fauna in the study area indicates the area has value in supporting populations and habitat for species threatened with extinction. The presence of two EECs; Natural Temperate Grassland and Yellow Box – Red Gum Grassy Woodland, indicate these areas have high natural integrity and may be considered to have principal characteristics of a class of Australia's natural environments.

The relatively undisturbed eastern Foreshores provides a large area of contiguous dry sclerophyll forest, connecting similar vegetation from the Tinderry Range (south of Googong) through to the north-eastern parts of the ACT. The western foreshores of the reserve contribute to the diversity of habitats for native flora and fauna within Googong Foreshores. The lowland woodland and grassland communities that dominate the western foreshores contrast with the dense sclerophyll forest of the steep slopes, and support a variety of grassland and woodland specialist species.

The reserve is a resource that is valued by residents of the ACT, Queanbeyan and surrounding region, for its recreational and aesthetic values. The scenic values of the area provide a backdrop to recreational activities, including bush-walking, mountain bike riding, fishing and bird watching. The expanse of the dam itself provides scenic views from numerous look-outs. The creeks and riverine environments across Googong Foreshores contribute to the aesthetic values of the area.

The scientific value of the area is considered significant due to the potential information that could be gained regarding the ecology of rare and threatened species. New information on rare or threatened species may contribute to ensuring appropriate protection or management is provided for rare or threatened species, for example, the inclusion of rare species within future conservation strategies.

Googong Foreshores provides habitat for several raptorial species, which have been studied since at least 1985. The overlapping territory and nest sites of two species at Googong Foreshores, the Wedge-tailed eagle and the White-bellied Sea-Eagle, have contributed to the scientific understanding of competition between different raptors. The active territories of raptors have the potential to continue providing information to the scientific community.

### 6.2.2 Geodiversity

The Queanbeyan Fault, which extends for about 50 km from Michelago to Sutton, dominates the geology of the Googong Foreshores. At the Foreshores the escarpment of the fault, rising to 950 m ASL, defines the edge of the Cullarin Block (horst). The latter is comprised of folded sandstone and shale. West of the fault, limestone lenses are a feature of the geology. A significant geomorphological feature known as London Bridge Natural Arch is located on a meander cut-off on Burra Creek. This is a natural arch in limestone containing fossils of brachiopods, corals, crinoids and trilobites. Several small caves and shafts also occur in the limestone. Other geological features of note are Cascades Gorge on the Queanbeyan River below the dam wall, and rock exposures in the Queanbeyan River below Gelignite Crossing, in the south–eastern part of the Foreshores. At the Cascades large boulders and rock faces of weathered granite are exposed, forming several large pools. Below Gelignite Crossing greywacke is exposed in the river bed and walls forming several small rapids and waterfalls (ERM Australia 2008b).

London Bridge Natural Arch has long been recognised for its representation of cave formation in karst, its Pleistocene mammal deposits and its related aesthetic, educational and scientific values. It also has Indigenous heritage values (s. 2.6). The arch is included on the Register of the National Estate (Place ID 1182) (see **Glossary** for origins of the register and the intended phasing out of its statutory basis by 2012). It is included in the

Commonwealth Heritage List nomination 'Googong Foreshores Cultural and Geodiversity Heritage Areas' (see s. 2.6).

The following statement of significance for geodiversity heritage values was prepared by ERM Australia (2008c: p. 27):

> London Bridge Natural Arch is important as a good example of cave formation due to karst and offers insight into the natural landscape development in the area. The London Bridge area is a good representation of the development of caves and an arch as a meander cut off, and the eventual abandonment of the meander channel. The caves contain rich Pleistocene deposits of small mammals, and Pleistocene bone breccia of large mammals is embedded in flowstone on the floor of the two main caves.
>
> The arch is a large attractive natural bridge, of aesthetic value. The karst features displayed at London Bridge, its close proximity to Canberra, and the cave deposits containing Pleistocene mammal fossils, make the area an important teaching and research site.
>
> The arch has also been a long term attraction to humans, who have viewed and appreciated the arch's natural aesthetic qualities. Europeans have visited the arch since the mid-19th century, whilst Aboriginal people have visited for thousands of years.

Soils in the Foreshores derive from the geology and vary from shallow skeletal soils to relatively deep podzols. The most common soil type is a skeletal sandy loam that has little or no profile development. These low nutrient soils occur on most land east of the fault and are the main soil type on sloping land in the western Foreshores area. The western area contains deeper soil profiles than the eastern area but they are still shallow and skeletal. Deeper soils are found in the Burra Creek valley.

### 6.2.3 Natural Heritage Values: Management Objectives, Policies and Actions

The *Googong Foreshores: Heritage Management Plan* (HMP) (ERM Australia 2008c) sets out general policies for conservation of natural heritage (HMP: s. 6.2.3); implementation strategies (HMP: Table 7.2); five year asset restoration and maintenance plans (HMP: s. 8.1.2); and a list of 'do's and don'ts' for repairs and maintenance works (HMP: s. 9). The Heritage Management Plan (maintenance schedule: s. 8.1.2) gives particular attention to the management of: (a) dry sclerophyll forest of the eastern Foreshores; (b) remnants of the endangered ecological communities of natural temperate grassland and yellow box – red gum grassy woodland (threatened ecological communities under the EPBC Act); and c) disturbed areas. The following general statements of policy and management actions derive from the *Googong Foreshores: Heritage Management Plan*. Specific policies and actions related to the items contained in the *Heritage Management Plan* are included in this Googong Foreshores Management Plan in the sections shown under 'Actions' below.

**OBJECTIVE: NATURAL HERITAGE**

- The natural heritage values of Googong Foreshores are conserved.

**Policies**

- Management of natural heritage will be carried out taking into account the Googong Foreshores: Heritage Assessment (ERM Australia 2008b) and in accordance with the

defined policies for conservation of natural heritage in the *Googong Foreshores: Heritage Management Plan* (ERM Australia 2008c).

**Actions**

- Implement the natural heritage strategies in the *Googong Foreshores: Heritage Management Plan*. These strategies provide a five-year and ongoing management program including (sections refer to this management plan):
  - cooperation with adjacent land managers to achieve consistent and complementary land management (s. 6.3)
  - weed management (s. 6.6.1)
  - pest animal management (s. 6.6.2)
  - kangaroo management (s. 6.7)
  - bushfire management (s. 9.1)
  - conservation of ecological communities, flora and fauna (s. 6.4, s. 6.5)
  - maintenance of catchment vegetation cover (s. 4.4)
  - control of recreational use (s. 5.4).

## 6.3 Habitats and Regional Significance

The diversity of habitats at Googong Foreshores reflects its geology and geomorphology, soils, vegetation, land use history, the presence of the reservoir, and inflowing streams. Habitats include steep and rocky slopes with open forest and woodland cover, rocky gullies, regenerating woodlands following clearing and fire, riparian areas including creek and river flats, and open grassland areas. Habitats at Googong Foreshores are significant as part of a corridor of mostly intact native vegetation encompassing the Tinderry Range, Googong Foreshores, the escarpment east of Queanbeyan, Kowen, and the north-eastern part of the ACT. The conservation value of this corridor has been recognised in the declaration of reserves (Tinderry, Burra Creek, Cuumbeun and Goorooyarroo Nature Reserves (NSW), and Molonglo Gorge Reserve (ACT)). The Foreshores also contributes to east–west connectivity. Habitat connectivity is an important consideration in planning for the effects of climate change.

The considerable uncertainty regarding the dimensions of climate change and local effects mean that a precise management response is not possible. However, available knowledge about climate change should be incorporated into the assessment of the effects of management actions, monitoring of high risk species and ecological communities, and evaluating ways in which the effects might be minimised.

**OBJECTIVE: HABITATS AND ECOLOGICAL CONNECTIVITY**

- The diversity of habitats at Googong Foreshores makes a significant contribution to regional ecological connectivity, in particular, along the escarpment of the Queanbeyan Fault.

**Policies**

- Ecological communities, wildlife habitats and ecological connectivity at Googong Foreshores will be protected, maintained and improved by appropriate management and rehabilitation activities.

**Actions**

- Communicate to relevant private and government organisations the importance of Googong Foreshores to regional ecological connectivity, in relation to environmental

planning, development control and specific development proposals adjacent to the Foreshores.

- Work with the NSW Department of Environment, Climate Change and Water and other NSW government agencies to achieve consistent and complementary management of adjoining or nearby natural areas.
- Identify threats to habitat and connectivity in Googong Foreshores and take actions to control, reduce or eliminate threats.
- Identify opportunities to improve habitat and connectivity in the management of Googong Foreshores and, where practicable, undertake appropriate management actions.

## 6.4 Flora

Googong Foreshores is located in the South Eastern Highlands Region as defined in the Interim Biogeographic Regionalisation for Australia (IBRA version 6.1 (DEWHA 2009)). At the time of European settlement, three characteristic vegetation communities in the Southern Tablelands part of this bioregion were:

- Extensive areas of native tussock grasslands at lower elevations (included in *Temperate Montane Grasslands* (Keith 2004, pp. 108–109));
- Grassy woodlands on plains, low hills and foothills (included in *Southern Tableland Grassy Woodlands* (Keith 2004, pp. 92–93));
- Dry open forests that occupied slightly higher areas, stony ridges and rugged ranges (included in *Southern Tableland Dry Sclerophyll Forests* (Keith 2004, pp. 164–165)).

Grassy woodlands and open forests were probably the main vegetation communities at Googong Foreshores. Grassland may have occupied some of the lower elevation 'frost hollow' areas, for example along Burra Creek (Field 1825 in Starr 2000). The grasslands and grassy woodlands of the Southern Tablelands were severely impacted by the European pastoral economy, associated urban and infrastructure development, changed fire regimes, and over time, invasion by weeds (ACT Government 2004b; 2005). Many dry forest areas of the Southern Tablelands have also been wholly or partly cleared for rough grazing despite the poverty of their soils (Keith 2004). They have also been affected by timber cutting, and more recently by activities such as off-road vehicle use.

### 6.4.1 Googong Foreshores Vegetation

Mapping and recording of vegetation at Googong Foreshores was undertaken in the 1990s by P. Barrer, who also carried out ecological surveys along the escarpment of the Queanbeyan Fault (Barrer 1993, 1997). Vegetation mapping, focused on tree and shrub cover, was also carried out by N. Taws in the 1990s. From this work, a digital vegetation map was produced at the level of vegetation communities, except for grassland which was undifferentiated as to whether it was natural grassland, secondary grassland (following tree removal), or primarily exotic grassland. Eddy (2009) identified substantial areas of natural temperate grassland and areas of grassy woodland, mostly of high conservation value. A species list for the Foreshores is also included in Starr (2000).

Woodlands and open forest are the most common vegetation formations in Googong Foreshores, covering about 60 per cent of the area. Grasslands comprise about 25 per cent, mainly in the western area and along Burra Creek. Three tree-dominated vegetation alliances have been described for the Foreshores (Costin 1954; Taws n.d.):

- *Eucalyptus macrorhyncha – E. rossii* (red stringybark – scribbly gum) dry sclerophyll open forest/woodland
- *E. melliodora – E. blakelyi* (yellow box – Blakely's red gum) grassy woodland
- *E. pauciflora – E. stellulata* (snow gum – black sallee) grassy woodland.

These alliances are included within the more general vegetation 'classes' defined by Keith 2004 (s. 6.4).

Though the extent is unknown, it is likely that land west of Googong Reservoir contained woodland and open forest at the time of European settlement and much of this was cleared during the pastoral period. Based on the Southern Tablelands generally (Keith 2004), there is sufficient evidence to suggest that there was a different pattern of vegetation communities either side of the Queanbeyan Fault, in relation to the proportions of woodland and open forest. Since 1982, significant planting (estimated at 40 000 trees and shrubs) has been undertaken in the western area to complement natural regeneration. While the survival rate of plantings has been low, the remaining plantings will result in some of the landscape changing from mainly grassland to an open woodland character.

**a) Dry Sclerophyll Open Forest and Woodland**
This alliance is found mostly in the more rugged escarpment country east of the reservoir but also occurs on shallow soils in steep areas in the western area. On the Southern Tablelands these dry sclerophyll forest and woodland communities have often been disturbed in the past by varying levels of clearing, ringbarking, timber-getting or fire. There is evidence for this at Googong by the presence of many trees in what appear to be younger age classes, as well as dense stands of eucalypt saplings. Starr (2000) observed that the main means of land clearing prior to World War II was ringbarking and that much of this was unsuccessful. Ringbarked areas commonly reverted to forest, closely resembling adjacent communities where there was no evidence of ringbarking. Both *E. macrorhyncha* and *E. rossii* form coppice regrowth after they have been cut for firewood or other uses.

**b) Yellow Box – Blakely's Red Gum Grassy Woodland**
At Googong Foreshores, this characteristic lowland woodland alliance is represented, in particular, by a yellow box (*E. melliodora*) – apple box (*E. bridgesiana*) association. Blakely's red gum (*E. blakelyi*) does not occur in the area (Eddy 2009). White box (*E. albens*), which is included in the EPBC listed community, does not occur in the area. This woodland occurs on soils of volcanic origin to the west of the reservoir, where, following clearing, it has been replaced by secondary grassland. It also occurs in gullies in the eastern part of the Foreshores and on some soils associated with granite. Along Burra Creek the most common species remaining from the former tree associations is apple box, which was not favoured for building or firewood. The community also occurs north of the dam wall. The majority of the woodland area surveyed by Eddy (2009) was assessed as meeting the EPBC criteria for inclusion in the white box – yellow box – red gum grassy woodland and derived native grassland ecological community (s. 6.4.2).

**c) Snow Gum – Black Sallee Grassy Woodland.**
This alliance occurs in areas of cold air drainage and in broader valleys along the Queanbeyan River and Burra Creek.

**d) Grassland**

Like the woodland, grassland in the area has been disturbed to varying degrees by past land uses. Nevertheless, the majority of grassland area surveyed by Eddy (2009) has sufficient floristic value to be described as natural temperate grassland under the EPBC Act. Many of the polygons surveyed by Eddy have high floristic scores. Some of this grassland may be secondary grassland, as noted above under yellow box – Blakely's red gum grassy woodland. There is still a high level of occurrence of the naturally dominant kangaroo grass (*Themeda australis* syn. *T. triandra*), which is less tolerant of grazing pressure than other native grasses. Kangaroo grass was the dominant or co-dominant grass species in two-thirds of the survey plots. Wallaby grasses (*Danthonia* spp.) were dominant in other plots and commonly the co-dominant with kangaroo grass. The grassland areas also contain many other native grass and non-grass plant species, as well as a wide range of weed species.

**e) Shrubland and Riparian Communities**

Many shrubland areas (comprising burgan (*Kunzea ericoides*) and tea-tree (Leptospermum spp.)) and are considered to be secondary communities following disturbance to the tree cover. Riparian vegetation includes cumbungi (*Typha* spp.), common reed (*Phragmites australis*), sedges and rushes. Stands of *Acacia* spp. have become established around the edges of the reservoir.

**f) Threats to Grassland and Grassy Woodland**

Eddy (2009) identified the following threats to the grasslands and grassy woodlands of the Foreshores:

- *Grazing pressure*: Grassy vegetation was grazed very short by kangaroos. This grazing pressure is higher than what would be desirable for the long term conservation of the natural temperate grassland.
- *Weeds*: There is a wide range of common and widely distributed weeds of the Southern Tablelands at the Foreshores. Several significant weed species (great mullein (*Verbascum thapsus*), St John's wort (*Hypericum perforatum*) and horehound (*Marrubium vulgare*)) occur in large numbers over extensive areas.
- *Feral pigs*: Feral pig populations appear to be associated with great mullein in low lying areas. Feral pig activity may assist in the spread of this weed.
- *Tree planting*: Many of the natural temperate grassland areas surveyed contain tree plantings which will affect the natural integrity of the grasslands over time.

The main vegetation communities occurring in different parts of the Foreshores are listed in Table 6.1.

