permanent access with Mulgoa Waste Services	-	\$20,000 in-kind	N/A	X			
Emergency meeting, parking & storage area	Purchase & delivery of lockable shipping container to meet herbicide and fox & deer pest control order regulations	\$6,000.00	-	N/A		X		

Rubbish	Remove all rubbish (old fencing) on site	-	\$11,000	N/A			x	x
Fire Management								
Fire Management Plans	Contact RFS to initiate burn plans as required	-	\$13,000	To be determined			x	x
Pasture Management								
Slashing	Pasture management, access trails & strategic weed slashing (min 4 sessions depending on seasonal conditions)	\$10,000.00	-	Map & report each slashing session including date		X	X	X
Invasive & overabundant flora								
Weeds	Initiate CLC Landcare group with monthly work sessions; Coordinate Green Army sessions; Purchase Bushcare Tools & Consumables (e.g. herbicide, volunteer tool kits, gloves, sunscreen, 2 x brushcutters, 1 x chainsaw)	\$3,000.00	\$12,000 in-kind	Map & report – see monitoring		x	x	X

Invasive fauna								
Fox & Rabbit Control	Training/Preparation, Approval, Purchase of Baits & Ejectors (S1), Contracted bait deployment & carcass disposal (S2)	\$1,920.00	\$14,000	Report according to approved Pest Management Plan when issued		x	x	X
Deer Control	Deer control - minimum two sessions of 'free feed' preparation & shooting by insured & certified contractor	\$3,000.00	-	Report each session detailing date, time and animals shot		X	X	X
Wildlife recovery								
Habitat logs	Receive & install habitat logs (20 tonnes/ha)	Unkn.	Est. \$30,000 to 2017	Measure all materials installed; initiate student monitoring project for Cumberland Land Snail population prior to and subsequent to deployment			x	x
WHS, Insurance & Licensing								
WHS management	Install WHS book and ensure all site visitors suitably inducted	-	\$12,000	N/A	X			X

Engagement, Education & Recreation								
Site visitation	Provide >3 community engagement & education activities (including materials)	\$4,835.00	Unkn.	Report attendance and brief write-up for each event delivered		X		
Signage	Design & Installation of interpretive & event signage (min 3 event signs and interpretive sign)	\$1,245.00	Unkn.	N/A		X		
Landowner costs & responsibilities								
LLS Rates	Lodge paperwork and pay LLS rates (annually)	\$105		N/A	X	x	x	X
Local Government Rates	Arrange rates relief with Penrith Council	-	-	N/A	X			
Monitoring								
Coordination, administration & reporting	Coordination, administration & reporting	\$10,000	\$20,000 in-kind	Plan of Management & related reporting	x	x	x	X
Vegetation monitoring	Refer appendix 5	-	\$5,000 in-kind	Refer appendix 5	X	x	x	X
Wildlife monitoring	Refer appendix 3	-	\$20,000 in-kind	Refer appendix 3	X		X	
Bird monitoring	Refer appendix 4	-	\$10,000	Refer appendix 4	x	X	x	X

			in-kind					
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Appendix 1 – Flora List

As at 3 June 2016

Exotic flora

Species	Notes	CPW	RFEF	Dams	Pasture
* <i>Ailanthus altissima</i>	Tree of heaven	x	x		
* <i>Amaranthus sp.</i>	Wetland Burr Weed			x	
* <i>Araujia sericifera</i>	Regen note - Moth Vine (see native Parsonsia)	x	x		
* <i>Asparagus aethiopicus</i>			x		
* <i>Bidens pilosa</i>			x		
* <i>Cestrum parqui</i>			x		
* <i>Chloris gayana</i>	Regen note - see native Chloris	x			
* <i>Cyperus eragrostis</i>			x		
* <i>Eragrostis curvula</i>	African Love Grass	x			
* <i>Gamochaeta americana</i>	Cudweed	x	x		
* <i>Heliotropium amplexicaule</i>		x			
* <i>Hypericum perforatum</i>	Regen note - St Johns Wart (has similar native)	x	x		
* <i>Ligustrum sinense</i>	Small-leaved Privet		x		
* <i>Ligustrum lucidum</i>	Broad-leaved Privet		x		
* <i>Lycium ferocissimum</i>	African Boxthorn	x			
* <i>Macfadyena unguis-cati</i>	Cats Claw Creeper		x		
* <i>Melia azedarach</i>	Regen note - White Cedar - Australian plant not native to Grassy Woodland/Riverflats	x	x		
* <i>Olea europaea subsp. cuspidata</i>	African Olive	x	x		

