

Superb Parrot (*Polytelis swainsonii*)

The Superb Parrot is listed as vulnerable under the EPBC Act and the TSC Act.

The Superb Parrot occurs mostly in riparian forest or woodland and surrounding plains of the Murrumbidgee and Murray Rivers. It feeds mainly on the ground in Box-Gum Woodlands and wooded farmland within 10 km of the river, taking grass seeds and herbaceous plants, as well as fruit, insects, grain, flowers, nectar, berries and buds (DEC 2005q; Higgins 1999).

It nests in hollows, usually in dead branches, but sometimes in holes in the trunk of a tall tree (Higgins 1999). The species is monogamous and is thought to maintain bonds year round (Higgins 1999).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Some trees with hollows would be removed along Googong Dam Road and Old Cooma Road as a result of the proposal. The Superb Parrot has not been recorded in the study area, or within 10 km of the study area. This species is a rare breeding summer migrant to the ACT and is generally restricted to the northern parts near Hall, Gungahlin and Belconnen (Taylor, 1992)

Competition for hollows in paddock areas is high, particularly from the Common Starling, which is abundant in the study area and has been observed nesting in tree hollows there. Given that the Superb Parrot has not been recorded in the area and wooded areas nearby contain better foraging and nesting habitat for this species than the study area, the removal of existing vegetation in the study area is not likely to affect the life cycle of the Superb Parrot.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The study area provides potential habitat for the Superb Parrot in the form of roadside vegetation, paddock trees, the vegetation associated with Googong Creek, and hollow-bearing trees. The majority of the study area consists of isolated paddock trees and some heavily grazed grass pastures, mostly consisting of Barley Grass (*Hordeum* spp.), but supporting some native grass species, such as Wallaby Grasses (*Austrodanthonia* spp.) and Spear Grass (*Austrostipa* spp.) in some areas.

Eucalypts are present along roadsides (Googong Dam Road and Old Cooma Road), and woodland is present along Googong Creek. It is considered unlikely that the study area represents important habitat for this species in the locality due to the lack of records of the species in the area and the low quality of the potential habitat compared to better quality potential habitat nearby. As such, the proposal is likely to have a minimal impact on the habitat of the Superb Parrot in the area.

Does the proposal affect any threatened species that are at the limit of its known distribution?

The Superb Parrot is found throughout eastern inland NSW (DEC 2005p). The study area is beyond the south-eastern limit of distribution for the species, which is recorded on the northern and north-west side of Canberra, although there is also a record from Cooma (NSW Government 2008).

How is the proposal likely to affect the current disturbance regimes?

The area of potential habitat for the Superb Parrot is dominated by grazing lands. Other disturbances include roads and powerlines.

The study area in general is to be developed as a new town, including tree removal and all the associated disturbances (e.g. potential weed invasion, trampling of habitat, loss of ground debris habitat such as fallen logs, predation by cats and dogs, increased competition from Common Starlings, etc).

How is the proposal likely to affect habitat connectivity?

The study area has been subject to disturbances and land clearing for many years. The majority of it has been cleared for grazing and paddock trees and roadside vegetation constitute "stepping stone" connectivity. Vegetation along Googong Creek is continuous with other vegetation associated with the Queanbeyan River. The proposal is not likely to impact habitat connectivity for the Superb Parrot.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the Superb Parrot (DECC 2008j).

The proposal will have a minimal impact on potential habitat for this species. Given the lack of records in the locality, it is not likely to be critical to the survival of this species.

Conclusion

Based on the above assessment, the Superb Parrot is unlikely to be significantly impacted by the activities.

Swift Parrot (*Lathamus discolor*)

The Swift Parrot is listed as endangered under both the EPBC and TSC Acts.

The Swift Parrot occurs from southern Queensland to South Australia and Tasmania. Breeding occurs only in Tasmania. Swift Parrots migrate in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland (DEC 2005r; DEWHA 2008e). During the non-breeding season large flocks congregate at suitable feeding resources throughout eastern NSW. The Swift Parrot prefers open eucalypt forests where it feeds on nectar and lerps.

Preferred feed trees include Swamp Mahogany *Eucalyptus robusta*, Mugga Ironbark *E. sideroxylon*, White Box *E. albens* and Spotted Gum *Corymbia maculata* (Higgins 1999), and Red Ironbark *E. tricarpa*, Grey Box *E. microcarpa*, and Yellow Gum *E. leucoxydon* are important sources of nectar in the box-ironbark forests and woodlands of Victoria and NSW (Swift Parrot Recovery Team 2001e).