**Table 6.1 Vegetation communities at Googong Foreshores**

| Location/Management Zones | Vegetation Communities |
|---|---|
| Western Foreshores: Zones 3A, 2A. | • Grassland including natural temperate grassland<br>• *E. rossii – E. polyanthemos – E. nortonii* open forest/woodland<br>• *E. bridgesiana – E. melliodora* woodland<br>• *E. bridgesiana woodland* |
| Eastern Foreshores: Zones 1A, 1B, 2A. | • *E. rossii – E. polyanthemos – E. nortonii* open forest/woodland<br>• Open forest/woodland communities involving varying associations of the following species: *E. macrorhyncha – E.rossii – E. polyanthemos –* |

| | |
|---|---|
| | *E. mannifera – E. nortonii – E. dives*<br>• *E. bridgesiana – E. melliodora* woodland |
| Burra Creek:<br>Zones 3B, 2B. | • Grassland including natural temperate grassland<br>• *E. bridgesiana – E. melliodora* woodland<br>• *E. bridgesiana – E. dives* woodland |
| Queanbeyan River:<br>Zone 2A. | • *E. mannifera – E. rossii* open forest/woodland<br>• *E. pauciflora – E. bridgesiana* woodland<br>• *E. pauciflora – E. stellulata* woodland<br>• Open forest/woodland communities involving varying associations of the following species: *E. bridgesiana – E. rossii – E. polyanthemos – E. melliodora – E. nortonii – E. dives* |

### 6.4.2 Threatened Ecological Communities, Threatened and Uncommon Plant Species

Ecological communities and plant species occurring at Googong Foreshores that are listed as threatened under Commonwealth, New South Wales, and ACT legislation are shown in Table 6.2.

**Table 6.2 Ecological communities and plant species at Googong Foreshores listed as threatened under Commonwealth, NSW and ACT legislation.**

| Ecological Community/ Plant Species | Common Name | Cwlth | NSW | ACT |
|---|---|---|---|---|
| **Ecological Communities** | | | | |
| White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland[1,2] | Grassy White Box Woodland / Lowland Grassy Woodland | CE | E | E |
| Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT | Natural Temperate Grassland / Lowland Native Grassland | E | – | E[2] |
| **Plant Species** | | | | |
| *Rutidosis leptorrhynchoides* | button wrinklewort | E | E | E |
| *Swainsona sericea* | silky swainson-pea | – | V | – |
| *Pomaderris pallida* | pale pomaderris | V | V | – |
| *Dillwynia glaucula* | Michelago parrot-pea | – | E | – |
| *Leucochrysum albicans* var *tricolor* | hoary sunray | E | V | – |

**Note:** 1 White box and Blakely's red gum do not occur at Googong Foreshores.
2 White box (*Eucalyptus albens*), yellow box (*E. melliodora*), Blakely's red gum (*E. blakelyi*).

**Legislation:**
**E**: Endangered; **V**: Vulnerable
Commonwealth: *Environment Protection and Biodiversity Conservation Act 1999*
NSW: *Threatened Species Conservation Act 1995*
ACT: *Nature Conservation Act 1980*

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Plant species recorded from Googong Foreshores that are regionally uncommon include:

- *Olearia rosmarinifolia* (rosemary-leaved olearia)
- *Solenogyne dominii* (solenogyne)
- *Lepidium pseudotasmanicum* (peppercress)
- *Rorippa laciniata* (watercress)
- *Einadia hastata* (saloop/berry saltbush)

- *Bossiaea prostata* (creeping bossiaea)
- *Desmodium brachypodum* (large tick-trefoil)
- *Discaria pubescens* (australian anchor plant)
- *Microseris lanceolata* (murnong/yam daisy)
- *Cullen tenax* (emu-foot cullen)
- *Asperula ambleia* (stiff woodruff)
- *Muehlenbeckia axillaris.*

Further survey, especially of ground cover, may reveal the presence of other threatened or uncommon species, or new occurrences of such species. Some threatened species that have been recorded in the region have the potential to occur in the Foreshores based on similarity of habitat.

### 6.4.3 Management Objectives, Policy and Actions

**OBJECTIVES: FLORA**

- Vegetation communities at Googong Foreshores are identified, protected and conserved.
- Populations of threatened and uncommon plant species are conserved in perpetuity.
- Degraded vegetation communities are rehabilitated where this is practicable.

**Policies**

- Management of vegetation at Googong Foreshores will be based on comprehensive survey, monitoring, mapping and preparation of a vegetation management plan.
- Management of vegetation communities at Googong Foreshores will aim to retain or recover (where practicable) the natural integrity[1] of those communities.
- Special attention will be given to the management of threatened ecological communities and populations of threatened and uncommon species.

**Actions**

- Prepare and maintain (through survey, monitoring and mapping) a comprehensive inventory and classification of vegetation communities and component species at Googong Foreshores.
- Undertake appropriate management to ensure that ecological communities and populations of threatened and uncommon plant species are conserved and protected from threatening activities (e.g. tree planting in natural temperate grasslands) or accidental damage.
- Prepare a vegetation management plan with detailed management guidelines, as required, for vegetation communities and component species, in particular threatened and uncommon species.
- As part of the vegetation management plan, review existing plantings and forward programs for tree planting to ensure that there are no adverse impacts on natural temperate grassland areas of high conservation value.
- Where practicable, undertake rehabilitation[2] activities for particular vegetation communities or areas of the Foreshores.
- Provide interpretive material on Foreshores vegetation for visitors.

Note:
1 Natural integrity, see **Glossary**.

2 At Googong Foreshores, rehabilitation (see **Glossary**) may serve a number of purposes including protection of water quality, conservation of threatened or uncommon plant species, and maintenance of faunal habitat.

## 6.5 Fauna

The diversity of habitat at Googong Foreshores, the relatively intact vegetation east of the reservoir, and the connectivity to native vegetation to the north and south along the escarpment of the Queanbeyan Fault are important for fauna at a regional level. Like the adjacent or nearby NSW nature reserves (s. 6.3), Googong Foreshores retains remnant native vegetation within a highly disturbed landscape that is subject to ongoing development pressures. The fauna of the Foreshores has not been thoroughly surveyed. However, existing surveys and those at several points along the escarpment north of the Tinderry Nature Reserve give an indication of the faunal importance of the area. Species numbers in the escarpment surveys include 25 native mammals, more than 100 birds, 28 reptiles, eleven frogs and at least three native fish.

The presence of Googong Reservoir, backed up waters in the Queanbeyan River and Burra Creek, Tin Hut Dam and other nearby farm dams contributes to the diversity of the Foreshores habitat reflected in the large number of bird species (165) recorded from the Foreshores. These include waterbirds, birds of prey, and forest and woodland species. Of particular note is habitat for the hooded robin (*Melanodryas cucullata*) (an ACT threatened species) (Table 6.3), which is known to be declining in woodlands around the urban fringes of the ACT. This species prefers more open woodland, with trees and perching sites, open grassy areas for foraging, and patches of thicker vegetation nearby, suitable for nesting sites. A database of birds recorded from Googong Foreshores compiled by the Canberra Ornithologists Group (COG) and other records contain a number of threatened and migratory bird species including: varied sitella (*Daphoenositta chrysoptera*), white-winged triller (*Lalage sueurii*), little eagle (*Hieraaetus morphnoides*), Latham's snipe (*Gallinago hardwickii*) (Table 6.3). The area contains a breeding territory and home range of one white-bellied sea eagle (*Haliaeetus leucogaster*). Wedge-tailed eagles (Aquila audax) are also resident in the area (ERM Australia 2008b; PCL 2008). A bird list brochure has been prepared for the Foreshores, which includes summary information on habitat, abundance and resident status for species recorded from 1995 to 2008 (PCL 2008).

Nine species of bats have been recorded including the eastern false pipestrelle (*Falsistrellus tasmaniensis*), listed as 'vulnerable' in New South Wales. The common bentwing-bat (*Miniopterus schreibersii*) can be found in the ACTEW tunnel.

The eastern grey kangaroo (*Macropus giganteus*), common wombat (*Vombatus ursinus*), common brushtail possum (*Trichosurus vulpecula*) are widespread. The swamp wallaby (*Wallabia bicolor*) is mainly present on the eastern area although one or two individuals survive in uncleared remnants on the western area. The common wallaroo (*Macropus robustus robustus*) has been recorded from the area but is not common. There is evidence (V-shaped notches in the bark of feed trees) of the presence of the sparsely distributed yellow-bellied glider (*Petaurus australis*) in the Bradleys Creek area. Scribbly gum (*Eucalyptus rossii*) is one of the glider's preferred sap-feeding trees and these are common in the eastern Foreshores. Koalas (*Phascolarctos cinereus*) are reported to move through the southern part of the area (ERM Australia 2008b). Platypus (*Ornithorhynchus*

*anatinus*) occur in the Queanbeyan River upstream of the reservoir and in the upper reaches of the reservoir itself.

The Foreshores contains much habitat suitable for reptiles and many species have been recorded from the area. The threatened Rosenberg's monitor (*Varanus rosenbergi*) and pink-tailed worm lizard (*Aprasia parapulchella*) occur there as well as the nocturnal black-headed snake (*Suta spectabilis*).

There is a high diversity of amphibians across the study area, suggesting the presence of healthy aquatic ecosystems. Two threatened frog species have previously been recorded: the green and gold bell frog (*Litoria aurea*) and the alpine tree frog (*Litoria verreauxii alpine*) (ERM Australia 2008b). However, it is not known if these species still occur in the area.

There is a population of the threatened Macquarie perch (*Macquaria australasica*) in the Queanbeyan River above Googong Reservoir, derived from 57 adult fish translocated from the reservoir in 1980 (Lintermans 2006). The waters of the reservoir flooded all the spawning sites in that section of the river (ACT Government 2007a). The threatened Murray cod and silver perch are also present as a result of the fish stocking program.

There have been no formal invertebrate surveys in the Foreshores. The threatened golden sun moth (*Synemon plana*) has been recorded outside the north-western boundary of the Foreshores and Key's matchstick grasshopper (*Keyacris scurra*), a species known to have declined (ACT Government 2005), occurs near the Queanbeyan River upstream of the reservoir.

### 6.5.1 Threatened and Uncommon Fauna

Animal species occurring at Googong Foreshores that are listed as threatened under Commonwealth, New South Wales, and ACT legislation are shown in Table 6.3.

**Table 6.3 Animal species at Googong Foreshores listed as threatened under Commonwealth, NSW and ACT legislation or protected under Migratory Bird Agreements**

| Animal Species | Common Name | Cwlth | NSW | ACT |
|---|---|---|---|---|
| **Birds[1]** | **Common name and status[2]** | | | |
| *Stagonopleura guttata* | diamond firetail (U R) | – | V | – |
| *Chthonicola sagittata* | speckled warbler (U R) | – | V | – |
| *Climacteris picumnus* | brown treecreeper (V R) | – | V | V |
| *Melanodryas cucullata* | hooded robin (U R) | – | V | V |
| *Lalage sueurii* | white-winged triller (V Mi) | – | – | V |
| *Gallinago hardwickii* | Latham's snipe (V Mi) | MBA[3] | – | – |
| *Ardea alba* | great egret (V N) | MBA | | |
| *Ardea ibis* | cattle egret (U N) | MBA | | |
| **Mammals** | | | | |
| *Petaurus australis*[4] | yellow-bellied glider | – | V | – |
| *Falsistrellus tasmaniensis* | eastern false pipestrelle | – | V | – |
| *Phascolarctos cinereus* | koala | – | V | – |
| **Fish** | | | | |
| *Macquaria australasica* | Macquarie perch | E | V | E |
| *Maccullocheela peelii peelii* | Murray cod | V | – | – |

| | | | | |
|---|---|---|---|---|
| *Bidyanus bidyanus* | silver perch | | V | E |
| **Reptiles** | | | | |
| *Aprasia parapulchella* | pink-tailed worm lizard | V | V | SPS |
| *Varanus rosenbergi* | Rosenberg's monitor | – | V | – |

**Notes:**

1 Bird names from Barrett *et al*. (2003).

2 Status refers to a) Abundance (C = Common; U = Uncommon; V = Rare); and b) Resident Status (B = Breeding resident; R = Resident all year; Mi = Migrant; N = Nomadic/occasional visitor) (PCL 2008).

3 MBA = migratory bird agreements. These are the *Migratory Bird Agreement between Japan and Australia* (JAMBA) and the *Migratory Bird Agreement between the People's Republic of China and Australia* (CAMBA). Migratory species listed under these agreements are listed also under the *Environment Protection and Biodiversity Conservation Act 1999*. Under this Act migratory species are a matter of National Environmental Significance (see <http://www.environment.gov.au/epbc/protect/migratory.html>).

4 Tree scar evidence only.

**Legislation:**
**E**: Endangered. **V**: Vulnerable. **SPS**: Special Protection Status.
Commonwealth: *Environment Protection and Biodiversity Conservation Act 1999*
NSW: *Threatened Species Conservation Act 1995*
ACT: *Nature Conservation Act 1980*

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It is possible that other species listed as threatened under one or more of the Acts referred to in Table 6.3 are present at Googong Foreshores based on unconfirmed sightings or presence of suitable habitat. These include:

- *Litoria aurea* (green and golden bell frog)
- *Litoria verreauxii alpine* (alpine tree frog)
- *Dasyurus maculatus* (spotted-tailed quoll)
- *Phascogale tapoatafa* (brush-tailed phascogale)
- *Pseudomys fumeus* (smoky mouse)

### 6.5.2 Management Objectives, Policy and Actions

**OBJECTIVES: FAUNA**

- Populations of native fauna species are maintained by protecting and improving habitat and managing key threats.
- Populations of threatened and uncommon animal species are conserved in secure habitat.

**Policies**

- Management of Googong Foreshores will aim to:
  - improve the knowledge of native fauna in the area
  - protect and conserve habitats
  - minimise and, where possible, eliminate threats to native fauna
  - encourage the recovery of animal populations that have been negatively impacted in the past.
- Special attention will be given to the management of populations of threatened and uncommon species and their habitats.

**Actions**

- Prepare a comprehensive inventory of the fauna of Googong Foreshores.

- Management the habitat of threatened and uncommon animal species to protect them from threatening activities or accidental damage.
- Where practicable, undertake habitat rehabilitation activities to improve the status, distribution and abundance of threatened animal populations.
- Prepare management guidelines for species that are declared threatened or are of conservation concern, in accordance with recovery plans and other relevant material.
- Encourage and support survey, monitoring and research into animal species and populations.
- Undertake feral animal control (see s. 6.6).
- Provide interpretive material on Foreshores fauna for visitors.

## 6.6 Pest Plants and Pest Animals

Introduced plants and animals can become environmental pests if they establish and thrive in the wild at the expense of ecological processes and native populations, or some other valued attribute such as access, visual amenity or productive capacity. Native species can also flourish to excess in response to changes in land use or other significant environmental events that result in more favourable environmental conditions for that species.

Introduced plants and animals are now part of most 'natural environments' influencing the ecosystems in which they live. A strategic approach to managing pest species involves determining priorities based on the damage that particular species cause. Whilst eradication of an established pest may be desirable, this is rarely feasible except at a local scale. Even then, continuing vigilance with an adequate response capacity is essential.

The management of pest plants and animals and the damage they cause is a particular challenge for land managers. Associated costs are substantial and usually ongoing, therefore an efficient and effective management program is required that is part of a coordinated strategy if enduring cost-effective benefits are to be achieved. While the management of pest plants and animals is a routine land management responsibility, sometimes broader or statutory control measures also need to be accommodated, such as the *Noxious Weeds Act 1993* (NSW) for Googong Foreshores.

### 6.6.1 Pest Plants

The presence of weed species at Googong Foreshores largely reflects the past pastoral uses of some of the area and clearing of the tree cover. Weeds are particularly prevalent in the grassland and grassy woodland areas. Weed species include: St John's wort (*Hypericum perforatum*); great mullein (*Verbascum thapsus*), serrated tussock (*Nassella trichotoma*); African lovegrass (*Eragrostis curvula*); blackberry (*Rubus fruticosus* agg.), willows (*Salix* spp.); clovers (*Trifolium* spp.); phalaris (*Phalaris aquatica*); briar rose (*Rosa rubiginosa*); horehound (*Marrubium vulgare*); hawthorn (*Crataegus monogyna*) and many herbaceous species found in grazing country including other introduced grasses, flatweeds, thistles and mulleins. There is the potential for the introduction of aquatic weeds to the reservoir, but this has not been an issue to date. Eddy (2009) reported that some of these weed species (great mullein, St John's wort, horehound) occur in much higher densities and populations at Googong Foreshores than in most other parts of the Southern Tablelands. This is possibly related to differences in the type and intensity of herbivore grazing.