<i>*Onopordum acanthium</i>	Scotch thistle			x		x
<i>*Paspalum dilatatum</i>		x		x		
<i>*Phyllanthus tenellus</i>				x		
<i>*Prunus cultivar</i>	Peach trees			x		
<i>*Rubus fruticosus sp. Agg.</i>	Blackberry			x		
<i>*Senecio madagascariensis</i>	Regen note - similar natives	x				
<i>*Setaria verticillata</i>	Pigeon Grass	x				
<i>*Sida rhombifolia</i>	Paddy's Lucerne	x		x		x
<i>*Solanum mauritianum</i>	Wild Tobacco			x		
<i>*Solanum pseudocapsicum</i>				x		
<i>*Tagetes minuta</i>	Stinking Roger Weed			x		
<i>*Taraxacum officinale</i>	Dandelion	x				
<i>*Tradescantia fluminensis</i>	Trad			x		
<i>*Verbena rigida</i>		x		x		

Native flora

Species	Notes	CPW	RFEF	Dams	Pasture
<i>Acacia decurrens</i>		x			
<i>Acacia parramattensis</i>		x	x		
<i>Acacia falcata</i>		x			
<i>Amyema miquelii</i>		x			
<i>Adiantum aethiopicum</i>	Maidenhair Fern		x		
<i>Alternanthera denticulata</i>			x		
<i>Angophora subvelutina</i>			x		
<i>Aristida ramosa</i>		x			
<i>Aristida vagans subsp. vagans</i>					

<i>Arthropodium milleflorum</i>	Vanilla Lily	x		x
<i>Atriplex semibaccata</i>	Even smaller leaves than Einadia with similar red berries		x	
<i>Backhousia myrtifolia</i>			x	
<i>Brachyscome graminea</i>	Grass Daisy	x		
<i>Brunoniella australis</i>			x	
<i>Bursaria spinosa</i>		x	x	
<i>Casuarina glauca</i>			x	
<i>Centella asiatica</i>			x	
<i>Chloris ventricosa</i>	Regen note - native Chloris	x		
<i>Clematis glycinoides</i>	Regen note - native looks like weeds		x	
<i>Commelina cyanea</i>	Regen note - native looks like Trad	x	x	
<i>Convolvulus erubescens</i>			x	
<i>Cymbopogon refractus</i>			x	
<i>Cyperus sanguinolentus</i>	Regen note - native		x	
<i>Desmodium rhytidophyllum</i>		x	x	
<i>Dichondra repens</i>			x	
<i>Dichopogon fimbriatus</i>		x		
<i>Echinopogon ovatus</i>		x	x	
<i>Einadia trigonos ssp. stellulata</i>		x		
<i>Einadia hastata</i>		x		
<i>Eragrostis leptostachya</i>		x		
<i>Eremophila debilis</i>		x		
<i>Eleocharis sphacelata</i>			x	x
<i>Eucalyptus amplifolia</i>			x	
<i>Eucalyptus eugenioides</i>		x		
<i>Eucalyptus crebra</i>		x		
<i>Eucalyptus tereticornis</i>		x		

<i>Galium gaudichaudii</i>		x		
<i>Geranium solanderi</i>		x		
<i>Glycine tabacina</i>		x	x	
<i>Glycine microphylla</i>		x		
<i>Imperata cylindrica</i>		x		
<i>Hardenbergia violacea</i>		x		
<i>Hypericum gramineum</i>	Regen note - native St Johns Wart	x		
<i>Lemna disperma</i>	Common duckweed - native		x	x
<i>Lomandra longifolia</i>			x	
<i>Melaleuca styphelioides</i>	(Single plant - bears native vine Parsonsia)		x	
<i>Microlaena stipoides</i>		x	x	
<i>Oplismenus aemulus</i>		x	x	
<i>Parsonsia straminea</i>			x	
<i>Persicaria subssesilis</i>			x	
<i>Plantago gaudichaudii</i>	Regen note - native looks like Plantain	x		
<i>Plectranthus parviflora</i>				
<i>Pratia purpurascens</i>			x	
<i>Pseudanthemum variabile</i>			x	
<i>Rubus parvifolius</i>	Regen note - native looks like blackberry		x	
<i>Rumex brownii</i>	Regen note - native looks like weeds	x		
<i>Senecio diaschides</i>	Regen note - native looks like fireweed		x	
<i>Senecio linearifolius</i>	Regen note - native looks like fireweed		x	
<i>Stephania japonica</i>			x	
<i>Solanum prinophyllum</i>	Regen note - native looks like weeds	x		
<i>Themeda australis</i>		x	x	
<i>Triglochin procerum</i>			x	
<i>Vernonia cinerea var cinerea</i>		x		

<i>Wahlenbergia communis</i>	x		x
<i>Wahlenbergia gracilis</i>	x	x	
<i>Wahlenbergia stricta</i>	x		