The Swift Parrot returns to some foraging sites on a cyclic basis depending on food availability (DECC 2005~).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

There are an estimated 2000 breeding Swift Parrots known in Tasmania (DEC 2005r; DEWHA 2008f). During the autumn and winter migration to south-eastern Australia the species can be found from Victoria and the eastern parts of South Australia to south-east Queensland. The main concentration of Swift Parrots outside the breeding season is in Victoria (Forshaw and Cooper 2002). During the non-breeding season large flocks congregate at suitable feeding resources throughout eastern NSW (DEC 2005r; DEWHA 2008g).

The Swift Parrot has not been recorded in the locality or within 10 km of the study area, but the species is known to pass through the Canberra region (Swift Parrot Recovery Team 2001g). The species does not breed in the region. Much of the construction work associated with the proposal would take place in paddocks of the study area. There would be some clearing of roadside vegetation and paddock trees. Vegetation along Googong Creek is unlikely to be impacted.

Swift Parrots may feed on flowering eucalypts in the study area on occasion during their migration, however better habitat is found elsewhere in the locality. As such, the proposal is unlikely to affect the lifecycle of Swift Parrots in the area.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Swift Parrot prefers open eucalypt forests where it feeds on nectar and lerps. Preferred feed trees include *Eucalyptus robusta*, *E. sideroxylon*, *E. albens* and *Corymbia maculata* (Higgins 1999).

Within the study area, limited potential habitat occurs within roadside vegetation, paddock trees, and the vegetation associated with Googong Creek. These trees are few, are not preferred species with high nectar production, and many are in poor condition. Swift Parrots may visit isolated flowering trees such as those that occur in the study area opportunistically on rare occasions.

Woodland adjacent to the study area is in moderate to good condition with a variety of native trees in much higher densities. The nearby woodlands therefore represent better quality foraging habitat for this species than the study area.

The proposal would remove predominantly cleared or modified grassland and woodland. Much of the construction work associated with the proposal would take place in paddocks of the study area. There would be some clearing of roadside vegetation and paddock trees. Vegetation along the Googong Creek is unlikely to be impacted. As such, the proposal is likely to have a minimal impact on the habitat of the Swift Parrot in the area.

Does the proposal affect any threatened species that are at the limit of its known distribution?

The study area does not occur at or near the limit of distribution of the Swift Parrot.

How is the proposal likely to affect the current disturbance regimes?

The area of potential habitat for the Swift Parrot is dominated by grazing lands. Other disturbances include roads and powerlines. The study area in general is to be developed as a new town, including tree removal and all the associated disturbances (e.g. potential weed invasion, increased competition from larger aggressive honeyeaters, etc).

How is the proposal likely to affect habitat connectivity?

The Swift Parrot is an autumn and winter migrant to NSW. It returns to some foraging sites on a cyclic basis depending on food availability (DECC 2005~). This species is highly mobile and moves large distances readily.

The study area has been subject to disturbances and land clearing for many years. The majority of it has been cleared for grazing and paddock trees and roadside vegetation constitute stepping stone” connectivity. Vegetation along the Googong Creek is continuous with other vegetation associated with the Queanbeyan River. The proposal is not likely to impact habitat connectivity for the Swift Parrot.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the Swift Parrot (DECC 2008h).

The proposal will have a minimal impact on potential habitat for this species. However, given the lack of records in the locality, it is not likely to be critical to the survival of this species.

Conclusion

Based on the above assessment the Swift Parrot is unlikely to be significantly impacted by the activities.

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

The Eastern False Pipistrelle is listed as vulnerable under the TSC Act (NSW).

The species inhabits sclerophyll forests, preferring wet habitats where trees are more than 20 m high (Churchill 1998). The Eastern False Pipistrelle hunts beetles, moths, weevils and other flying insects above or just below the tree canopy (Churchill 1998). There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary and enter torpor (Menkhorst and Lumsden 1995).

This species also appears to be highly mobile and records indicate movements of up to 12 km between roosting and foraging sites (Menkhorst and Lumsden 1995). This species roosts in hollow-bearing trees (both dead and alive) and caves and buildings (Churchill 1998). Two observations have been made of roosts in stem holes of living Eucalypts (Phillips 1995).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Eastern False Pipistrelle was recorded within the study area (in the gully of Googong Creek) during previous surveys (Johnstone Centre 2004f). This species is known to roost in hollow-bearing trees (both dead and alive) and/or caves and buildings (Churchill 1998). No caves occur within the study area. Many hollow-bearing trees were recorded within the study area; however, all were in dry habitats not usually favoured by this species. Farm buildings could provide additional roosting habitat.

Clearing for the proposal would remove some isolated native trees and farm buildings that could potentially provide roosting habitat for this species. This is unlikely to have an adverse effect on the life cycle of this species as hollows occur throughout the woodland in adjacent areas where the forests is more to this species' preference. The removal of existing vegetation in the study area is not likely to affect the life cycle of the Eastern False Pipistrelle.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The study area provides potential habitat for the Eastern False Pipistrelle in the form of roadside vegetation, paddock trees, the vegetation associated with Googong Creek (including hollow-bearing trees), and farm dams.