The NSW Department of Environment, Climate Change and Water has identified St John's wort as a high priority for weed control in Cuumbeun Nature Reserve, to the north of Googong Foreshores. Some of the weed species found at Googong Foreshores are declared 'noxious weeds' in New South Wales, 'pest plants' under ACT legislation, and are included in the list of Weeds of National Significance (WONS) (see Table 6.4). An active weed management program is undertaken across the Foreshores. Large scale control programs have been undertaken for St John's wort.

**Table 6.4 Declared weed species at Googong Foreshores**
(Adapted from ERM Australia (2008b))

| | | Declaration | | |
|---|---|---|---|---|
| Common Name | Scientific Name | ACT[1] | NSW[2] | Cwlth[3] |
| St John's wort | *Hypericum perforatum* | Must be contained | Class 3 | – |
| serrated tussock | *Nassella trichotoma* | Must be contained | Class 4 | WONS |
| Patterson's curse | *Echium plantagineum* | Must be contained | Class 4 | – |
| African lovegrass | *Eragrostis curvula* | Must be contained | Class 4 | – |
| All blackberry excepted permitted cultivars | All *Rubus fruticosa* (aggregate) except for permitted cultivars | Must be contained | Class 4 | WONS |
| All willows except permitted species | All *Salix* spp. except for permitted species | Must be suppressed | Class 5 | WONS |
| sweet briar | *Rosa rubiginosa* | Must be suppressed | – | – |
| hawthorn | *Crataegus monogyna* | Must be contained | – | – |
| horehound | *Marrubium vulgare* | – | Class 4 | – |
| Scotch thistle | *Onopordum acanthium* | Must be contained | Class 4 | – |
| saffron thistle | *Carthamus lanatus* | Must be contained | – | – |
| slender thistle | *Cardus pyncnocephalus* | Must be contained | – | – |
| slender thistle | *Carduus tenuiflorus* | Must be contained | – | – |

**Notes:** 1 ACT: *Pest Plants and Animals (Pest Plants) Declaration 2005 (No 1)* under the *Pest Plants and Animals Act 2005*.

2 NSW: *Noxious Weeds Act 1993. Special Supplement*, August 2006 (Weed Control Order No. 20). Class 3 = Regionally controlled weeds; Class 4 = Locally controlled weeds; Class 5 = Restricted plants.

3 Cwlth: *Weeds of National Significance* (WONS)(Australian Weeds Committee 1999) (http://www.weeds.org.au/natsig.htm). See also *Weeds of National Significance. Update 2008* (http://www.weeds.org.au/docs/WONS_update_2008.pdf).

The conservation of threatened animal species may require weed control and vegetation manipulation to retain or rehabilitate suitable habitat. In this regard, the growth of the native shrub, burgan (*Kunzea ericoides*), may need to be controlled to retain open habitat for the threatened pink-tailed worm lizard (*Aprasia parapulchella*). In highly disturbed areas, some woody weed species may be important for habitat and it may be appropriate that a replacement program using desirable species, staged over time, accompany removal.

**OBJECTIVE: PEST PLANTS**

- The damaging impacts of pest plants on the values of Googong Foreshores are minimised through strategic and effective management programs.

**Policies**

- An integrated program of pest plant management will be undertaken at Googong Foreshores based on weed control priorities, co-operation with adjacent land managers, and evaluation of the effectiveness of previous programs.
- Weed control programs will comply with legislative and policy requirements for the safe and appropriate use of chemicals.
- The effects on habitat and reservoir water quality will be considered in pest plant control programs. Removal and replacement may be staged over time to maintain habitat continuity.

**Actions**

- Design and undertake management programs for pest plants in accordance with relevant legislation and strategies, weed control priorities, and in co-operation with adjacent land managers.
- Undertake coordinated control of St John's Wort with the NSW Department of Environment, Climate Change and Water.
- Maintain and/or instigate hygiene measures to minimise the introduction and spread of weed species in management of the Foreshores. Measures include:
  - washing vehicles and machinery
  - minimising soil disturbance
  - avoiding the import of material (e.g. soil, mulch) that is likely to contain weed seeds
  - educating visitors about the potential to import and spread weed species, including aquatic weeds.

### 6.6.2 Pest Animals

Pest animals can have significant harmful impacts on biodiversity, habitat, water quality, recreational and scenic quality, and productivity of adjacent rural lands. They can also contribute to the spread of pest plants and pathogens. The main vertebrate pest species occurring in Googong Foreshores are the European rabbit (*Oryctolagus cuniculus*), European red fox (*Vulpes vulpes*), pig (*Sus scrofa*), goat (*Capra hircus*) and fallow deer (*Dama dama*). These are subject to an integrated feral animal control program. Feral cats are probably present also in the Foreshores. As noted in s. 5.4.1(a), Carp have not yet established in the reservoir, but eastern gambusia (*Gambusia holbrooki*) and redfin perch (*Perca fluviatilis*) are found there. The approaches outlined in the *ACT Vertebrate Pest Management Strategy* (ACT Government 2002) are appropriate for application in the Foreshores, even though the formal jurisdiction of the document is the ACT.

**OBJECTIVE: PEST ANIMALS**

- The damaging impacts of pest animals on the values of Googong Foreshores are minimised through strategic and effective management programs.

**Policies**

- A program of pest animal management will be undertaken at Googong Foreshores based on pest animal control priorities, co-operation with adjacent land managers, and evaluation of the effectiveness of previous programs.

**Actions**

- Design and undertake management programs for pest animals in accordance with relevant legislation and strategies, pest animal control priorities, and in co-operation with adjacent land managers.
- Continue the successful rabbit control program to reduce grazing pressure to acceptable levels.

## 6.7 Kangaroos

Open grassy environments at Googong Foreshores provide ideal kangaroo habitat and high densities have been recorded. Management of kangaroos at the Foreshores is included in the *ACT Kangaroo Management Plan* (ACT Government 2010a), which should be consulted if more detail is required.

### 6.7.1 Maintaining Ground Cover

As discussed in Chapter 4, maintenance of catchment condition in Googong Foreshores is a crucial management consideration. Central to this is the vegetation cover. The main concern regionally is whether ground cover falls below 70 per cent, a minimum acceptable threshold set by the Murrumbidgee Catchment Management Board (2003), recommended by McIvor (2002a, 2002b), and supported by studies such as that of Jefferies (1999) which showed a sharp increase in the rate of water erosion about this level. Ideally, given the proximity of Googong Foreshores to the reservoir, it is desirable to maintain cover above this level.

The parts of Googong Foreshores of most management concern are the grassland areas west and south-west of the reservoir. Particularly important is the northern part of this area, opposite the main basin of the reservoir. Pollutant material such as sediment or bacteria from this area has the potential to be rapidly transferred to the reservoir. Material introduced further upstream in the catchment has greater opportunity to settle out, or decompose. Ground cover in the grassy areas fluctuates according to the interaction of seasonal conditions and herbivore grazing pressure (primarily kangaroos and rabbits). Management of herbage mass (see **Glossary**) in relation to fire risk is also important in these areas and grazing is the main influence on this.

Rainfall at Queanbeyan (>130 year record) has a coefficient of variation between years of 27 per cent. For that reason grassland biomass fluctuates strongly between years. Compared to grass, kangaroo populations are slower to grow, and to die back, and kangaroo density at Googong Foreshores is much less variable. Thus the grazing pressure exerted by the kangaroos will vary considerably. When there is a strong spurt of pasture growth the grassland will be under-grazed, and when the pasture is dying back, it will be over-grazed. When the pasture is eaten to a low level in dry years, there is a reduction of groundcover, and increased risk of erosion.

The potential for contamination of the reservoir was demonstrated by an extreme storm in March 2003. Occurring during a drought, it resulted in large volumes of grass litter, kangaroo faecal material and soil moving into Googong Reservoir from the well eaten down grassland on the western foreshore. While such extreme storm events are likely to increase the risk of algae outbreaks, such as the one recorded the following summer, fortunately they are also uncommon. As well as nutrients, which may lead to algal blooms, faecal material can also be associated with parasites. Kangaroos carry a large number of endoparasites incapable of harming humans. Eastern grey kangaroos can also

carry the human pathogen *Cryptosporidium*. However, research in the Warragamba Catchment of the Sydney Catchment Authority has shown that kangaroos do not carry *Cryptosporidium* types that have caused a water-borne outbreak of disease (SCA and NSW Dept of Education and Training 2009).

### 6.7.2 Kangaroo Population Size

The overwhelming majority of kangaroos at Googong Foreshores are eastern grey kangaroos (*Macropus giganteus*) (Muranyi 2000). Spotlight counts of the kangaroo population were undertaken in the early 1980s, ceased for a ten year period (1985–1995), and recommenced in 1996 (Figure 6.1). The density index shown in Figure 6.1 tracks relative change but is incapable of providing absolute density e.g. number per hectare. Since 1996 estimation methods have been used at Googong that allow the calculation of absolute density (Table 6.5).

The mean density of kangaroos in 2002 (when the population had reached its peak) was 5.01 kangaroos per hectare (501 per km$^2$), based on nocturnal line transect estimates (Fletcher 2006). These densities are much higher than in surrounding rural land in New South Wales where densities (estimated by helicopter line transect) in 2003 and 2006 were 0.12 and 0.14 kangaroos per hectare (12 and 14 per km$^2$) respectively (Cairns 2004, 2007).

The pattern of growth of the kangaroo population at Googong Foreshores (Figure 6.1) conforms to a typical herbivore 'irruption' described in the ecological literature (Caughley 1976; Forsyth and Caley 2006; Leopold 1943). It is one of a number of irruptions that have occurred in the ACT and region over the past two decades. At Googong, the kangaroo population appears to have risen slowly at first, then increased exponentially, overshot its food supply (coincident with the drought conditions of 2002–2003), and collapsed. The time around the peak and ensuing collapse is a time of extreme pressure on the vegetation and therefore increased exposure of bare ground and likelihood of erosion in rainfall events.

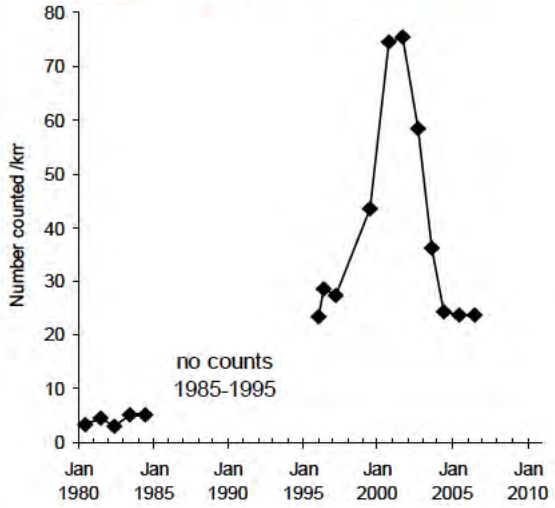


**Figure 6.1 Eastern grey kangaroo 'herbivore irruption' at Googong Foreshores**
The graph shows the kangaroo population increase until 2001–2002 then a steep decline due to starvation, reaching approximately its current level in 2004. The graph shows that the

decrease was genuinely due to starvation, not the culling of 800 kangaroos in July 2004 which was too late and too few to affect the pattern.

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As shown in Figure 6.1, after 2002 in developing drought conditions, the population 'crashed' and the extreme storm in March 2003 resulted in erosion of the grazed areas and temporary pollution of the reservoir (s. 6.7.1). Following the January 2003 bushfire in the ACT, there was concern about water supplies and in 2004, amid concern for catchment condition, a cull of 800 kangaroos was undertaken at Googong Foreshores. The aim of this was to lessen grazing pressure, such that if the drought broke, herbage mass and groundcover would be restored to a threshold level likely to prevent erosion. However, the population was already in a severe decrease phase following the irruption and would have declined regardless of whether or not a cull was undertaken. Counts show that kangaroo density has changed little following the cull.

**Table 6.5 Estimates of kangaroo densities at Googong Foreshores since 1996**

| Date | Method used[1] | Kangaroo density (EGK/ha) | Standard error | Number of kangaroos | Source |
|---|---|---|---|---|---|
| June 1996 | Distance sampling | 2.00 | 0.54 | 900 | Muranyi 2000 |
| Aug 1999 | Distance sampling | 3.60 | 0.97 | 1620 | Muranyi 2000 |
| Aug 2001 | Sweep count | 3.80 | NA | 1710 | Fletcher 2006 |
| 2001–02[2] | Distance sampling | 4.38 | 1.21 | 1972 | Fletcher 2006 |
| 2002–03[2] | Distance sampling | 5.01 | 1.47 | 2253 | Fletcher 2006 |

**Notes**: 1 See *Estimating kangaroo density* in **Glossary** for description of methods
2 Mean of six bimonthly surveys.

### 6.7.3 Managing the Kangaroo Population

The main issues regarding management of the kangaroo population at Googong are:

*Reduction of herbage*: Grazing by kangaroos at Googong Foreshores potentially performs a valuable role in fire fuel hazard reduction. The ability to manage this through changing seasonal conditions is difficult, as herbage reduction may be insufficient in good seasons and excessive in dry periods and in winter.

*Kangaroo population growth*: Due to the management regime at Googong Foreshores (equivalent to a reserve), the kangaroo population is not subject to the rural culling and commercial harvest that occurs in surrounding New South Wales, nor is there significant predation. In these circumstances population increase to 'ecological carrying capacity' (see **Glossary**) is highly probable, and this is associated with reduced herbage mass and possible loss of soil in drought periods. It is not appropriate to allow the kangaroo population to remain indefinitely at ecological carrying capacity, given the need to protect both the water catchment and the condition of native grassy ecosystems.

*Catchment protection*: Given the primary purpose of Googong Reservoir and its increased importance to security of the Canberra–Queanbeyan water supply, the maintenance of catchment condition is a key management task. Controlling total grazing pressure so as to maintain adequate ground cover that can resist erosion, slow overland flow and filter sediments and organic material is essential. However, there is not a simple relationship between kangaroo density and catchment stability. No management solution, even a

complete removal of all grazing animals, would entirely eliminate the risk of erosion in an extreme drought.

*Threatened species and ecological communities*: Overgrazing by kangaroos can have deleterious impacts on grassy ecosystems and limit woodland regeneration. Eddy (2009) notes that 'it seems probable that the current kangaroo population and grazing pressure is significantly higher than the natural level, and higher than would be desirable in the long term'.

*Kangaroo population management*: The 2004 cull of kangaroos was targeted by animal rights protestors with the protest being linked also to opposition to commercial harvesting. The proposed Googong New Town development immediately west of Googong Foreshores will result in urban settlement replacing rural land use. From both political and practical perspectives this may make culling by shooting a more difficult task.

A long term, proactive approach is needed to managing kangaroos at Googong Foreshores, rather than actions such as responding to the onset of dry weather conditions by starting to remove kangaroos. To reduce the likelihood of erosion and damage to grassy ecosystems, kangaroo density should be maintained at a level that accords with other land management objectives. Examination of the pastures at Googong Foreshores, including a study of kangaroo and pasture dynamics (Fletcher 2006), indicates the pasture is of similar food value to that in ACT lowland grassy ecosystems. The most desirable option for kangaroo populations in native grasslands, of maintaining *grassland conservation densities* (see below), would also maintain suitable catchment conditions at Googong.

Recent research on a range of sites and pasture types (natural and exotic) in the ACT and at Googong Foreshores (Fletcher 2006), as well as mathematical modelling, suggest that *a significant increase in herbage mass is associated with kangaroo densities that are in the range of approximately 0.6 to 1.5 per hectare in grassland areas*. This estimate is regarded as an initial approximation that requires further refinement. However, it accords with observations of the deleterious impacts of kangaroos on lowland native grasslands in the ACT when their densities are higher. While recognising the need for further research to better estimate appropriate densities, the term *grassland conservation densities* is used in the *ACT Kangaroo Management Plan* to refer to densities that:

- relate to the management objectives for the land
- maintain suitable habitat for other grassland flora and fauna species (in particular, threatened species)
- recognise a kangaroo density of less than 1.5 per hectare as a likely requirement in order to maintain the natural integrity of lowland grassy ecosystems.