Appendix 2 – Fauna List

As at 3 June 2016

Fish

Common name	Scientific	Status
*Carp	<i>Cyprinus carpio</i>	Introduced

Reptiles

Common name	Scientific	Status
Lace Monitor	<i>Varanus varius</i>	
Dark-flecked Garden Sun-skin	<i>Lampropholis delicata</i>	
Eastern Snake-necked Turtle	<i>Chelodina longicollis</i>	
Red-bellied Black-snake	<i>Pseudechis porphyriacus</i>	
Eastern Brown Snake	<i>Pseudonaja textilis</i>	
Robust Ctenotus Skink	<i>Ctenotus robustus</i>	

Amphibians

Common name	Scientific	Status
Striped Marsh Frog	<i>Limnodynastes peronii</i>	
Common Froglet	<i>Crinia signifera</i>	
Peron's Tree Frog	<i>Litoria peronii</i>	
Smooth Toadlet	<i>Uperoleia laevigata</i>	
Eastern Dwarf Tree Frog	<i>Littoria fallax</i>	

Mammals

Common name	Scientific	Status
*European Red Fox	<i>Vulpes vulpes</i>	Introduced
*Fallow Deer	<i>Dama dama</i>	Introduced
*Black Rat	<i>Rattus rattus</i>	Introduced
*Hare	<i>Lepus europaeus</i>	Introduced
Common Wallaroo	<i>Macropus robustus</i>	
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	
Swamp Wallaby	<i>Wallabia bicolor</i>	
Sugar Glider	<i>Petaurus breviceps</i>	
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	

Large-eared pied Bat	<i>Chalinolobus dwyeri</i>	
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	
Chocolate wattled bat	<i>Chalinolobus morio</i>	
Little bent-wing bat	<i>Miniopterus australis</i>	Vulnerable
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	Vulnerable
East-coast free-tailed bat	<i>Mormopterus norfolkensis</i>	Vulnerable
Eastern free-tailed bat	<i>Mormopterus ridei</i>	
Fishing Bat	<i>Myotis macropus</i>	Vulnerable
Long-eared Bat	<i>Nyctophilus spp.</i>	
Horseshoe Bat	<i>Rhinolophus megaphyllus</i>	
White-striped Mastif Bat	<i>Tadarida australis</i>	

Birds

Common name	Scientific	Status
Pacific Black Duck	<i>Anas superciliosa</i>	
Grey Teal	<i>Anas gracilis</i>	
Hardhead	<i>Aythya australis</i>	
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	
White-faced Heron	<i>Egretta novaehollandiae</i>	
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	
Purple Swamphen	<i>Porphyrio porphyrio</i>	
Dusky Moorhen	<i>Gallinula tenebrosa</i>	
Eurasian Coot	<i>Fulica atra</i>	
Masked Lapwing	<i>Vanellus miles</i>	
Wedge-tailed Eagle	<i>Aquila audax</i>	
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	
Swamp Harrier	<i>Circus approximans</i>	
Whistling Kite	<i>Haliastur sphenurus</i>	
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>	
Spotted Dove	<i>Spilopelia chinensis</i>	
Crested Pigeon	<i>Ocyphaps lophotes</i>	
Peaceful Dove	<i>Geopelia placida</i>	
Bar-shouldered Dove	<i>Geopelia humeralis</i>	
Brown Cuckoo-Dove	<i>Macropygia amboinensis</i>	
Shining Bronze Cuckoo	<i>Chrysococcyx lucidus</i>	
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	
Tawny Frogmouth	<i>Podargus strigoides</i>	
Dollarbird	<i>Eurystomus orientalis</i>	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	
Sacred Kingfisher	<i>Todiramphus sanctus</i>	
Azure Kingfisher	<i>Ceyx azureus</i>	

Galah	<i>Eolophus roseicapillus</i>	
Little Corella	<i>Cacatua sanguinea</i>	
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	
Eastern Rosella	<i>Platycercus eximius</i>	
King Parrot	<i>Alisterus scapularis</i>	
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	
Superb Fairywren	<i>Malurus cyaneus</i>	
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	
Noisy Friarbird	<i>Philemon corniculatus</i>	
Red Wattlebird	<i>Anthochaera carunculata</i>	
Yellow-faced Honeyeater	<i>Caligavis chrysops</i>	
Bell Miner	<i>Manorina melanophrys</i>	
Noisy Miner	<i>Manorina melanocephala</i>	
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	
Spotted Pardalote	<i>Pardalotus punctatus</i>	
Weebil	<i>Smicrornis brevirostris</i>	Regionally Declining
White-browed Scrubwren	<i>Sericornis frontalis</i>	
White-throated Gerygone	<i>Gerygone olivacea</i>	
Brown Thornbill	<i>Acanthiza pusilla</i>	
Yellow Thornbill	<i>Acanthiza nana</i>	
Striated Thornbill	<i>Acanthiza lineata</i>	
Grey Butcherbird	<i>Cracticus torquatus</i>	
Australian Magpie	<i>Gymnorhina tibice</i>	
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable
Golden Whistler	<i>Macropygia amboinensis</i>	
Rufous Whistler	<i>Pachycephala rufiventris</i>	
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	
Olive-backed Oriole	<i>Oriolus sagittatus</i>	
Willie Wagtail	<i>Rhipidura leucophrys</i>	
Grey Fantail	<i>Rhipidura albiscapa</i>	
Rufous Fantail	<i>Rhipidura rufifrons</i>	
Magpie-Lark	<i>Grallina cyanoleuca</i>	
Australian Raven	<i>Corvus coronoides</i>	
Eastern Yellow Robin	<i>Eopsaltria australis</i>	
Rose Robin	<i>Petroica rosea</i>	
Jacky Winter	<i>Microeca fascians</i>	Regionally Declining
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	
Australian Reed Warbler	<i>Acrocephalus australis</i>	
Rufous Songlark	<i>Megalurus mathewsi</i>	Regionally Declining
Welcome Swallow	<i>Hirundo neoxena</i>	