The majority of the study area consists of isolated paddock trees and some heavily grazed grass pastures, mostly consisting of Barley Grass (*Hordeum* spp.), but supporting some native grass species, such as Wallaby Grasses (*Austrodanthonia* spp.) and Spear Grass (*Aurolstipa* spp.) in some areas. Eucalypts are present along roadsides (Googong Dam Road and Old Cooma Road), and woodland is present along Googong Creek. Farm dams are present in the grazing areas.

Habitat throughout much of the area is considered suboptimal for the Eastern False Pipistrelle, however, foraging is occurring on occasion. The proposal would lead to the removal of some foraging habitat along the roadsides in the area.

Does the proposal affect any threatened species that are at the limit of its known distribution?

In NSW, the Eastern False Pipistrelle has a distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. It also occurs in Tasmania (Churchill 1998). The study area does not occur at or near the limit of distribution of the Eastern False Pipistrelle.

How is the proposal likely to affect the current disturbance regimes?

The area of potential habitat for the Eastern False Pipistrelle is dominated by grazing lands. Other disturbances include roads and powerlines. The study area in general is to be developed as a new town, with all the associated disturbances (including loss of hollow-bearing trees).

How is the proposal likely to affect habitat connectivity?

The study area has been subject to disturbances and the majority of it has been cleared for grazing. However, the existing paddock trees and roadside vegetation constitute "stepping stone" connectivity. Vegetation along the Googong Creek is continuous with other vegetation associated with the Queanbeyan River. The proposal is not likely to impact habitat connectivity for the Eastern False Pipistrelle.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the Eastern False Pipistrelle (DECC 2008i).

The proposal will have a minimal impact on known and/or potential habitat for this species. Also, given the suboptimal nature of the habitat and high mobility of this species, it is not likely to be critical to the survival of this species.

Conclusion

Based on the above assessment, the Eastern False Pipistrelle is unlikely to be significantly impacted by the activities.

Appendix 14 - EPBC Act Impact Assessments - Flora

Flora

As discussed in the Report, no threatened species or populations were found in the flora surveys at the subject sites. However, the habitat assessment, combined with flora survey information and data obtained by the literature reviews, collectively indicate the existence of 'habitat' that might be considered suitable for two EECs and seven Threatened Species, listed by the EPBC Act.

In this Section, 'Tests of Significance' are conducted for those, listed below:

Endangered Ecological Communities:

- Natural Temperate Grassland of the Southern Highlands of NSW and the ACT
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland'

Threatened Species:

- Button Wrinklewort (*Rutidosia leptorrhynchoides*);
- Mountain Swainson Pea (*Swainsona recta*);
- Hoary Sunray (*Leucochrysum albicans* var. *tricolor*);
- Tessellated Spider Orchid (*Caladenia tessellata*);
- Pale Pomaderris (*Pomaderris pallida*);
- Mauve Burr-daisy (*Calotis glandulosa*); and
- Austral Toadflax (*Thesium australe*).

Critically Endangered and Endangered Ecological Communities

Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT

The Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT are a low elevation ecological community dominated by native perennial grasses with a diversity of native herbaceous plants. This community is listed in as 'endangered' in the EPBC Act (ACT Government, 1997b; 2004a; 2005; 2007b; c; DECC, 2009a; DEWHA, 2000a; b; Environment ACT, 2005).

The grasslands are dominated by moderately tall (25–50 cm) to tall (50–100 cm), dense to open tussock grasses in the genera *Austrodanthonia*, *Austrostipa*, *Bothriochloa*, *Poa* and *Themeda australis*. Up to 70% of all plant species may be forbs (i.e. herbaceous, non-grass-like plants), which include many species able to regenerate by vegetative means from buds buried in the soil, present at the ground level where they are protected by surrounding soil or litter, or on aerial shoots to 25 cm above the ground. The community may be treeless or contain up to 10% cover of trees, shrubs or sedges.

Twelve threatened plant species (and seven threatened animal species) listed under the Commonwealth EPBC Act and/or the TSC Act are known to occur in natural temperate grasslands. These include species like Button Wrinklewort (*Rutidosia leptorrhynchoides*); Mountain Swainson Pea (*Swainsona recta*), Silky Swainson Pea (*Swainsona sericea*), Mauve Burr Daisy (*Calotis glandulosa*), Hoary Sunray (*Leucochrysum albicans* var. *tricolor*) and Austral Toadflax (*Thesium australe*).