Animal welfare is an important consideration for every program involving the manipulation of animal populations. Any kangaroo management undertaken at Googong will comply with the relevant animal welfare codes of practice prevailing at the time, as outlined in the *ACT Kangaroo Management Plan*.

Relevant NSW legislation also needs to be considered as all kangaroo species are designated as 'protected fauna' in New South Wales under *the National Parks and*

*Wildlife Act 1974*. However, the *National Parks and Wildlife Act 1974* and the *National Parks and Wildlife Regulation 2002* make provisions for the licensing of a range of activities, including harming fauna for a specified purpose. When undertaking kangaroo management activities at Googong Foreshores, the ACT will also need to ensure compliance with this legislation.

A reduction in food availability via reforestation of formerly cleared land could make some contribution to managing kangaroo populations by reducing the extent of pasture. However, it is important that such planting is not undertaken in areas of natural temperate grassland (s. 6.4).

### 6.7.4 Management Objectives, Policy and Actions

**OBJECTIVE: KANGAROOS**

- The kangaroo population at Googong Foreshores is managed so that grassy ecosystems are conserved and water catchment conditions are maintained or improved.

**Policies**

- Kangaroos will be managed as an integral part of the fauna of Googong Foreshores and the grassy ecosystems of the area in particular.
- Kangaroo management will be based on the objectives and policies outlined in the *ACT Kangaroo Management Plan* (KMP), in particular, those for kangaroo welfare (KMP s. 4.4), managing kangaroo densities (KMP s. 4.6), lowland native grassy ecosystem areas (KMP s. 5.3.1), and Googong Foreshores (KMP s. 5.6).
- Management of kangaroo grazing will be undertaken in the context of total herbivore grazing pressure, considering in particular, the contribution by rabbits.
- Googong Foreshores will be included in long term monitoring of lowland grassy ecosystems that includes the interaction between the vegetation and large/medium herbivores (domestic stock, kangaroos and rabbits).
- Kangaroo populations will be managed with the aim of achieving grassland conservation densities.
- Culling of the kangaroo population will only be undertaken for the purposes of maintaining or improving catchment condition and grassy ecosystem conservation.
- Kangaroo management and culling will comply with relevant NSW legislation (for example, firearm licensing, animal welfare, harming protected fauna) and the relevant NSW codes of practice (see s. 9.3.7).
- A long-term program of increasing the tree and shrub cover in previously cleared areas will be evaluated and undertaken where practicable, aimed at reducing suitable kangaroo habitat, as well as providing direct catchment protection benefits. Tree planting will not be undertaken in areas of natural temperate grassland. This will be considered as part of the vegetation management plan (s. 6.4.3).

**Actions**

- Continue and develop, as required, a scientifically based monitoring program for herbivores (focused on kangaroos and rabbits) and lowland grassy ecosystems with appropriate analysis and recording of results.

- Take a proactive approach to kangaroo management, so that densities do not increase in favourable seasons to levels that are unsustainable and impact on catchment and grassy ecosystem condition.
- Manage the kangaroo population with the aim of achieving grassland conservation densities, which on current knowledge are densities of less that 1.5 kangaroos per hectare in grassy ecosystems.
- Where culling of kangaroos is required, undertake a culling program in accordance with the policies outlined in the *ACT Kangaroo Management Plan*.
- In preparing any culling program, consult with ActewAGL and arrange for carcass disposal that does not have potential impacts on reservoir water quality
- Explain management policies and actions for kangaroos in information to the public, especially where interventions are required.
- As part of the vegetation management plan for Googong Foreshores, evaluate, and if desirable and feasible, undertake programs to increase tree and shrub cover, where this does not impact on areas of natural temperate grassland.

# Chapter 7 Cultural Heritage

## 7.1 Cultural Heritage: Primary Management Objective

**Cultural heritage within Googong Foreshores is identified, conserved, and where appropriate, interpreted and promoted to retain and foster community associations and an appreciation of the past.**

*Cultural heritage value* and *cultural significance* are defined and discussed in s. 2.6.

## 7.2 Cultural Heritage at Googong Foreshores

Current recognition of cultural heritage at Googong Foreshores relates to prior Aboriginal occupation, the geological feature of London Bridge Natural Arch and the representation of the early European pastoral period in London Bridge Homestead. Over time, other significant associations with Googong Foreshores may develop and become recognised.

As part of establishing baseline conditions for the Googong Lease, the Commonwealth has prepared a background assessment of heritage values: *Googong Foreshore: Heritage Assessment* (ERM Australia 2008b) and *Googong Foreshores: Aboriginal Heritage Assessment* (ERM Australia 2008a). The Commonwealth has also prepared a *Googong Foreshores: Heritage Management Plan* (ERM Australia 2008c), which considers heritage values and management in four categories: natural, geodiversity, historic, and Indigenous (Aboriginal). These three documents provide the basis for heritage management at Googong Foreshores and are referred to in more detail below.

Natural and geodiversity heritage values are referred to in s. 2.6 and s. 6.2 of this *Googong Foreshores Plan of Management*.

### 7.2.1 Legislative framework

As noted in s. 1.4, as Googong Foreshores is Commonwealth Land in New South Wales, Commonwealth legislation takes precedence over all other legislation unless the other legislation is capable of operating concurrently with Commonwealth legislation. Legislation applicable to heritage management (both natural and cultural) at the Foreshores is outlined in Table 7.1. ACT heritage legislation does not apply in the Foreshores.

### 7.2.2 Non-statutory considerations

Guidance for the conservation and management of places of cultural significance (cultural heritage places) is provided by the Australian ICOMOS (International Council on Monuments and Sites) Charter for the conservation of places of cultural significance (the Burra Charter). The charter sets a standard of practice for those who provide advice, make decisions about or undertake works to places of cultural significance including owners, managers and custodians. The charter is revised from time to time and only the latest version is the approved Burra Charter (<http://icomos.org/australia/burra.html>).

More detailed guidelines for the conservation and management of cultural heritage places are contained in: *Protecting Local Heritage Places: A guide for local communities*

(Australian Heritage Commission 2000) and *Ask First: A guide to respecting Indigenous heritage places and values* (Australian Heritage Commission 2002b).

**Table 7.1 Heritage legislation applicable to Googong Foreshores**

| Legislation | Main provisions |
|---|---|
| **Commonwealth** | |
| *Environment Protection and Biodiversity Conservation Act 1999* | Provisions relating to Googong Foreshores are:<br>• Matters of National Environmental Significance.<br>• Activities involving Commonwealth Land or undertaken by Commonwealth agencies with potential to have a significant impact on the environment.<br>• Minimisation of adverse impacts on heritage values of a place on the Commonwealth Heritage List.<br>• Ongoing protection of heritage values of a place included on the Commonwealth Heritage List in the event of sale or transfer.<br>(see also s. 1.4.2 of this management plan) |
| *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* | Act protects areas/objects of significance to Aboriginal people, which are under threat of destruction. Act must be invoked by Aboriginal or Torres Strait Islander people. |
| **State** | |
| *Heritage Act 1977* | Act protects the natural and cultural heritage of NSW with emphasis on non-Indigenous cultural heritage. |
| *National Parks and Wildlife Act 1974* | Primary legislation regulating protection of Aboriginal heritage (Aboriginal objects and places). |
| *Environmental Planning and Assessment Act 1979* | Act requires that impacts on Indigenous and non-Indigenous heritage are considered in land use planning. |

### 7.2.3 Recognised heritage places at Googong Foreshores

Two places, London Bridge Natural Arch (Place ID 1182) and the London Bridge Homestead Group (Place ID 1174), are included on the Register of the National Estate (RNE) (see **Glossary**). In accordance with the process of placing RNE sites in statutory registers (as explained in the Glossary), both the arch and the homestead group, described as the 'Googong Foreshores Cultural and Geodiversity Heritage Areas', have been nominated for the Commonwealth Heritage List (Place ID 106072) (see s. 2.6, s. 6.2.2). No places at Googong Foreshores are currently listed under New South Wales heritage legislation (see <http://www.heritage.nsw.gov.au>).

London Bridge Natural Arch has both natural values (s. 6.2.2) and elements of all the values that make up cultural significance (s. 7.1), including significant Aboriginal values (s. 7.3). The feature has long attracted interest since first being described by explorer Mark Currie, who was directed there by an Aboriginal guide. Currie described it as 'a natural bridge of one perfect Saxon arch, under which the water passed' (Department of Territory and Municipal Services 2009). The arch features widely in tourism information about the region.

London Bridge Homestead Group incorporates both the homestead and associated buildings dating from the 1860s, and the woolshed and shearers' quarters further north, built in the 1930s.

## 7.3 Aboriginal Cultural Heritage

As noted in s. 2.4 and Table 2.1, archaeological evidence suggests that in common with elsewhere on the Southern Tablelands, the Queanbeyan River valley at Googong Foreshores was an occupation site for Aboriginal people. Evidence of campsites and the Aboriginal economy in the river valley have been lost under the reservoir waters and sediments, in floods, and due to erosion of soil horizons in the reservoir (ERM Australia 2008a). The more sheltered river valleys that were not frost hollows provided year-round occupation sites. River valleys and associated lowland grasslands and woodlands provided mammals, reptiles, ducks and other birds, plant foods and a seasonal abundance of fish (Flood 1980, pp. 61–82, 97–100). Aboriginal camps in the Googong area have been dated to be at least 800 years old, though occupation was likely to have been much longer (Table 2.1).

Three documented archaeological surveys have been undertaken at Googong Foreshores. Isolated artefacts, two stone cairns and one campsite were recorded in the area to be flooded by the dam (Smith 1975 in Flood 1980). An archaeological survey and specific investigations of the London Bridge Natural Arch area were undertaken by Boot and Cooke (1990) in preparing a conservation management plan for the area. The most recent survey was based on a representative sample of likely locations for Aboriginal sites in the Foreshores (ERM Australia 2008a). Transects were conducted in the north–eastern, north–western and south–western areas. This survey recorded twelve sites, all on the western Foreshores. The majority of these were new sites. None of the previously recorded sites could be located, and most had been inundated by flood waters. The sites comprised: one campsite (exposed by low reservoir water level); three isolated finds; five artefact scatters; a scarred tree (yellow box) with the size of the scar suggesting use for a canoe; a low stone cairn (possible burial site); and the sacred site of London Bridge Natural Arch. The study area appears to contain a balanced and diverse range of landforms, features, food sources and water that could have been utilised by large numbers of Aboriginal peoples over the Holocene period (last 10 000 years) and presents significant opportunities for future archaeological work (ERM Australia 2008a).

The following statement of significance for Aboriginal Heritage Values is based on that prepared by ERM Australia (2008c: p. 28), with only slight modifications:

> Googong Foreshores contains a diverse range of known Aboriginal sites including stone artefact scatters, a scarred tree, cairns (with potential burials), campsites and a sacred site associated with known ceremonial activities. Googong Foreshores has zones with high and moderate potential to yield further sites. All recorded Aboriginal sites are contained within a cultural landscape, where their location suggests deliberate selection and use of particular landforms.
>
> The London Bridge Arch has been identified as a sacred area, connected to the use of Googong Foreshores as a possible 'staging zone'. It has been suggested that Aboriginal people waited within the habitable confines of Googong Foreshores, on the lower slopes and rises, prior to moving into the ACT's Brindabella Mountains for ceremonial purposes via the Arch and ridgeline system to the south–west of the boundary of the foreshores.
>
> The ability of the land within Googong Foreshores to support a large number of Aboriginal people for an extended period of time is demonstrated through the rich and diverse ecology of the area. The hypothesis of intensive use of this area is also supported by the extent, variety and quantity of archaeological material observed within Aboriginal sites.

> Future archaeological and ethnographic study of Aboriginal sites at Googong Foreshores has the potential to further the knowledge relating to Aboriginal economy (subsistence and trade), demography (population number and movement) and society (inter-tribal relationship and ceremonial activities) across the ACT/Queanbeyan area. Such study could present new information with regard to the recorded ceremonial sites and activity in the ACT's high country.

The *Googong Foreshores: Heritage Management Plan* (HMP) (ERM Australia 2008c) sets out general policies for conservation of Aboriginal heritage (HMP: s. 6.2.4); implementation strategies (HMP: s. 7.1.2); and a list of 'do's and don'ts' for repairs and maintenance works (HMP: s. 9).

### 7.3.1 Management Objectives, Policies and Actions

The effects of the European pastoral economy and the filling of Googong Reservoir are assumed to have removed much of the evidence of previous Aboriginal occupation of the Googong Foreshores area. However, the evidence that remains and knowledge of regional Aboriginal economy, demography and society suggest that the area was important to Aboriginal people over a long period of time. There are opportunities to integrate recognition of Aboriginal cultural heritage into the management of the Foreshores, involving consultation with local Aboriginal communities. Information and interpretative material on the Foreshores can play an important role in this. The bases for management of Aboriginal cultural heritage at Googong Foreshores are the heritage assessments and heritage management plan referred to in s. 7.2.

**OBJECTIVE: ABORIGINAL CULTURAL HERITAGE**

- Aboriginal cultural heritage values and prior Aboriginal occupation are recognised, identified, protected, incorporated into the management of the Foreshores and interpreted where appropriate, taking account of cultural sensitivity.

**Policies**

- Management of Aboriginal cultural heritage will take account of the *Googong Foreshores: Heritage Assessment* (ERM Australia 2008b), the *Googong Foreshores: Aboriginal Heritage Assessment* (ERM Australia 2008a), and accord with the policies for conservation of Aboriginal heritage in the *Googong Foreshores: Heritage Management Plan* (ERM Australia 2008c).
- Management of Aboriginal cultural heritage will be carried out in accordance with the requirements of Commonwealth and NSW legislation.
- Aboriginal sites and objects (as defined under Commonwealth and NSW legislation) will be protected.
- Management of London Bridge Natural Arch will give recognition to its significant Aboriginal heritage values.
- Recognition of prior Aboriginal occupation will be incorporated into management of the Foreshores, in consultation with local Aboriginal communities.

**Actions**

- Implement the Aboriginal heritage strategies in the *Googong Foreshores: Heritage Management Plan*. These strategies provide a five-year and ongoing management program including:

- formal recognition of Aboriginal heritage values and Aboriginal heritage sites
- involvement of the local Aboriginal community in decisions involving their heritage sites
- formal recognition of the value of an Aboriginal heritage ranger position
- a recording system for Aboriginal heritage sites
- monitoring of Aboriginal heritage sites
- management of potential impacts on Aboriginal heritage sites
- salvage and/or excavation and radiocarbon dating of sites exposed by low reservoir water levels
- consideration of 'salvage' of sites of diminished condition and integrity that could be further impacted by visitor use.

## 7.4 European Cultural Heritage

London Bridge Homestead group and the associated 1930s woolshed and shearers' quarters are the main focus of European cultural heritage management at the Foreshores. As noted in s. 7.2.3, London Bridge Natural Arch also has European cultural heritage values.

London Bridge Homestead is located in the Burra Valley in the south-western part of the Foreshores. The area was first settled by Europeans in 1834 with the first purchase in 1857. In subsequent years, the holding was expanded to reach its largest size (4047 hectares) in about 1900. It was known by various names, all including reference to London Bridge. The property converted from cattle to mainly sheep grazing in the latter part of the 19th century with over 7000 sheep being recorded in 1901. It was one of the largest holdings in the district. The present woolshed and shearers' quarters were constructed in the 1930s, replacing a former woolshed adjacent to the homestead. The Commonwealth resumed the property in 1973, and the former owner leased a section of the property back from the Commonwealth (ERM Australia 2008b; Freeman Collett and Partners Pty Ltd 1995).

The collection of buildings now present at the homestead comprises at least five architectural styles and different building materials, commencing with a stone cottage constructed in 1860 from material quarried from a nearby hill. Significant remains of a woolshed and some slab-walled outbuildings exist. The relic of a lever arm woolpress is extremely rare. A hawthorn (*Crataegeus monogyna*) hedge is present on three sides of the homestead. The homestead is clearly visible from outside a security fence and is open to the public on regular open days. Many of the outbuildings are outside the fence. The Commonwealth Heritage List nomination (see above) includes both the homestead group and the later woolshed and shearers' quarters to the north. The latter now form part of a picnic area and commencing point for the walk to the natural arch and the homestead group.