Tree Martin	<i>Petrochelidon nigricans</i>
Silvereye	<i>Zosterops lateralis</i>
Common Myna	<i>Acridotheres tristis</i>
Common Blackbird	<i>Turdus merula</i>
Mistletoebird	<i>Dicaeum hirundinaceum</i>
Red-browed Finch	<i>Neochmia temporalis</i>

Appendix 3 – Fauna Monitoring Methodology

The benchmark quantitative fauna surveys were undertaken in June 2016 and are anticipated for repeat on an annual basis.

This constituted a major project with Southern Cross University, students, CLC volunteers and Greater Sydney Local Land Services support and operated over a 2 month period.

The full report including Methodology is anticipated in August 2016. For the purposes of the POM a summary of techniques is provided below, itemised for each of the four major habitat types:

- 2 x ANABAT recorders x 2 weeks duration x 4 habitat zones
- 10 x Footprint Tunnel traps x 2 weeks duration x 4 habitat zones
- 2 x Accoustic monitors x 2 weeks duration x 4 wetland habitats
- 4 x Camera Traps x 2 weeks duration x 4 habitat zones

For analysis purposes the survey stations have been marked and recorded by GPS, allowing the same stations to be used for post-recovery surveys. These are marked on the map following.



Figure 12 - Regular Fauna Monitoring Locations

Appendix 4 – Bird Monitoring Methodology

Baseline bird surveys are conducted using the 20minute/2Ha methodology to record species and abundance. Eight (8) 2Ha areas will be monitored on a monthly basis for a one year period. Subsequent surveys may be conducted bi-monthly.

A brief description of the monitoring areas follows:

N1 (North) Two large dams and open bursaria/pastureland.

E1 (East) Large dam and Cumberland Plain Woodland dominated by 'Narrow-leaved Ironbark' *E. crebra*.

E2 (East) Cumberland Plain Woodland dominated by 'Forest Red Gum' *E. tereticornis*

W1 (West) Riparian corridor along Mugloa Creek and adjacent pastureland

NE (North East) Open Cumberland Plain Woodland dominated by 'Narrow-leaved Ironbark' *E. crebra*

NW (North West) Cumberland Riverflat Eucalypt Forest, this site has recorded most avian activity and the highest number of species in preliminary surveys.

SE (South East) Alluvial Woodland and Cumberland Plain Woodland dominated by 'Grey Box' *Eucalyptus molucanna*

SW (South West) Riparian corridor, Alluvial Woodland and Cumberland Plain Woodland dominated by 'Grey Box' *Eucalyptus molucanna*

Incidental observations (out of time or 2Ha area) and other fauna will also be included.

Bird monitoring data may also be used to interpret, but is not limited to:

The relationship of non-native plants and frugivores and granivores

The relationship of eucalypt lowering cycles and nectavores

Modification of pasture/substrate to benefit granivores and insectivores



Figure13 - Bird Monitoring Quadrats

Appendix 5 – Vegetation Monitoring (Quadrat) Methodology

Vegetation condition will be assessed annually in Spring (September) at one permanently marked plot and replicated 50 m transect replicated in each habitat unit.

Monitoring will be according to the simplified NSW BioMetric methodology outlined below. This methodology is consistent with the Native Vegetation Interim Type Standard (DECCW 2009).

20 m x 20m plot (as staked)

Site condition attribute	Data
Number of native plant species*	
Native mid-storey cover (%)	
Exotic mid-storey cover (%)	
Native ground cover (%)	
Exotic ground cover (%)	

*Attach a species list for each survey

50 m transect (as staked)

Site condition attribute	5 m	10 m	15 m	20	25	30	35	40	45	50	Total
Number of tree hollows (1 cm – 20 cm)											
Length (m) of terrestrial logs (>10 cm dia)											
Canopy cover (%)											