The EEC occurs within the geographical region of the Southern Tablelands of NSW and the ACT at altitudes between 560 metres in central and northern parts of its distribution and 1200 metres in the south, in valleys influenced by cold air drainage and in broad plains (Benson, 1994). Minimum ground temperatures are often < 10°C. The rainfall is winter-dominated, and in the ACT and areas to the south, the mean annual rainfall is 450 mm to 700 mm (Benson, 1994; Benson and Wyse Jackson 1994; Mclvor and McIntyre, 2002).

The floristic composition of the EEC shows some variation across its geographic range. The grass and forb species composition at any one site is also influenced by the amount of litter present, the amount of bare ground and inter-relationships between particular exotic species and native species and the dominant grasses (DECC, 2009a; DEWHA, 2000a; b; Environment ACT, 2005).

It is thought that the perennial grass *Themeda australis* (Kangaroo Grass) originally dominated much of the grassland prior to European settlement, sometimes with the perennial grasses *Austrostipa* spp. (Spear Grasses) or *Austrodanthonia* spp (Wallaby grasses) as co-dominants. *Poa sieberiana* (Poa Tussock, Snowgrass) is also thought to have been an original dominant (Benson, 1994).

Grasslands dominated by species of *Austrodanthonia* and *Austrostipa* and by *Bothriochloa macra* (Red-leg Grass) may have become more common following European settlement, as more palatable species like *Themeda* were grazed out (Benson 1994; Benson and Wyse Jackson 1994; Sharp and Shorthouse, 1996). While the above changes relate to the dominant grass species, no information is available on whether these changes have also caused other changes in the community.

There is considerable literature on studies and reviews associated with the EEC. These describe various differences in different bioregions, and the subtle differences in species that dominate and characterise the EEC (DECC, 2009a; DEWHA, 2000a; b; Environment ACT, 2005).

Grassland in the south-western sub-region is generally restricted to drainage lines, flats and lower slopes dominated by *Poa labillardieri* (River Tussock), Kangaroo Grass and *Juncus* spp. or to other moist sites dominated by a mix of Kangaroo Grass, *Austrodanthonia* spp. and *Poa sieberiana*. These same species are also common in similar habitats throughout the other geographic sub-regions.

These grassy ecosystems have declined dramatically since European settlement, largely as a result of agriculture, urban and infrastructure development and invasion by weeds. They are now considered one of Australia's most threatened ecosystems. The remnants of the EEC are generally widely scattered and small, and considered to be highly fragmented (ACT Government, 2005; Mclvor and McIntyre, 2002).

Environment ACT (2005) recognises the ACT as a separate sub-region, based on differences in levels of disturbance, land uses, management and threats, although its climate is similar to the north-western subregion of Southern Tablelands.

A range of disturbances have resulted in significant fragmentation of natural temperate grasslands, changes to its floristic composition (through loss of species and/or changed abundance), adversely affecting the integrity of the EEC and also probably changing faunal habitats (Benson, 1994; Benson and Wyse Jackson 1994). Lunt *et al.* (1998) noted that pastoral activity from the early 1800s transformed grasslands in south-eastern Australia and also resulted in the decline or extinction of many animal species.

No specific information is available on how the loss of faunal species may have caused functional changes in the grasslands. However, small mammals, such as bandicoots, bettongs, rat kangaroos and rats, which were known to have occupied grasslands, may have been important agents of soil disturbance. Herds of eastern grey kangaroos regularly feed on extensive areas of open grazing lands in NSW and the ACT. There is recognition that kangaroos can play a role in natural grasslands by grazing and controlling biomass production, allowing a greater diversity of grassland plants to flourish.

Is there a real chance or possibility that the action will lead to a reduction of the extent of an ecological community?

The EEC is characterised by vegetation dominated by moderately tall, dense to open tussock grasses (i.e. Wallaby Grasses - *Austrodanthonia* spp., Spear Grasses - *Austrostipa* spp., *Bothriochloa* spp., *Poa* spp. and Kangaroo Grass - *Themeda australis*). The non-grass component could be up to 70% forbs, comprising a wide variety of small, rosette-forming species and sedges. This vegetation is currently **not** present in the study areas, which are degraded roadside vegetation or degraded pasture, still under heavy grazing pressure. Although *Austrostipa* spp., *Austrodanthonia* spp. and *Themeda australis* does occur as minor components, the dominant grasses at the study sites are introduced pasture species (i.e. *Phalaris* spp., *Eragrostis* spp., *Bromus* spp., *Hordeum* spp., *Poa* spp., *Lolium* spp. and others). The forb component of the vegetation is also extremely poor in species richness and quality.