The following statement of significance for Historic (European) Heritage Values has been prepared by ERM Australia (2008c: p. 28):

> The London Bridge Homestead group and outbuildings survive as the focus of a large, mid nineteenth century marginal pastoral holding. The groups of buildings and materials indicate the social and economic changes that have taken place over a period of one hundred years. The Woolshed and Shearers' Quarters provide an insight into the 1930s

period of wool production management of the property, and reflect the importance of this industry to the local economy during this period.

The London Bridge Homestead group is a rare example of a group of buildings in Australia which illustrate the range and sequence of regional vernacular construction techniques as a complete homestead precinct. The Homestead group also has research potential to provide further insight into the pastoral settlement of the region. The buildings demonstrate a variety of construction types, sophistication and materials and illustrate the suitability of those materials in a rural setting.

The London Bridge Homestead group displays aesthetic qualities stemming from pastoral activity and the need for self sufficiency in a remote rural area.

The Woolshed and Shearers' Quarters are intact and strong examples of their type.

The cultural landscape is valued by community groups for its ability to convey both landscape qualities and the aesthetics of nineteenth century and twentieth century vernacular farm buildings.

A conservation strategy for the homestead group was prepared in 1995 (Freeman Collett and Partners Pty Ltd 1995) and extensive conservation work was carried out on the homestead complex, mainly in the 1990s. The *Googong Foreshores: Heritage Management Plan* (HMP) (ERM Australia 2008c) sets out general policies for conservation of historic heritage (HMP: s. 6.2.2); implementation strategies (HMP: s. 7.1.1); detailed five year asset restoration and maintenance plans (HMP: s. 8.1.1); and a list of 'do's and don'ts' for repairs and maintenance works (HMP: s. 9).

### 7.4.1 Management Objectives, Policies and Actions

London Bridge Homestead, Woolshed and Shearers' Quarters (London Bridge Homestead Group) and the adjacent London Bridge Natural Arch, are significant elements of European cultural heritage at the Foreshores and in a regional context. The woolshed and shearers' quarters at the London Bridge car park provide a tangible link to the area's rural past and complement the picnic area. The homestead can only be reached along a 3.4 km return walking track (management trail). These features, including the picnic area near the woolshed, are popular recreational destinations at the Foreshores. This is facilitated by information and interpretative material, signs and regular 'open days' for the homestead. The bases for management of European heritage at Googong Foreshores are the heritage assessments and heritage management plan referred to in s. 7.2.

**OBJECTIVE: EUROPEAN CULTURAL HERITAGE**

- European cultural heritage values are conserved and interpreted to visitors to Googong Foreshores.

**Policies**

- European cultural heritage will be identified, conserved and interpreted for its educational value and to foster historical understanding.
- Management of European cultural heritage will take account of the *Googong Foreshores: Heritage Assessment* (ERM Australia 2008b) and accord with the

policies for conservation of European heritage in the *Googong Foreshores: Heritage Management Plan* (ERM Australia 2008c).

- Management of European cultural heritage will be carried out in accordance with the requirements of Commonwealth and NSW legislation.

**Actions**

- Implement the European heritage strategies in the *Googong Foreshores: Heritage Management Plan* including a five-year and ongoing restoration and maintenance schedule for the London Bridge Homestead group.
- Ensure that all works proposed for Googong Foreshores fulfil legislative requirements related to heritage protection.
- Maintain the practice of having 'open days' for London Bridge Homestead, subject to the consideration of public safety and requirements for the conservation of the physical fabric of the place.

# Chapter 8 Education and Research

## 8.1 Education and Research: Primary Management Objectives

- **Opportunities are provided for the community to acquire knowledge of the values of Googong Foreshores and to understand its primary water supply purpose.**
- **Research is undertaken at Googong Foreshores that contributes to management of the area and the conservation of its values.**

## 8.2 Education and Research Opportunities

At Googong Foreshores, the diversity of landscapes and ecological communities, geological features, water supply infrastructure, and Aboriginal and European cultural heritage offer opportunities for formal and informal education and research projects. These opportunities are enhanced by the location of the Foreshores close to Canberra and Queanbeyan.

Nature study and visiting natural and cultural heritage sites at the Foreshores are encouraged, combining recreational and educational activities (s. 5.4). Information is provided, for example, in the *Googong Foreshores: Map and Guide*, the *Googong Foreshores: Bird List 2008* (PCL 2008), and at Googong Homestead on regular 'open days'.

The Foreshores is recognised as a place of scientific value (ERM Australia 2008a), referring to the area's known or potential ability to reveal further information. There are opportunities to carry out research at the Foreshores that supports management. The location also provides a protected environment for carrying out more fundamental research. An example of this is the study of raptors and their interactions in the area over more than two decades (Olsen et al. 1998; Olsen et al. 2006).

### 8.2.1 Management Objectives, Policies and Actions

**OBJECTIVES: EDUCATION AND RESEARCH**
Objectives are stated at s. 8.1.

**Policies**

- Educational activities will be encouraged at Googong Foreshores that:
  - enhance knowledge and understanding of the area's water supply purpose, and natural and cultural heritage values
  - conform to the same objectives and policies as defined for recreational use (s. 5.4).
- Survey, monitoring and research will be encouraged at Googong Foreshores, particularly related to water supply, catchment management, natural and cultural heritage, and protected area management.

**Actions**

- Provide interpretive and educational materials to support educational activities at the Foreshores, including materials that:
  - assist in an understanding of water supply issues (e.g. water quality)
  - support nature study

  - assist in interpreting European and Aboriginal cultural heritage.
- Encourage survey, monitoring and research activities at the Foreshores, particularly related to water supply, catchment management, natural and cultural heritage, and protected area management.
- Maintain a repository of educational materials and information relating to the Foreshores, including the results of research projects.

# Chapter 9 Environmental Planning, Protection and Management

Chapters 4 to 8 have outlined management of Googong Foreshores to conserve the values identified in section 2.6. Chapter 9 considers a number of other management issues and requirements. These also support the conservation of Foreshore values to varying degrees. While the chapter focuses on the responsibilities of the managing agency, the concept of environmental stewardship applies to all those individuals and organisations that have an involvement with Googong Foreshores.

## 9.1 Fire Management

Fire management is important in water supply catchments in relation to protection of water quality and catchment yields. Loss of vegetation cover can result in accelerated erosion with ash and sediment inputs causing elevated turbidity levels in reservoir waters. Vegetation regrowth following fire may result in reduced water yields for a period of time in the catchment. At Googong Foreshores, as well as protection of water quality, other considerations in fire management are biodiversity conservation, safety of staff and visitors, asset protection, and impacts on neighbouring land holders.

### 9.1.1 Fire History

Fires in 1985 burnt almost all of Googong Foreshores except for the area south of the junction of Burra Creek and the Queanbeyan River. Smaller prescribed burns have been undertaken at various times. The largest of these were along the Queanbeyan River in the southern section of the Foreshores in 1986 and 1987. Prescribed burns have not been undertaken in recent years.

### 9.1.2 Legislative Basis for Fire Management

In New South Wales, the control of bushfires is granted to authorised persons under the *Rural Fires Act 1997*. The Act gives powers to the NSW Rural Fire Service (RFS) to coordinate fighting of bushfires, undertake bushfire prevention activities, and to protect property and the environment. Landholders are also responsible for the control of bushfires in NSW. For Googong Foreshores, this responsibility rests with the ACT Government. The ACT Emergency Services Authority and the ACT Rural Fire Service have no direct involvement in, or jurisdiction over, bushfire control at Googong Foreshores. The *Strategic Bushfire Management Plan for the ACT* (ACT ESA 2004) has no jurisdiction at Googong Foreshores, so a specific plan for the Foreshores has been developed (*Strategic Bushfire Management Plan 2007/8 to 2011/12 Googong Foreshores Nature Reserve* (BES 2007)). This plan has been prepared under NSW legislation.

### 9.1.3 Fire Management Arrangements

Fire planning and response for the Googong Foreshores is carried out in association with the NSW Rural Fire Service. Googong Foreshores is in the Southern Ranges Fire Weather Region and Lake George RFS Fire Control Zone which is based from Queanbeyan. If a total fire ban is called in the Southern Ranges Fire Weather Region or the ACT, Googong Foreshores is closed. The Foreshores lies within the Burra Bush Fire Brigade District of Palerang Shire and, in general, staff and fire equipment from Googong Foreshores form part of the Burra Brigade. Googong Foreshores observes the NSW Bushfire Season, which may differ to that prescribed for the ACT.

Operational details for bushfire management at Googong Foreshores (in particular the arrangements with the Burra Brigade) are set out in the annual Fire Action Plan prepared by the ACT Government. This covers arrangements for fire readiness and response. Fire prevention standards such as those for fuel and access management are detailed in the *Strategic Bushfire Management Plan 2007/8 to 2011/12 Googong Foreshores Nature Reserve* (BES 2007). The activities planned to be undertaken each year to achieve these standards are detailed in the Bushfire Operational Plan prepared by the ACT Government for lands that it manages. Bushfire Operations Plans are a requirement under the *Strategic Bushfire Management Plan for the ACT* (ACT ESA 2004) for managers of land in the ACT. Googong Foreshores is included in the Bushfire Operational Plan as part of the overall fire management responsibility of the ACT Government, rather than being a requirement under the *Strategic Bushfire Management Plan for the ACT*. Googong Foreshores contains a network of mapped fire trails, which NSW Rural Fire service units are able to access through perimeter gates. Keys to the gates are held also by NSW Police and the Urban Fire Brigade (Queanbeyan).

### 9.1.4 Key Bushfire Management Concepts

The following concepts underpin the strategies in the Googong Foreshores Strategic Bushfire Management Plan (based on BES 2007):

- Widespread wildfire, and especially high intensity wildfire, would have significant impact on the water quality and long term water yield of Googong Dam. The risk of this occurring in the life time of the dam is very high. Minimising this risk is critically important especially given the enhanced role of Googong Reservoir in ensuring water security for the ACT and Queanbeyan.
- Strategies to reduce the impacts on water supply and quality should also improve life and property protection and conserve biodiversity.
- At Googong Foreshores the spatial pattern of burning is more important than the frequency of burning. Long fire intervals are necessary for maximising protection of ground cover within the water catchment and for biodiversity conservation.
- Strategic use of prescribed fire may not stop wildfires, especially under extreme weather conditions. It will increase the probability of wildfire control, especially under non-extreme weather conditions. Prescribed fire will reduce fire intensity and the consequential post-fire water quality effects of some wildfires.
- Fire regimes for biodiversity conservation may be provided by wildfire or prescribed fire or a combination of both.
- Protection of built assets is best achieved immediately adjoining the asset.
- Rapid fire detection and response is required to reduce risk of widespread high fire intensity.
- An effective network of access trails is required for minimising fire size and intensity and fire fighter safety.
- Cooperative arrangements with neighbours and fire authorities are fundamental to effective risk reduction.

### 9.1.5 Key features of the Googong Foreshores Strategic Bushfire Management Plan

The *Strategic Bushfire Management Plan 2007/8 to 2011/12 Googong Foreshores Nature Reserve* (BES 2007) addresses life and property protection, water quality, and biodiversity conservation within Googong Foreshores. With regard to protection of water

quality, a mosaic pattern of prescribed burning strategically located within the catchment is considered the most appropriate long term strategy. In addition, a Water Quality Protection Zone (WQPZ) consisting of a vegetated filter strip of at least 200 m from the high water mark is to be maintained around the reservoir and 50 m either side of main watercourses (which are mapped in the plan). The plan requires that the approval of ActewAGL be obtained prior to the use of backburning, wetting agents, foaming agents, retardant or earth moving machinery within the Water Quality Protection Zone. The plan requires that ActewAGL be advised when fire retardant foams and wetting agents are used anywhere in the Foreshores.

### 9.1.6 Management Objectives, Policies and Actions

**OBJECTIVE: FIRE MANAGEMENT**

- Fire is managed at Googong Foreshores so that water quality, biodiversity, built assets (water resource infrastructure, cultural heritage places, recreational and management facilities), life and property are protected both within the Foreshores and on neighbouring land.

**Policies**

- Bushfire management at Googong Foreshores will be undertaken in accordance with the *Strategic Bushfire Management Plan 2007/8 to 2011/12 Googong Foreshores Nature Reserve*.
- ACT agencies responsible for the management of Googong Foreshores will collaborate with the NSW Rural Fire Service for bushfire readiness and response in the Googong Foreshores area.
- Details of the agreed arrangements for bushfire readiness and response will be outlined in the annual Fire Action Plan prepared by the ACT Government.
- Bushfire prevention activities (fuel and access management) for Googong Foreshores will be outlined in the Bushfire Operational Plan prepared by the ACT Government for all land that it manages.

**Actions**

- Liaise with the NSW Rural Fire Service to establish agreed arrangements for bushfire readiness and response in the Googong Foreshores area.
- Include arrangements for bushfire readiness and response in the annual Fire Action Plan prepared by the ACT Government.
- Undertake the Works Program specified in the Googong Foreshores Strategic Bushfire Management Plan.
- Maintain the existing restrictions on lighting of fires in the Foreshores and closure on total fire ban days.
- Notify ActewAGL of planned fuel reduction burns so that specific water sampling may be undertaken to enhance understanding of the effects of fire on reservoir water quality.
- Assess the conservation requirements of the twelve Aboriginal cultural heritage sites at Googong Foreshores recorded by ERM Australia (2008a) (s. 7.3), in relation to bushfires and bushfire management. Include, where necessary, consideration of these sites in the Googong Foreshores Strategic Bushfire Management Plan.

## 9.2 Environmental Impact Assessment

In an area such as Googong Foreshores, with management akin to a reserve, it is appropriate that all works and significant policy decisions be subject to environmental assessment whether or not it is legislative requirement. It is preferable that environmental considerations be part of the early stages of project formulation (an environmental planning approach). It is also advantageous to address a number of planned projects collectively in order to determine cumulative impacts. Indirect and offsite impacts should also be considered. It is important to assess potential impacts as rigorously as knowledge and techniques allow to separate those are trivial, limited or inconsequential from those that are serious, irreversible and cumulative.

The primary legislation applicable to the Googong Dam Area in relation to environmental impact assessment is the *Environment Protection and Biodiversity Conservation Act 1999*. Under the EPBC Act, approval is required for actions that are likely to have a significant impact on:

- a matter of national environmental significance
- the environment of Commonwealth land (even if undertaken outside Commonwealth land)
- the environment anywhere in the world (if the action is undertaken by the Commonwealth).

Matters of national environmental significance currently applicable to Googong Foreshores are:

- threatened species and ecological communities listed under the Act
- migratory species protected under international agreements.

'Action' is defined broadly in the EPBC Act and includes: a project, a development, an undertaking, an activity or series of activities, or an alteration of any of these things. The EPBC Act uses a key threshold, that of likely 'significant impact' on listed matters of national environmental significance, to determine whether an action falls into the category of a 'controlled action'. Controlled actions require assessment and approval under the Act (s. 75(2)).

A 'significant impact' is defined in the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines. Matters of National Environmental Significance* (May 2006) (DEH 2006a) and the *EPBC Act Policy Statement 1.2 Significant Impact Guidelines. Actions on, or impacting on, Commonwealth land, and actions by Commonwealth agencies* (May 2006) (DEH 2006b), namely:

> A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

The Googong Lease (clause 4.2) specifies that the ACT will refer to the Commonwealth Environment Minister under the EPBC Act:

a) any request for a Commonwealth approval for the use of the Googong Dam Area for a purpose, other than the purposes specified in clause 4.1 of the Lease (these

uses being the collection, diversion, storage, conveyance, treatment and purification of water; the prevention of pollution of the water; and the existing type of recreational use at the date of the signing of the Lease)

b) any proposed action in relation to the Lease, including any enlargement, expansion or intensification of a Permitted Use, which may have an impact on the environment

other than a proposed action under a Permitted Use not referred to in paragraph (b). (Commonwealth of Australia 2008).

Requirements for environmental impact assessment for works or developments on land in New South Wales are contained in the *Environmental Planning and Assessment Act 1979* (NSW) and local environmental plans. Works include projects associated with capital works, grants funding, community projects and urgent works. No major works are currently proposed at Googong Foreshores. It is the ACT Government's practice to conduct an environmental impact evaluation of proposed works to identify if there is a need for fuller environmental assessment as required by relevant legislation.

**Note: No approvals are required under NSW law if the works are required for water supply purposes because such works are empowered under the Googong Dam Act, which is Commonwealth legislation and takes effect in precedence to New South Wales law. Should any works be proposed at Googong Foreshore that are not currently a Permitted Use and/or are likely to have a significant environmental impact, then legal advice should be sought as to the requirements for approval under the Commonwealth or New South Wales legislation.**

### 9.2.1 Carrying Out Works

The Googong Lease (section 8) provides for the ACT Government to carry out works at Googong Foreshores at its cost and in accordance with any environmental approvals and the Googong Dam Act. The ACT must, at the Commonwealth's request, provide confirmation that the necessary approvals are in place to undertake such work. Subject to clause 4.2 of the Lease (see s. 9.2 above), the Commonwealth authorises the ACT to sign and lodge any application for a development or environmental approval for any work (within the scope of the Permitted Uses (clause 4.1 of the Lease)) to be undertaken at the Foreshores that would otherwise be required to be signed by the Commonwealth.

Work is defined in the Lease (clause 8.1) to cover a wide range of architectural and engineering works including, but not limited to: construction of new buildings and refurbishment of existing ones; landscaping and earthworks; clearing of land; and demolition or destruction of improvements.

### 9.2.2 Management Objectives, Policies and Actions

**OBJECTIVE: ENVIRONMENTAL IMPACT ASSESSMENT**

- Assessment of potential environmental impact is conducted for all proposed works and developments in accordance with the requirements of the Googong Lease and applicable legislation, in particular the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).

**Policies**

- All proposed works and developments at Googong Foreshores will be assessed for their potential impact on the values of the Foreshores as defined in this management plan.
- All proposed works and developments will be assessed in accordance with the requirements of the Googong Lease and applicable legislation.
- ACTEW Corporation and/or ActewAGL will be consulted if there are potential reservoir water quality implications associated with any proposed works and developments, or if water quality implications need to be ascertained.

**Actions**

- Incorporate environmental considerations into the early stages of project formulation.
- Undertake assessment of the potential environmental impact of proposed works and developments in the Foreshores, including in relation to the EPBC Act.
- Carry out works in accordance with the requirements of the Googong Lease.
- Should any works be proposed at Googong Foreshore that are not currently a Permitted Use in the Googong Lease and/or are likely to have a significant environmental impact, seek legal advice as to the requirements for approval under Commonwealth or New South Wales legislation.

## 9.3 Management Operations

Maintenance of environmental quality, resource and energy conservation, public health and safety, and control of activities that have the potential to impact on the values of Googong Foreshores and on visitors are important considerations and functions for management.

**OBJECTIVE: MANAGEMENT OPERATIONS**

- Systems for operational management are designed and developed to best-practice standards to maintain the environmental quality of Tidbinbilla and to ensure the health and safety of visitors.

### 9.3.1 Environmental Policies

A range of government environmental policies and strategies (Appendix 3) potentially apply to the management of Googong Foreshores and, where relevant, these will be used to guide management decisions.

### 9.3.2 Water and Energy Use

Management of Googong Foreshores will aim to minimise greenhouse gas emissions, energy and water use in accordance with ACT Government policies and programs (ACT Government 2004a, 2007). Water and energy efficiency principles and technologies will be applied to the design and development of new buildings, park infrastructure, landscaping, and retrofitting of buildings, using energy and water rating schemes where feasible. The use of renewable energy sources for infrastructure will be evaluated.

### 9.3.3 Waste Management

Since the opening of Googong Foreshores for recreation in the early 1980s, it has been policy not to supply rubbish bins. Visitors are advised of this in signs and information material. This policy will be continued (see Table 5.2).

### 9.3.4 Chemicals and Hazardous Materials

The use of chemicals and hazardous materials at the Foreshores is considered in s. 4.4.6.

### 9.3.5 Fees and Charges

There is no entry fee to Googong Foreshores and no change to this policy is proposed. The ACT Government does not have a licensing and fees system for commercial tour operators at present. Should such a system be established in the future, its applicability to Googong Foreshores will be considered in relation to all the areas managed by the ACT Government and the pattern of commercial use. Any commercial tour operation would need to be assessed in terms of the recreational policies in this plan (Chapter 5) and the provisions of the Googong Lease that limit recreational use to the existing type present at the time of the signing of the lease (clause 4.1). A fee may be charged for ranger guided interpretation activities at the Foreshores.

### 9.3.6 Concessions and Commercial Activities

A concession is a right granted by way of a lease, licence or permit for occupation or use of part of an area to provide facilities or services (e.g. food vending) or to undertake particular commercial activities (e.g. film-making, guided fishing). There is little interest in, or need for, concessions at recreational access points in Googong Foreshores and the establishment of concessions will not be implemented. Occasional and temporary commercial activities may be allowed provided that:

- proposals are consistent with the current management requirements and do not adversely impact on Foreshore values
- such activities do not conflict with other Foreshores users
- organisers are prepared to pay a fee for the use of the area, if fees apply
- the activity is carried out in accordance with relevant legislation and government policies.

### 9.3.7 Firearms and Codes of Practice

Recreational use of firearms is not permitted at Googong Foreshores. Management staff or contractors occasionally use firearms for the control of pest animals and for kangaroo culling. It is management policy that the use of firearms at Googong Foreshores is prohibited except for management purposes. Use of firearms for these purposes will be in accordance with relevant legislation (the *Firearms Act 1996* (NSW)) and government policy (including codes of practice). With regard to kangaroos, New South Wales uses the national codes of practice for humane shooting, namely:

- *National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Commercial Purposes* (NRMMC 2008a)
- *National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Non-commercial Purposes* (NRMMC 2008b).

### 9.3.8 Resource Extraction

Resource extraction at Googong Foreshores will be limited to small-scale use of local materials where use of external materials is impracticable or undesirable (e.g. use of local soil or gravel material for benching walking tracks). The following activities are prohibited:

- timber cutting and firewood removal (note that wood is supplied at the only wood barbecue in the Foreshores (Downstream Picnic Area))
- taking rocks, gravel or soil

- excavation for archaeological research (except with a licence under the *National Parks and Wildlife Act 1974*)
- taking, killing, picking, defacing or otherwise disturbing natural or cultural features except:
  - taking fish from the reservoir in accordance with NSW fishing regulations
  - by Aboriginal people for cultural purposes (if agreed protocols are established)
  - for authorised purposes under NSW legislation (e.g. for research)
- beekeeping.

### 9.3.9 Domestic Animals

Domestic animals are not allowed in Googong Foreshores, except for guide dogs (see Table 5.1).

### 9.3.10 Training Exercises

Australian, New South Wales and ACT Government agencies (e.g. emergency services authorities, Australian Defence Force, Australian Federal Police) may, from time to time, use the Foreshores for training purposes. Such activities should only be undertaken when they do not impact in any significant way on the values of the Foreshores as defined in this management plan. Arrangements need to be made for such activities with the ACT Government managers of the Foreshores and ActewAGL. A protocol may be the appropriate way to establish an ongoing arrangement between the ACT Government/ActewAGL and an agency that seeks to use the Foreshores on a regular basis e.g. annually or more frequently.

## 9.4 Delegations

As outlined in s. 1.4.3, ACT Government employees who manage Googong Foreshores administer the provisions of relevant NSW legislation but without enforcement powers. Enforcement of New South Wales legislation can only be carried out by NSW authorities. It is likely that use pressures will increase on Googong and it may become desirable or necessary that ACT staff are properly authorised to enforce some NSW laws.

**Policies**

- The legal means to enforce New South Wales legislation at Googong Foreshores, such as delegations to ACT management staff, will be investigated should this be warranted.

# Chapter 10 Implementation

## 10.1 Implementation

Management policies and actions outlined in this management plan provide the basis for its implementation; primary responsibility for which rests with ACT Government managers. The plan has also identified where consultation is required with ACTEW/ActewAGL and NSW agencies e.g. NSW Department of Primary Industries, NSW Rural Fire Service. Table 10.1 contains the actions listed in Chapters 4 to 10 of the plan to which priorities have been attached.

## 10.2 Community Involvement

The primary purpose of the Googong Dam Area is to provide high quality raw water for potable water supply. Local community groups are welcome to participate in the management of the area, but their role will be different to catchments where rural and other landholders are the main occupants of the catchment. Catchment groups potentially play a significant role in the management of the larger Googong Catchment outside the Foreshores. Other roles for community groups are: (a) the provision of information that can be used in interpretive material e.g. the assistance of the Canberra Ornithologists Group and Friends of Googong in preparing the Googong Bird List; and (b) the carrying out of on-ground conservation activities such as track maintenance, weed removal and bush regeneration projects.

A range of community groups are involved with catchment protection and other environmental management activities in the upper Murrumbidgee River Catchment (s. 2.5.2). Catchment groups supported by state and territory governments provide the means to link with national funding programs. The Molonglo Catchment Group is the umbrella planning and coordination body for the Googong Catchment supporting local groups: the Burra Creek Landcare Group, Friends of Googong Parkcare, Queanbeyan Landcare Group (see<http://molonglocatchment.com.au>).

### 10.2.1 Management Objectives, Policies and Actions

**OBJECTIVE: COMMUNITY INVOLVEMENT**

- Community groups participate in the conservation of the values of Googong Foreshores.

**Policies**

- Community involvement in the conservation of the values of Googong Foreshores will be encouraged.

**Actions**

- Identify opportunities for, and encourage community involvement in the conservation of the values of Googong Foreshores.

**Table 10.1 Management actions and priorities**
(Priority: H–high; M–medium; L–low; O–ongoing)

**Notes for the following table:**

**Priority**
(High, Medium, Low) is used in two ways in this table:
1. For some actions, it indicates the priority that should be given to *undertaking and completing* the action. (for example, a High priority action of this type should be undertaken early in the life of the management plan);

2. For many actions it indicates the priority that should be given to an action *that will remain current across the life of the plan* (in the context of all management activities). These are generally shown as Ongoing.

**Time scales for actions**
As a guide the following time scales are appropriate for actions in category 1:
**High**: Undertaken/completed within one/two years of completion of this plan.
**Medium**: Undertaken/completed within three/four years of completion of this plan.
**Low**: Undertaken/completed within five years of completion of this plan.

| Chapter/ Section | Actions | Priority |
|---|---|---|
| **Chapter 4** | **Water Resources** | |
| **Micro-organisms s. 4.4.3** | **(a) Toilet Facilities**<br>• Investigate the septic tanks in Googong Foreshores to determine whether these represent a significant risk to human health and the environment (ACT Government and ActewAGL).<br>• Evaluate the costs and benefits of a staged replacement of septic tanks with concrete tanks that are periodically pumped out, with the contents processed through an off-site sewage facility.<br>**(b) Recreation**<br>Manage recreational use of Googong Foreshores to minimise impact on microbiological water quality, in particular by:<br>• prohibiting body contact recreation in the reservoir (swimming, windsurfing, water skiing)<br>• prohibiting other recreational activity that has the potential to adversely affect water quality (Table 5.1)<br>• providing advisory signs for recreational users on the importance of avoiding body contact with reservoir water and the need for good | H<br>M<br>HO |

| Chapter/ Section | Actions | Priority |
|---|---|---|
| | hygiene<br>• providing adequate toilet facilities that are regularly monitored and maintained<br>• prohibiting pets and horse riding<br>• involving community groups, where appropriate, in management activities in the Foreshores aimed at protection of water quality.<br>**(c) Stock Grazing**<br>Manage stock grazing at Googong Foreshores to minimise impact on microbiological water quality, in particular by:<br>• restricting use of stock grazing to the minimum necessary for fire fuel reduction in grassland and for weed control and to areas outside an appropriate buffer from the reservoir<br>• requiring stock to be more than two years old<br>• exclusion of stock from ephemeral and permanent streams and drainage lines by fencing and the provision of off-stream watering<br>• removal of stock as soon as fire fuel reduction or weed management objectives have been achieved<br>• ensuring vegetation cover is not compromised by stock grazing<br>• maintaining boundary fencing of the Foreshores to prevent stock access from neighbouring properties<br>• liaison with properties bordering the Foreshores for removal of stray stock.<br>**(d) Grazing by native and feral animals**<br>Control populations of native and feral animals at Googong Foreshores to minimise direct and indirect impacts on microbiological water quality, by:<br>• managing kangaroo densities (see s. 6.7)<br>• undertaking feral animal control using the most effective current approaches that are also suitable for use in a water catchment. | HO<br><br>HO |
| **Turbidity and Suspended Solids s. 4.4.4** | • Manage stock grazing and populations of native and feral animals to limit loss of ground cover and soil disturbance, and consequent erosion and transport of material to the reservoir.<br>• Restrict recreational activities in the steep Eastern Foreshores area (Zone 1B) and areas with low vegetation cover to limit erosion potential (see also Chapter 5).<br>• Undertake stabilisation and erosion control measures in areas of the Foreshores that show evidence of erosion developing.<br>• Where feasible, direct and filter runoff from bare areas (e.g. vehicle and walking tracks) to detain sediments that might otherwise flow to the reservoir.<br>• Aim to maintain 90 per cent ground cover for 12 months of the year in non-forested areas of the Foreshores (excluding areas of skeletal soils and bedrock exposure). | HO<br><br>MO<br><br>MO<br>MO<br><br>HO |
| **Excess Nutrients (Phosphorus and** | • Manage stock grazing and populations of native and feral animals to limit erosion and transport of nutrients (soil phosphorus and nutrients in faecal material) to Googong Reservoir.<br>• Document and investigate instances of excessive algal growth in the reservoir, with the aim of identifying nutrient sources. If there is evidence of sources within the Foreshores, undertake remedial action where this can be defined and is practicable. For nutrients | HO<br><br>MO |

| Chapter/ Section | Actions | Priority |
|---|---|---|
| **Nitrogen) s. 4.4.5** | suspected to have originated outside of the Foreshores, liaise with ActewAGL, NSW Government agencies and local government regarding potential sources and corrective measures.<br>• Monitor and maintain toilet facilities in the Foreshores to ensure that there is no leakage of nutrients to the catchment. | <br>HO |
| **Chemicals and Hazardous Materials s. 4.4.6** | • As far as practicable, only use chemicals outside an appropriate buffer distance from the reservoir and away from catchment drainage lines. Use of chemicals for weed control in riparian and shoreline areas (e.g. blackberry control) will be carried out at times when water is not being extracted from the reservoir.<br>• Minimise chemical usage by application of Integrated Pest Management techniques, and select chemicals and application methods that will have least environmental impact, including impact on reservoir water.<br>• Use only chemicals that have been approved for use in water catchments.<br>• Establish protocols for advising ActewAGL when pesticides are in use, as well as reporting protocols for accidental spills.<br>• Manage the use, handling, transport and storage of chemicals in accordance with industry best practice, relevant NSW legislation, and ACT Government procedures and protocols.<br>• Ensure that all Googong staff are trained in the safe use of chemicals, including emergency management procedures.<br>• Identify, remove or replace any scheduled ozone depleting substances held at the Foreshores.<br>• Water Treatment Plant – underground fuel storage tanks (Actew AGL):<br>o Immediate cessation of use of Tank 1; removal of contents; removal of tank and associated fuel lines; remediation of adjacent contaminated soil. Any contaminated perched groundwater that is encountered in the excavations of remediated soil should be collected for off-site disposal.<br>o Unless there is a clear reason to retain, remove Tank 2.<br>o Undertake groundwater investigations to determine whether there is an actual or potential significant risk of harm, and evaluate the need for groundwater remediation at this location.<br>• Water Treatment Plant – sludge drying bed discharge point and clarifier tank discharge point (ActewAGL):<br>o Determine and advise the Commonwealth and ACT governments regarding possible actions to minimise the discharge of aluminium and zinc into the environment.<br>• Ranger Station – underground fuel storage tanks (ACT Government):<br>o Immediate cessation of use of Tank 3; removal of contents; removal of tank and associated fuel lines; remediation of adjacent contaminated soil. Any contaminated perched groundwater that is encountered in the excavations of remediated soil should be collected for off-site disposal.<br>o Unless there is a clear reason to retain, remove Tank 4.<br>o Undertake groundwater investigations to determine whether there is an actual or potential significant risk of harm, and evaluate the need for groundwater remediation at this location.<br>• Ranger Station – other areas (ACT Government): | MO<br>MO<br>MO<br>MO<br>MO<br>MO<br>H<br>H<br>H<br>H<br>H |