The adverse impacts of continuous grazing are evident, as all areas of NH1A are compacted, sparsely vegetated, dominated by the introduced pasture species (which are subject to heavy grazing), and a wide variety of weedy species, typically associated with pastoral agriculture in the region (such as St. John's Wort, Patterson's Curse and various Thistles). The roadside vegetation is also highly disturbed and infested by introduced species, and aggressive colonisers.

However, it must be recognised that if the long-term disturbances caused by pastoral agriculture (i.e. introduction of new pasture species and other impacts like associated thinning of trees) had not occurred, this landscape would have been similar to habitats currently occupied by the EEC. It is therefore necessary to consider that some species, which characterise the EEC, could be present in this 'potential habitat' and to assess the impacts of the proposal accordingly.

In the region, relatively good quality remnants of the EEC occur at several sites on Commonwealth land in the ACT and in the Jerrabomberra Valley (Act Government, 2007b; c). However, the degraded pasture at the Googong site, with 'potential habitat' for some of the constituent species of the EEC, are not considered important for its the long-term survival. Despite the presence of elements of the EEC in the general area, none of the local environment plans, or the Googong Foreshores Draft Plan of Management (ACT Government, 2007a) considered it necessary to propose the area for biodiversity conservation.

The water Infrastructure route and other construction activities in the proposal are not likely to lead to a reduction of the extent of the grasslands EEC in the local area. However, recognising the presence of some species that are characteristic of the EEC, work should be preferentially directed, wherever possible, to cleared or currently degraded areas, to avoid direct impacts on elements of native grasslands that are present. Albeit small, patches of native grassland species (mainly Kangaroo Grass) occur along Old Cooma Road, Googong Dam Road, either inside the current boundary fences, or on partially degraded roadside verges.

Restoration of the disturbed areas by best practice techniques of land rehabilitation is recommended, after construction works. This would require re-establishing the grassland cover that would be removed by grubbing, clearing and trenching, with Australian native grasses, preferably with locally occurring indigenous species (such as Kangaroo Grass, Wallaby Grasses and Spear Grasses), and close monitoring and control of potential weed incursions.

Is there a real chance or possibility that the action will fragment or increase the fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?

The proposed Water Cycle Project works are directed for some part in creating corridors (easements) along Old Cooma Road, Googong Dam Road, road that enters the Water Treatment Plant (WTP), Reservoir Hill and sites for Water Recycling Plant and Sewage Pumping stations and for the creation of the stormwater drainage system and riparian corridors. These areas do not currently have the EEC, but only 'potential habitat' for some of the species that represents the EEC, as explained above.

Although these works may impact on what might be considered as potential habitat of the grassland EEC and its constituent species, works are not large enough to substantially and adversely modify the overall habitat availability for the EEC, locally or in the region. Also, given that the areas likely to be disturbed are already very disturbed due to vehicular traffic, road maintenance, continuing pastoral agriculture and related human activities, the proposed works are not likely to cause further fragmentation and extent of the EEC's habitat in the region, such that its local occurrence is likely to be placed at risk of extinction.

The species assemblage and individual populations of species that represent the EEC will not become isolated from similar habitat as a result of the proposed works, as the routes for infrastructure are of limited width (about 5 m) and where possible, will be directed to degraded pasture areas away from remnant, intact populations of Australian native grassland species, such as Kangaroo Grass, which are representative of the EEC.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of an ecological community?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for this EEC.

Is there a real chance or possibility that the action will modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

The proposal does not involve any other large-scale clearing of native vegetation. The area of impact does not contain the EEC; only potential habitat for some of the species assemblage of the EEC. The extent of disturbance of habitat is not extensive. Therefore, the proposal will not significantly impact on soil, water and nutrients necessary for the EEC. Nor will it cause a reduction in groundwater levels in the area. Some alterations of surface water drainage patterns are inevitable, but these are not considered large enough to cause major modifications. Furthermore, stormwater management across the site will utilise the existing drainage lines.

Is there a real chance or possibility that the action will cause substantial changes in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

The proposal will have some impact in areas considered potential habitat for some of the constituent species of the EEC. However, the grasslands areas likely to be excavated and cleared for the water cycle infrastructure are not extensive. Also, the grasslands at the proposal site are very poor quality, degraded pasture. The areas are devoid of most species of native grasses and forbs that characterise the grasslands EEC. The abundance and cover of the native species that are present, is also not high.

The degraded pastures are dominated by a wide variety of exotic species, including *Phalaris* spp., *Eragrostis* spp., *Poa* spp., *Bromus* spp., and *Hordeum* spp. In addition, the impact of grazing pressure over a long period has led to severe compaction and soil degradation. The proposal is therefore not likely to cause a decline or loss of functionally important species in this EEC, because most species are not present, and the areas to be cleared for the water cycle infrastructure are relatively small.