| Chapter/ Section | Actions | Priority |
|---|---|---|
| | ○ Undertake an audit and prepare a hazardous substances register for dangerous goods and hazardous building materials.<br>• London Bridge Woolshed – sheep dip (ACT Government):<br>○ Manage the sheep dip area to minimise exposure of visitors to the arsenic contaminated soils.<br>○ Prior to any redevelopment or disturbance at the site, undertake further investigation to assess the extent and degree of contamination, to guide the management of any contaminated soils that would be disturbed by the development.<br>• Buried Former Homesteads (ACT Government):<br>○ Prepare a site management plan to manage areas that may contain buried former homesteads at the southern end of the Foreshores, including homesteads at London Bridge and Tin Hut, and other demolished buildings along the Burra Road.<br>○ Ensure these areas are investigated prior to any excavation or other earth-moving activities. | MO<br><br><br><br>M |
| **Chapter 5 Recreation** | | |
| **Recreational Activities s. 5.4.1** | See Table 5.2. The actions/strategies in Table 5.2 are ongoing and mostly already established (and are of Low to Medium priority). Information requirements for fishing, and boating safety are ongoing but High priority. A warning sign for the Cascades included in this table is also listed under the actions for s. 5.4.4. | |
| **Recreational Facilities s. 5.4.2** | • Assess the likely impact on water quality in Googong Reservoir arising from upgrades or changes to existing facilities.<br>• Maintain all visitor facilities to a high standard, including visitor information.<br>• Provide appropriate access and facilities for visitors with disabilities (this may not be practicable in all areas). | HO<br>HO<br>MO |
| **Recreational Impacts s. 5.4.3** | • Manage recreational activities to minimise (a) the risk of body contact with reservoir water (see s. 5.4.1 and s. 5.4.2 above) and (b) the potential for erosion and transport of sediments to the reservoir<br>• Provide information about appropriate behaviour (including good hygiene practices) to protect water quality.<br>• Manage recreational activities to minimise impact on natural and cultural values by controlling access, educating visitors, providing protection measures, and monitoring. | HO<br><br>MO<br>MO |
| **Visitor Safety s. 5.4.4** | • Provide information in brochures, signs and at the Ranger Station on boating safety (repeat of Action in Table 5.2).<br>• Install a warning sign that jumping and diving from rocks at the Cascades is discouraged, and the hazards of changes in flow (repeat of Action in Table 5.2).<br>• Maintain limitations on lighting fires (only in barbecues provided), the prohibition on use of barbecues when there is a very high or extreme fire danger, and closure of the Foreshores on total fire ban days (s. 9.1.5).<br>• Provide appropriate advice (e.g. warning signs) if undertaking pest animal baiting or other activities using chemicals.<br>• Provide contact/emergency contact phone numbers on signs and other information material. | HO<br>H<br><br>HO<br><br>HO<br>HO |
| **Chapter 6 Natural Heritage** | | |
| **Biodiversity and** | • Implement the natural heritage strategies in the *Googong Foreshores: Heritage Management Plan*. These strategies provide a five-year and ongoing management program including (sections refer to this management plan): | For priority, |

| Chapter/ Section | Actions | Priority |
|---|---|---|
| **Geodiversity s. 6.2** | ○ cooperation with adjacent land managers to achieve consistent and complementary land management (s. 6.3)<br>○ weed management (s. 6.6.1)<br>○ pest animal management (s. 6.6.2)<br>○ kangaroo management (s. 6.7)<br>○ bushfire management (s. 9.1)<br>○ conservation of ecological communities, flora and fauna (s. 6.4, s. 6.5)<br>○ maintenance of catchment vegetation cover (s. 4.4)<br>○ control of recreational use (s. 5.4). | see actions in indicated sections. |
| **Habitats and Regional Significance s. 6.3** | • Communicate to relevant private and government organisations the importance of Googong Foreshores to regional ecological connectivity, in relation to environmental planning, development control and specific development proposals adjacent to the Foreshores.<br>• Work with the NSW Department of Environment, Climate Change and Water and other NSW government agencies to achieve consistent and complementary management of adjoining or nearby natural areas.<br>• Identify threats to habitat and connectivity in Googong Foreshores and take actions to control, reduce or eliminate threats.<br>• Identify opportunities to improve habitat and connectivity in the management of Googong Foreshores and, where practicable, undertake appropriate management actions. | MO<br>MO<br>MO<br>MO |
| **Flora– Management Objectives, Policy and Actions s. 6.4.3** | • Prepare and maintain (through survey, monitoring and mapping) a comprehensive inventory and classification of vegetation communities and component species at Googong Foreshores.<br>• Undertake appropriate management to ensure that ecological communities and populations of threatened and uncommon plant species are conserved and protected from threatening activities (e.g. tree planting in natural temperate grasslands) or accidental damage.<br>• Prepare a vegetation management plan with detailed management guidelines, as required, for vegetation communities and component species, in particular threatened and uncommon species.<br>• As part of the vegetation management plan, review existing plantings and forward programs for tree planting to ensure that there are no adverse impacts on natural temperate grassland areas of high conservation value.<br>• Where practicable, undertake rehabilitation2 activities for particular vegetation communities or areas of the Foreshores.<br>• Provide interpretive material on Foreshores vegetation for visitors. | MO<br>HO<br>H<br>H<br>MO<br>MO |
| **Fauna– Management Objectives, Policy and Actions s. 6.5.2** | • Prepare a comprehensive inventory of the fauna of Googong Foreshores.<br>• Management the habitat of threatened and uncommon animal species to protect them from threatening activities or accidental damage.<br>• Where practicable, undertake habitat rehabilitation activities to improve the status, distribution and abundance of threatened animal populations.<br>• Prepare management guidelines for species that are declared threatened or are of conservation concern, in accordance with recovery plans and other relevant material. | MO<br>HO<br>MO<br>MO |

| Chapter/ Section | Actions | Priority |
|---|---|---|
| | • Encourage and support survey, monitoring and research into animal species and populations.<br>• Undertake feral animal control (see s. 6.6).<br>• Provide interpretive material on Foreshores fauna for visitors. | MO<br>HO<br>MO |
| **Pest Plants s. 6.6.1** | • Design and undertake management programs for pest plants in accordance with relevant legislation and strategies, weed control priorities, and in co-operation with adjacent land managers.<br>• Undertake coordinated control of St John's Wort with the NSW Department of Environment, Climate Change and Water.<br>• Maintain and/or instigate hygiene measures to minimise the introduction and spread of weed species in management of the Foreshores. Measures include:<br>o washing vehicles and machinery<br>o minimising soil disturbance<br>o avoiding the import of material (e.g. soil, mulch) that is likely to contain weed seeds<br>o educating visitors about the potential to import and spread weed species, including aquatic weeds. | HO<br>MO<br>HO |
| **Pest Animals s. 6.6.2** | • Design and undertake management programs for pest animals in accordance with relevant legislation and strategies, pest animal control priorities, and in co-operation with adjacent land managers.<br>• Continue the successful rabbit control program to reduce grazing pressure to acceptable levels. | HO<br>HO |
| **Kangaroos s. 6.7.4** | • Continue and develop, as required, a scientifically based monitoring program for herbivores (focused on kangaroos and rabbits) and lowland grassy ecosystems with appropriate analysis and recording of results.<br>• Take a proactive approach to kangaroo management, so that densities do not increase in favourable seasons to levels that are unsustainable and impact on catchment and grassy ecosystem condition.<br>• Manage the kangaroo population with the aim of achieving grassland conservation densities, which on current knowledge are densities of less that 1.5 kangaroos per hectare in grassy ecosystems.<br>• Where culling of kangaroos is required, undertake a culling program in accordance with the policies outlined in the ACT Kangaroo Management Plan.<br>• In preparing any culling program, consult with ActewAGL and arrange for carcass disposal that does not have potential impacts on reservoir water quality<br>• Explain management policies and actions for kangaroos in information to the public, especially where interventions are required.<br>• As part of the vegetation management plan for Googong Foreshores, evaluate, and if desirable and feasible, undertake programs to increase tree and shrub cover, where this does not impact on areas of natural temperate grassland. | HO<br>MO<br>HO<br>MO<br>H<br>MO<br>LO |
| **Chapter 7 Cultural Heritage** | | |
| **Aboriginal Cultural** | • Implement the Aboriginal heritage strategies in the *Googong Foreshores: Heritage Management Plan*. These strategies provide a five-year and ongoing management program including:<br>o formal recognition of Aboriginal heritage values and Aboriginal heritage sites | MO–HO |

| Chapter/ Section | Actions | Priority |
|---|---|---|
| **Heritage s. 7.3.1** | ○ involvement of the local Aboriginal community in decisions involving their heritage sites<br>○ formal recognition of the value of an Aboriginal heritage ranger position<br>○ a recording system for Aboriginal heritage sites<br>○ monitoring of Aboriginal heritage sites<br>○ management of potential impacts on Aboriginal heritage sites<br>○ salvage and/or excavation and radiocarbon dating of sites exposed by low reservoir water levels<br>○ consideration of 'salvage' of sites of diminished condition and integrity that could be further impacted by visitor use. | |
| **European Cultural Heritage s. 7.4.1** | • Implement the European heritage strategies in the *Googong Foreshores: Heritage Management Plan* including a five-year and ongoing restoration and maintenance schedule for the London Bridge Homestead group.<br>• Ensure that all works proposed for Googong Foreshores fulfil legislative requirements related to heritage protection.<br>• Maintain the practice of having 'open days' for London Bridge Homestead, subject to the consideration of public safety and requirements for the conservation of the physical fabric of the place. | MO–HO |
| **Chapter 8** | **Education and Research** | |
| | • Provide interpretive and educational materials to support educational activities at the Foreshores, including materials that:<br>○ assist in an understanding of water supply issues (e.g. water quality)<br>○ support nature study<br>○ assist in interpreting European and Aboriginal cultural heritage.<br>• Encourage survey, monitoring and research activities at the Foreshores, particularly related to water supply, catchment management, natural and cultural heritage, and protected area management.<br>• Maintain a repository of educational materials and information relating to the Foreshores, including the results of research projects. | MO<br><br>MO<br><br>MO |
| **Chapter 9** | **Environmental Planning, Protection and Management** | |
| **Fire Management: Objective, Policies and Actions s. 9.1.6** | • Liaise with the NSW Rural Fire Service to establish agreed arrangements for bushfire readiness and response in the Googong Foreshores area.<br>• Include arrangements for bushfire readiness and response in the annual Fire Action Plan prepared by the ACT Government.<br>• Undertake the Works Program specified in the Googong Foreshores Strategic Bushfire Management Plan.<br>• Maintain the existing restrictions on lighting of fires in the foreshores and closure on total fire ban days.<br>• Notify ActewAGL of planned fuel reduction burns so that specific water sampling may be undertaken to enhance understanding of the effects of fire on reservoir water quality.<br>• Assess the conservation requirements of the twelve Aboriginal cultural heritage sites at Googong Foreshores recorded by ERM Australia (2008a) (s. 7.3), in relation to bushfires and bushfire management. Include, where necessary, consideration of these sites in the Googong Foreshores Strategic Bushfire Management Plan. | H<br><br>HO<br>HO<br>HO<br>MO<br><br>H |
| **Environ-** | • Incorporate environmental considerations into the early stages of project formulation. | HO |

| Chapter/ Section | Actions | Priority |
|---|---|---|
| **mental Impact Assessment s. 9.2** | • Undertake assessment of the potential environmental impact of proposed works and developments in the Foreshores, including in relation to the EPBC Act.<br>• Carry out works in accordance with the requirements of the Googong Lease.<br>• Should any works be proposed at Googong Foreshore that are not currently a Permitted Use in the Googong Lease and/or are likely to have a significant environmental impact, seek legal advice as to the requirements for approval under Commonwealth or New South Wales legislation. | HO<br>HO<br>HO |
| **Chapter 10 Implementation** | | |
| **Community Involvement s. 10.2.1** | • Identify opportunities for, and encourage community involvement in the conservation of the values of Googong Foreshores. | MO |

# APPENDIX 1

## Land and Conservation Management Plan

### Section 5.2 of the Lease between The Commonwealth of Australia and The Australian Capital Territory (2008)

The Land and Conservation Management Plan must include the measures to apply during the Term for the protection, management, maintenance, refurbishment and repair of the Premises in relation to the following matters, including such measures consistent with applicable New South Wales and Commonwealth laws, and which are sufficient to satisfy the Commonwealth's obligations as landowner in respect of the Premises under the Commonwealth Environment and Heritage Legislation:

- land use in relation to the dam, water supply, buildings, fencing, plant, equipment and storage, and the activities of other Territory agencies on the Premises
- the prevention of pollution on the Land, and the management of water quality
- land conservation and erosion management
- contamination and management of hazardous materials, including a site hazardous materials register covering all buildings occupied by, and dangerous goods stored by the ACT, an ACT Entity and any sub-lessee of the ACT or a contractor of any of those persons
- environmentally sustainable development of the Land, including energy efficiency, water efficiency and waste minimisation
- recreational use
- control, monitoring and management of native plants and animals (including threatened species, ecological communities and biodiversity) and over abundant species, noxious weeds, and feral animals
- fire risk and mitigation strategies.

# APPENDIX 2

## Permitted Use of the Googong Dam Area

### Section 4.1 of the Lease between The Commonwealth of Australia and The Australian Capital Territory (2008)

During the Term the Premises must only be used for any of:

- the collection, diversion and storage of water on the Land
- the conveyance and supply of water from the Land for the use in the Australian Capital Territory or in a place that is the subject of an agreement under subsection 12(2) of the Googong Dam Act for the conveyance and supply of water
- the treatment and purification of water supplied or to be supplied from the Land
- the prevention of the pollution of water supplied or to be supplied from the Land
- the existing type of recreational use occurring on the Land as at the Commencing Date
- any other purpose approved in writing by the Commonwealth, such approval not to be unreasonably withheld or delayed.

# APPENDIX 3

## Selected Policies, Plans, Strategies and Guidelines Relevant to the Management of the Googong Foreshores

(Note: Many of these documents (especially guidelines) are subject to periodic revision and the latest version should be sought. ACT Government publications may be accessed through the ACT Government entry portal <www.act.gov.au> and environmental publications and information through <www.tams.act.gov.au>.)

**Commonwealth**

- *The National Strategy for Ecologically Sustainable Development* (Commonwealth of Australia 1992)
- *The National Strategy for the Conservation of Australia's Biological Diversity* (ANZECC 1996). Under revision:
  *Australia's Biodiversity Conservation Strategy 2010–2020. Consultation Draft* (National Biodiversity Strategy Review Task Group 2009)
- *The National Framework for the Management and Monitoring of Australia's Native Vegetation* (ANZECC 1999)
- *Australian Weed Strategy* <http://www.weeds.org.au/nws.htm>
- *Caring for our Country* <http://www.nrm.gov.au>
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000)
  <http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality>
- Recovery plans for species and ecological communities listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*
- National Environment Protection Measures (NEPMs)
  <http://www.ephc.gov.au/nepms>
- *Australian Natural Heritage Charter for the conservation of places of natural heritage significance.* 2nd Edition (Australian Heritage Commission 2002)
- *Protecting Local Heritage Places: A guide for local communities* (Australian Heritage Commission 2000)
- *Ask First: A guide to respecting Indigenous heritage places and values* (Australian Heritage Commission 2002)

**New South Wales**

- *NSW Biodiversity Strategy* (NSW National Parks and Wildlife Service 1999)
- *Murrumbidgee Catchment Action Plan* (Murrumbidgee Catchment Management Authority)
  <http://murrumbidgee.cma.nsw.gov.au/catchment-action-plan/4-catchment-action-plan.html>
- *Biodiversity Planning Guide for NSW Local Government. Edition 1* (NSW National Parks and Wildlife Service 2001)
  <http://www.environment.gov.au/biodiversity/toolbox/templates/nsw-bio-plan-guide.html>

- *NSW Water Quality and River Flow Objectives – helping to consider community values for water quality in decision making* <http://www.environment.nsw.gov.au/ieo/>
- *Planning Framework for Natural Ecosystems of the ACT and NSW Southern Tablelands* (Fallding 2002)
- Recovery plans for species and ecological communities listed as threatened under NSW threatened species legislation (see s. 1.4.3 above)

**Local Government**

- *Yarrowlumla Local Environmental Plan 2002*
  (The former Yarrowlumla Shire has been incorporated into Palerang Council, which is preparing a new Local Environmental Plan. See < http://www.palerang.nsw.gov.au >)
- *Queanbeyan Local Environmental Plan 1998* and *Queanbeyan Local Environmental Plan (Googong) 2009*
  (Queanbeyan City Council. See <http://www.qcc.nsw.gov.au>)

**ACT**

- *Environmental Flow Guidelines 2006* (ACT Government 2006)
  (Specify environmental flows immediately downstream of Googong Dam)
- *Fish Stocking Plan for the Australian Capital Territory2009–2014* (ACT Government 2009)
  (Includes stocking of Googong Reservoir)
- *Think water, act water* (ACT Government 2004)
- *Integrated Catchment Management (ICM) Framework for the ACT* (ACT Government 2000)
- *ACT and Sub-Region Planning Strategy* (ACT and Sub-Region Planning Committee 1998)
- *Woodlands for Wildlife: ACT Lowland Woodland Conservation Strategy* (ACT Government 2004)
- *A Vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy* (ACT Government 2005)
- *Ribbons of Life: ACT Aquatic Species and Riparian Zone Conservation Strategy* (ACT Government 2007)
- *Weathering the Change – The ACT Climate Change Strategy 2007–2025* (ACT Government 2007)
- *ACT Kangaroo Management Plan* (ACT Government 2010)

**Non-government**

- *Australia ICOMOS Burra Charter, 1999* (Australia ICOMOS) <http://www.icomos.org/australia/>
- 2004 *Australian Drinking Water Guidelines* (NHMRC) <http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm>

# APPENDIX 4a

## Risk Management Framework for Managing Water Quality Impacts within Googong Foreshores

| Risk | Cause | Risk level | Critical limit (for water safety) | Management targets | Controls | Monitoring | Verification | Corrective Actions (i.e. if monitoring shows controls are not managing risk) | Relates to Section in the Management Plan |
|---|---|---|---|---|---|---|---|---|---|
| **1.** Direct microbiological contamination of reservoir from human sources | Human activities in reservoir water body (e.g. through swimming, boating, fishing) | Very high | Pathogens / microbial indicators in reservoir are maintained below raw water standards | Manage recreation to ensure no body contact with reservoir water occurs, therefore minimising impact of humans on microbiological water quality | • Prohibit body contact recreation in reservoir e.g. swimming, wind surfing<br>• Prevent body contact from boating activities<br>• Implement recreation policy through active education and signs | Assess illegal swimming/ entering water during boating activity frequency/ numbers | Verification with ActewAGL water quality data and exceedance reporting | • Additional toilets<br>• Monitor boating numbers<br>• Limit increased boating or increase supervision of increased boating<br>• Implement boating permit system<br>• Restrict boating to southern end of reservoir (greatest distance from water intake)<br>• Initiate procedures to identify foreshore versus catchment sources of pathogens | • Ch. 4 Water Resources<br>• Ch.5 Recreation |
| **2.** Direct microbiological contamination of reservoir from stock | High stock numbers, incompatible stock age classes or combination of rainfall event and use of stock within Foreshores | High | Pathogens / microbial indicators in reservoir are maintained below raw water standards | Manage stock grazing to minimise impact on microbiological water quality | • Limit stock numbers in foreshore area to minimal level required for weed control and fuel reduction<br>• Manage fences to prevent wandering stock<br>• Limit access of inappropriate stock age classes<br>• Restrict use of stock grazing for fuel / weed reduction to areas outside acceptable buffer from reservoir | • Monitor ground cover in areas where stock are used for fuel reduction<br>• Regularly check fences<br>• Undertake event based monitoring | Verification with ActewAGL water quality data and exceedance reporting | • Assess grazing management regime<br>• Find alternative methods of fuel and weed management | • Ch. 4 Water Resources<br>• Ch 6 Natural Values |

| Risk | Cause | Risk level | Critical limit (for water safety) | Management targets | Controls | Monitoring | Verification | Corrective Actions (i.e. if monitoring shows controls are not managing risk) | Relates to Section in Management Plan |
|---|---|---|---|---|---|---|---|---|---|
| **3.** Indirect microbiological contamination of reservoir from human sources e.g. toilets, organic litter, fishing bait | Activities in Foreshores, particularly in areas where there are no toilet and waste facilities (Note: rubbish bins are not provided) | High | Pathogens / microbial indicators in reservoir are maintained below raw water standards | Manage recreational activities and facilities to minimise impact of humans on microbiological water quality | • Regular monitoring and checking of toilet facilities<br>• Education of public, particularly fishers<br>• Effective waste and litter management program<br>• Signs advising that no rubbish bins are provided and visitors are to take rubbish with them when they leave | • Visual assessment of litter<br>• Microbial indicators through water quality monitoring program | Verification with ActewAGL water quality data and exceedance reporting | • Consider limiting walks to short circuits that can be undertaken within a few hours<br>• Reassess education program<br>• Initiate procedures to identify foreshore versus catchment sources of pathogens<br>• Review signs regarding rubbish removal | • Ch. 4 Water Resources<br>• Ch.5 Recreation |
| **4.** Turbidity and nutrient levels reaching potentially unsafe levels or exceeding treatment capability | • Recreation activities (e.g. walking, bicycling) leading to increased erosion | Low | Suspended solids, turbidity and nutrient levels in reservoir are maintained below raw water standards | Manage recreational impacts to achieve a nil impact on reservoir water quality | • Encourage active recreation only in the western part of the foreshore area<br>• Minimise erosion potential from walking and other tracks by appropriate maintenance<br>• Maintain appropriate signs and education program<br>• Restrict activity in erosion prone areas | • Regular assessment of erosion caused by recreational activities (visual)<br>• Visitor use assessment | Verification with ActewAGL water quality data and exceedance reporting | • Restrict recreational access/use resulting in erosion<br>• Close/realign/harden recreational access where significant erosion is occurring<br>• Reassess education program<br>• Initiate procedures to identify foreshore versus catchment sources of turbidity | • Ch. 4 Water Resources<br>• Ch.5 Recreation |

| Risk | Cause | Risk level | Critical limit (for water safety) | Management targets | Controls | Monitoring | Verification | Corrective Actions (i.e. if monitoring shows controls are not managing risk) | Relates to Section in Management Plan |
|---|---|---|---|---|---|---|---|---|---|
| **5.** Turbidity and nutrient levels reaching potentially unsafe levels or exceeding treatment capability | High wildlife or pest numbers reducing ground cover and exacerbating erosion | High | Turbidity measure (NTU) of 5 or less | Manage impacts of wildlife to minimise impact on reservoir water quality | • Proactive management of kangaroo densities<br>• Control rabbit populations<br>• Aim to maintain grassland biomass at levels that ensure a variable structure and at least 90% ground cover | • Monitoring of biomass and total herbivore grazing pressure<br>• Monitoring of kangaroo and rabbit densities | Verification with ActewAGL water quality data and exceedance reporting | • Evaluate long-term vegetation strategies aimed at reducing suitable kangaroo habitat<br>• Review herbivore management programs | • Ch. 4 Water Resources<br>• Ch 6 Natural Values |
| **6.** Spills or illegal discharges of hazardous chemicals entering reservoir | Accidental or intentional misuse of hazardous chemicals | Moder-ate | Concentrations of hazardous chemicals in reservoir are maintained below raw water standards | • Manage chemical use and storage to achieve nil impact on reservoir water quality<br>• Manage illegal or accidental discharges to reservoir according to best practice principles | • Use of approved water catchment chemicals<br>• No use of chemicals within appropriate buffer distance from reservoir<br>• Manage use, handling, transport and storage of chemicals in foreshore area in accordance with industry best practice, NSW legislation, ACT procedures and protocols<br>• Appropriate training and education of staff<br>• No petroleum powered boats permitted in reservoir except as required for management, water supply, emergency purposes<br>• Manage illegal entry and security risks | • Regular checks of chemical storage facilities<br>• Staff training reviews<br>• Emergency manage-ment plan<br>• Local community reporting and vigilance | Verification with ActewAGL water quality data and exceedance reporting | • Reassess methods for use, handling, transport and storage of chemicals<br>• Reassess emergency management plan | • Ch. 4 Water Resources |

# APPENDIX 4b

## Using the Risk Management Framework

The **Risk** is the risk to water quality for domestic purposes. The **Cause** is the potential cause of the risk occurring. **Risk Level** is determined by consideration of the severity of the risk and the likelihood of the risk occurring. **Critical Limits** are based on the requirements for water quality for domestic purposes as outlined in the ACT Environment Protection Regulation 2005 and ActewAGL standards for raw water. These are monitored by ActewAGL as part of their business of providing potable water.

The **Management Targets** are the targets that the ACT Government will meet that should have a positive influence on meeting the **Critical Limits**. There needs to be a strong feedback link between information on how well specifications under the **Critical Limits** are being met and the **Management Targets** (described below). **Controls** are the actions that are to be undertaken to achieve the **Management Targets**. **Monitoring** should assess how well **Management Targets** are being met.

Meeting **Management Targets** is the responsibility of the ACT Government and there are **Critical Limits** that should not be exceeded for purposes of safe water supply. ActewAGL carry out extensive monitoring of parameters related to these **Critical Limits**. **Verification** provides the feedback loop between **Critical Limits** and **Management Targets**.

**Verification** is necessary to ensure that **Management Targets** are contributing towards keeping water quality parameters within **Critical Limits**, and that management targets continue to be appropriate for meeting the requirements of the **Critical Limits**. Where there is evidence that this is not the case, the approach must be redefined and **Corrective Actions** may be utilised.

Exceedance reporting will be the main mechanism employed in verification. It is proposed that ActewAGL will advise ACT Government staff if any significant trends become apparent in monitoring of parameters related to the **Critical Limits** or if any other significant issues arise. The relationship between management targets and critical limits should be assessed based on this information. This means that as well as monitoring if the **Management Targets** are being met, it is necessary for the ACT Government to assess whether the management targets are addressing requirements for **Critical Limits** (noting, however, that the Googong Foreshores represent only 6% of the catchment area).

# Glossary and Abbreviations

## ABBREVIATIONS

GL = gigalitre (1 000 000 000 litres or 1000 megalitres)

## GLOSSARY

### Biodiversity

*Biodiversity* (biological diversity) is the variety of all life forms (plants, animals, microorganisms, their genes) and the ecosystems of which they form a part (Commonwealth of Australia 1996).

### Connectivity

Habitat *connectivity* is the degree to which an organism can move around the landscape due to the presence of suitable habitat. For fauna, connectivity has been defined as the 'degree to which the landscape facilitates or impedes movement among patches' (Bennett 1999).

### Conservation

The following are definitions for *conservation* as applied to natural heritage and cultural heritage:

*Natural Heritage*: Conservation means all the processes and actions of looking after a place so as to retain its natural significance and always includes protection, maintenance and monitoring. It may also involve actions to repair degradation and includes conserving natural processes of change (*Australian Natural Heritage Charter*. 2nd edition (Australian Heritage Commission 2002)). Conservation, as applied to species and ecological communities, refers to all the processes and actions aimed at the maintenance of those entities in perpetuity. This is also expressed as the 'conservation of biological diversity'.

*Cultural Heritage*: Conservation means all the processes of looking after a place so as to retain its cultural significance. Cultural significance means aesthetic, scientific, social or spiritual value for past, present or future generations (*Australia ICOMOS Burra Charter, 1999* (Australia ICOMOS 1999)). Conservation may also be applied to specific objects.

### Ecosystem

An *ecosystem* is a dynamic complex of organisms and their environment, interacting as a functional unit (Australian Heritage Commission 2002).

### Ecological carrying capacity

*Carrying capacity* is defined as the number or weight of animals of a single or mixed population that can be supported permanently on a given area (Sharkey 1970 in Krebs 2001). *Ecological carrying capacity* is the point that will eventually be reached by a herbivore population that is not culled or harvested and is not limited by predation. All other carrying capacities have fewer herbivores and more vegetation. Ecological carrying capacity represents a natural accommodation between the growth rates of the vegetation and the herbivores. It is a long-term mean observed density of animals left to themselves i.e. it is a self-regulating system (Shepherd and Caughley 1987). It is unlikely to be a

desirable state in an area where there are other management objectives such as protection of grassland reptiles that depend on grassland tussock structure or maintenance of ground cover for catchment protection. More detailed explanation is contained in the *ACT Kangaroo Management Plan* (ACT Government 2010a).

**Estimating kangaroo density**
Ecologists have used six main methods to estimate kangaroo density. Two of these have been used at Googong Foreshores:

*Sweep Counts,* also known as *Drive Counts* involve a group of people walking in an organised way through the kangaroos so that all animals are recorded once. Repeats are advisable to test the results of sweep counts.

*Distance Sampling* refers to a group of methods, of which only the linear subset (or *Line Transect Method*) is applied to kangaroos. Line transect is probably the most wildly used method in the world for estimating abundance of wildlife. For kangaroos, the observer travels along a transect line in a helicopter, off-road vehicle, or on foot, and records the distance from the point of observation to each group of kangaroos with a laser rangefinder, and their angular displacement from the line with a compass or compass rose, enabling their perpendicular *distance* (displacement) from the transect to be estimated. The key step in Distance Sampling is to fit a *detection function* to the observed displacements, and use the fitted detection function to estimate the proportion of objects missed by the survey. Thus, the absolute abundance of the population (animals seen plus unseen) can be estimated. *Walked line transect* surveys have had extensive use in the ACT, carried out through the daylight hours.

**Existence value**
*Existence value* means that living organisms, earth processes and ecosystems may have value beyond the social, economic or cultural values held by humans (Australian Heritage Commission 2002).

**Geodiversity**
*Geodiversity* is the natural range (diversity) of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes (Australian Heritage Commission 2002).

**Guideline / Standard**
A *guideline* is a numerical concentration or narrative statement recommended in order to support or maintain a designated water use. A *standard* is a guideline established under legislation and therefore enforceable.

**Herbage mass**
*Herbage mass* is the above-ground component of a pasture, including both dead and living plant parts.

**Natural integrity**
*Natural integrity* is the degree to which a place or ecosystem retains its natural biodiversity and geodiversity and other natural processes and characteristics (Australian Heritage Commission 2002).

**Potable water**
*Potable water* is water that is fit or suitable for drinking. Guidelines for the quality of drinking water are set out in the *Australian Drinking Water Guidelines* (NHMRC 2004).

**Register of the National Estate**
The Register of the National Estate (RNE) was originally established under the *Australian Heritage Commission Act 1975* (Cwlth) and more than 13 000 places were added to the register. In 2004 the Australian Heritage Council became responsible for maintaining the register under the *Australian Heritage Council Act 2003* (AHC Act). On 1 January 2004 a new national heritage system was established under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). From 19 February 2007, the RNE was 'frozen' meaning that no new places can be added or existing places removed. It is intended that from February 2012 all references to the register will be removed from the AHC Act and EPBC Act. This transition period is to allow time to transfer places to other local, state, territory and Australian Government registers. More information can be obtained at <http://www.environment.gov.au/heritage/places/rne/index.html>.

**Rehabilitation**
*Rehabilitation* refers to the improvement in condition of land and/or ecological communities and their component species following degrading disturbance. Rehabilitation may involve regeneration, restoration or reinstatement representing progressively **greater degrees of human intervention.**

These terms are defined in the *Australian Natural Heritage Charter* (Australian Heritage Commission 2002).

> *Regeneration* means the natural recovery of natural integrity following disturbance or degradation.
>
> *Restoration* means returning existing habitats to a known past state or to an approximation of the natural condition by repairing degradation, by removing introduced species or by reinstatement.
>
> *Reinstatement* means to introduce to a place one or more species or elements of habitat or geodiversity that are known to have existed there naturally at a previous time, but that can no longer be found at that place.

**Threatened**
An umbrella term for various categories of risk of premature extinction.

**Values**
A *value* is a property or characteristic of something which makes it esteemed, desirable or useful. A value expresses worth, merit or importance. In land management, values are characterised as natural (deriving from the natural environment i.e. from landforms, geology, soils, vegetation, flora and fauna, hydrology, waterways) or cultural (deriving from human use and/or settlement).

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