Is there a real chance or possibility that the action will cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

(i) Assisting invasive species that are harmful to the listed ecological community, to become established? Or

(ii) Causing regular mobilization of fertilizers, herbicides or other chemicals or pollutants into the ecological community, which kill or inhibit the growth of species in the ecological community?

The Water Cycle Project proposal involves trenching to install water and wastewater infrastructure and clearing of specific locations to construct the Water Recycling Plant, sewage pumping stations and delivery mains. Although the total area involved is not extensive, following constructions of the infrastructure, the areas disturbed will be prone to invasion by weeds, given that a significant seed bank and propagules of invasive species exists in the vicinity. However, the disturbed areas are to be consolidated and rehabilitated. Some species, both native grasses and forbs, scattered in the area, will continue to survive even if the habitat is disturbed.

Some herbicides are likely to be used in the integrated management of weeds, after the disturbances. The amounts required are not likely to be high. All topsoil to be used in the reconstruction and rehabilitation will be certified free of weed seeds.

Suitable ground covers and small shrubs will be used in the landscape reconstruction following construction of the water cycle infrastructure. This activity is not likely to introduce large amounts of fertilizers, such that constituent species of the EEC will be affected. Overall, the activities in the proposal are not likely to inhibit the growth and occurrence of typical native grass or forb species in the area, or reduce the quality or integrity of the species assemblage of this EEC.

Is there a real chance or possibility that the action will interfere with the recovery of an ecological community?

The Australian Government adopted the National Recovery Plan for the EEC (Environment ACT, 2005) in January 2006. This recovery plan builds upon information in other state and national recovery/action plans for the EEC and species associated with it. Broadly, it is a 'multi-species' approach to recover the EEC and its component species. This plan provides a framework for on-going monitoring and management of the EEC in the ACT and some of its recommendations are applicable to the proposal.

The main recovery actions included in the Plan (Environment ACT, 2005) relate to obtaining an adequate information base, conserving component species, applying best practice management (Eddy, 2002; Sharp *et al.*, 2005), involving landholders and the community in conservation activities, and applying effective planning for grassland conservation in a regional context. The Plan recognises that many temperate grassland remnants are small in size, are located on land with a range of tenures and may require periodic disturbance such as grazing by stock. Therefore, it is generally considered that a combination of on and off-reserve conservation is required to protect the remnants (Environment ACT, 2005).

The National Recovery Plan also aims to determine remnants that should be high priority for protection and conservation. A framework for this, based on the botanical significance rating, has been proposed (Sharp, 2006). Currently, the grasslands in the areas affected by the proposal are in an extremely degraded state, possibly reflecting a rating of 5 or 'exotic', on the scale proposed by Sharp (2006). Avoidance of the following activities has been recommended to prevent impacting adversely on the natural temperate grassland EEC (Sharp and Shorthouse, 1996; DEWHA, 2000a; b; Hamilton, 2001; Eddy, 2002):

- Earthworks that alter drainage patterns, clearing, rock removal, cultivation, pasture improvement, adding fertiliser, excessive livestock grazing, topsoil removal and stockpiling or spreading of soil;
- Prolonged intensive uses that may reduce plant cover and cause soil compaction, disturbance or erosion should also be avoided (ACT Government, 1997b);
- Planting of exotic or non-local tree or shrub species, and self-sown exotic or non-local trees and native herbaceous species that are not found naturally in natural temperate grassland;
- Introduction of pest animals, such as rabbits, cats, pigs and foxes; and
- Creating excessive shading of grassland areas, through tree planting or the construction of buildings;

While the emphasis in the National Recovery Plan (Environment ACT, 2005) is on protecting high quality grassland remnants, low diversity remnants are also important for providing connectivity between high quality remnants and other vegetation types, especially where woodlands, wetlands, riparian strips or even forests remain adjacent to grasslands. It is also recognised that degraded native pastures or low quality grassland can also form important buffers around high quality remnants, by reducing the effects of external disturbance or adjacent incompatible land uses on them, as well as helping to provide connectivity between remnants by removing barriers to movement. Low quality areas may also have some habitat value for threatened species, both flora and fauna (Environment ACT, 2005).

Construction work in the proposal will be undertaken following the guidance of the recovery plan and 'best practices', so that adaptive management can be followed. This would aim to minimise the loss of potential habitat for the constituent species of the EEC. Also, development and rehabilitation of the area with adequate safeguards, over the longer term, provides an opportunity to increase the abundance of native species that might have been lost from the area.

Conclusion

The proposal will remove some potential habitat, which might be deemed available to some of the species that are characteristically present in the Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT. However, the EEC does not exist in the areas affected by the proposal. Therefore, the proposal will not lead to a significant reduction of the habitat areas available for the EEC, locally or in the region. Nor will it lead to any extinction of species that constitute the EEC. As such, a referral under the provisions of the EPBC Act is not recommended for this EEC.

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The 'White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland' ecological community is found on relatively fertile soils on the tablelands and western slopes of NSW and is listed by the EPBC Act as critically endangered. The NSW TSC Act does not list the 'White Box-Yellow Box-Blakely's Red Gum Woodland' as an EEC any more. The previous NSW listing has been replaced by the new name.

The EEC, known informally as 'Box-Gum Woodland and Derived Grassland' (DEWHA, 2006a; b), occurs in areas that receive rainfall between the 400 and 800 mm per annum, extending from the western slopes, at an altitude of about 170 m to about 1200 m, on the northern tablelands. Major regions where the EEC occurs within NSW include the North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions (NSW Scientific Committee, 2002a; ACT Government, 2004a; b; DECC, 2009b; DEH, 2006b; c; DEWHA 2006a; b).

The White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands that existed prior to European settlement now exists as remnants in three different states. The three states are:

- An overstorey of eucalypt trees exists, but there is no substantial native understorey;
- A native understorey exists, but the trees have been cleared.
- Both a native understorey and an overstorey of eucalypts exist together.

In the nomination for listing the EEC, the Scientific Committee (DEWHA, 2006a) considered that areas in which an overstorey exists without a substantially native understorey are degraded and are no longer a viable part of the ecological community. Although some native species may remain, in most of these areas the native understorey is effectively irretrievable. *In order for an area to be included in the listed ecological community, a patch must have a predominantly native understorey.*

The EEC includes those woodlands where the characteristic tree species are one or more of the following species in varying proportions and combinations - *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) or *Eucalyptus blakelyi* (Blakely's Red Gum).

Native grass and herbaceous species generally characterise the ground layer. In some areas of the EEC, dominant pasture species typically change from *Themeda australis*, *Austrostipa* spp. and *Poa* spp. to *Austrostipa falcata*, *Austrodanthonia* spp. and *Bothriochloa macra*, as grazing intensity increases. This may reflect differences in palatability of these species and their ability to tolerate grazing pressure. Light grazing and burning may also lead to *Aristida ramosa* dominance (NSW Scientific Committee, 2002a). Shrubs are generally sparse or absent in the typical EEC, although they may be locally common in different areas.

Woodlands with *Eucalyptus albens* are most common on the undulating country of the slopes region, while *E. blakelyi* and *E. melliodora* predominate in grassy woodlands on the tablelands. Drier woodland areas, dominated by *E. albens*, often form mosaics with areas dominated by *E. blakelyi* and *E. melliodora*, occurring in more moist situations, while areas subject to waterlogging may be treeless. Other Eucalypts are often found in association with *E. melliodora* and *E. albens*.

Prober and Thiele (1995) discussed latitudinal and climatic gradients in the patterns of abundant species and the gradual change in herb and grass species occurring in the EEC, from northern to southern NSW. For instance, within the Box-Gum Woodland species, such as *Rostellularia adscendens*, *Chloris ventricosa*, *Austrodanthonia racemosa*, *Brunoniella australis*, *Cymbopogon refractus*, *Swainsona galegifolia*, *Notelaea microcarpa*, *Stackhousia viminea*, *Olearia elliptica*, *Jasminum suavissimum*, *Plantago gaudichaudii*, *Dichanthium sericeum*, *Plantago debilis* and *Wahlenbergia communis* are generally restricted to more northern areas (Prober and Thiele, 1995).

On the other hand, in the southern areas, the common understorey species include: *Gonocarpus elatus*, *Austrostipa blackii*, *Aristida behriana*, *Bracteantha viscosa*, *Austrodanthonia auriculata* and *Austrostipa nodosa* (Prober and Thiele, 1996). The understorey may be highly modified by grazing history and disturbance. A number of native species appear not to tolerate grazing by domestic stock and are confined to the least disturbed remnants. These include species like *Dianella revoluta*, *Diuris dendrobioides*, *Microseris lanceolata*, *Pimelea curviflora* and *Templetonia stenophylla* (Prober and Thiele, 1995).

A large number of fauna species of conservation significance are associated with some stands of Box-Gum Woodlands, as are a number of plants of conservation significance (NSW Scientific Committee, 2002a).

The EEC is acknowledged as habitat for several flora species, which are listed as threatened species by the EPBC Act (viz. Button Wrinklewort - *Rutidosis leptorrhynchoides*; Mountain Swainson Pea - *Swainsona recta*; Mauve Burr Daisy - *Calotis glandulosa*; Hoary Sunray - *Leucochrysum albicans* var. *tricolor*; and Austral Toadflax - *Thesium australe*).

The extent of the Box-Gum Woodlands has been drastically reduced in area and has become highly fragmented, because of human disturbances, including clearance for cropping and pasture improvement. Further, remnants of the community are degraded as a consequence of their disturbance history.

Some remnants of these communities survive with the trees partly or wholly removed by post European activities, and conversely, often remnants of these communities survive with these tree species largely intact, but with the shrub or ground layers degraded to varying degrees through grazing or pasture modification NSW Scientific Committee, 2002a; ACT Government, 2004a; b; DECC, 2009b; DEH, 2006b; c; DEWHA 2006a; b.

Other threats include: further clearing for cropping, pasture improvement or other development; and deterioration of the remnant condition caused by firewood cutting, increased livestock grazing, and invasion of remnants by non-native plant species. Non-native plant species that can lead to invasion of remnants include pasture species, as well as noxious weeds and environmental weeds. Environmental weeds include garden escapes, olives and pines.

Degradation of the Box-Gum Woodlands' landscape has also occurred due to inappropriate fire regimes, soil disturbance and increased nutrient loads, as well as soil acidification, salinity, and loss of connectivity between remnants. Furthermore, invasion of remnants and predation by feral animals (i.e. European Red Fox - *Vulpes vulpes* and the Feral Cat - *Felis catus*) is a Key Threatening Process under the EPBC Act that has been recognised as another cause of loss of fauna or modification of habitat in this EEC.

Is there a real chance or possibility that the action will lead to a reduction of the extent of an ecological community?

In order for an area to be included as containing the 'White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Grassland' EEC, a patch must have a predominantly native understorey.

This definition excludes much of the area affected by the proposal (i.e. Old Cooma Road, Googong Dam Road, WTP site and road corridor and Neighbourhood 1A from being considered further for the EEC, as these areas can no longer be identified as having a largely native understorey. However, despite the fragmentation that has been caused by past human activities, potential habitat for the EEC does exist in the Googong Creek habitat, affected by this proposal.

This proposal envisages using the Googong Creek for discharges of stormwater from the residential development. Impacts of this activity need to be considered for the EEC, because the creek flows through an area containing the species assemblage of the EEC that has been fragmented by past human activities. However, most of the constituent species assemblages of the EEC occupy the upper riparian (typically 2-5 m above the creek) to terrestrial habitat, well above the creek.

However, the amount of stormwater likely to be released is not high, as a result of water sensitive urban design (WSUD) elements to be implemented in the development. Also, the stormwater is not likely to be very high or enriched with nutrients, as the proposal involves stormwater treatment through WSUD elements. Following WSUD, the quality of the stormwater after development is not likely to be different from the existing runoff quality.

Therefore, the Googong Creek habitat is not likely to be modified in a manner that poses a threat to habitat availability for the EEC. It is also not likely to modify conditions in the creek, so as to place at risk of extinction any species that characterise the EEC.

The Box-Gum Woodland and Derived Grassland EEC is generally under threat because of indiscriminate clearing, degradation and fragmentation of remnants for agricultural, forestry, infrastructure and residential development and upgrades. Continuous heavy grazing and trampling of remnants by grazing stock has resulted in losses of plant species, thereby simplifying the understorey and ground layer and suppressing the development of a robust overstorey of canopy trees. Erosion and other soil changes, including increased nutrient status, as a result of clearing and development, continue to pose considerable threats.

Whilst it must be recognised that development in the vicinity, as proposed, is likely to contribute to exacerbation of some of the above threats, the area of Box-Gum Woodlands associated with the Googong Creek are already heavily fragmented and continually impacted upon by fire trails and access roads that are supporting the adjacent Googong WTP.

The creek is meandering through a fairly steep gully; its upper riparian to terrestrial vegetation is largely a mix of Box-Gum Woodlands' species and vast shrubland areas dominated by Burgan (*Kunzea ericoides*) and a mix of *Acacia* spp. There are very little grasslands associated with the area, and even the available grasslands are severely infested with Serrated Tussock (*Nassella trichotoma*).

Given the above, the proposed activity in the area, i.e. release of stormwater from the subdivision, will not significantly modify or reduce the extent of the EEC or its potential habitat, such that the extent or composition of the Box-Gum Woodlands in the area would be adversely affected.

Is there a real chance or possibility that the action will fragment or increase the fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?

The condition of Box-Gum Woodland and Derived Grassland remnants is well recognised to range from relatively good to highly degraded, such as paddock remnants with weedy understoreys and only a few hardy natives left. Some remnants of the community may consist of only an intact overstorey or an intact understorey, but may still have high conservation value due to the flora and fauna they support.

Also, disturbed remnants are still considered to form part of the EEC, including remnants where the vegetation, either understorey, overstorey or both, would, under appropriate management, respond to assisted natural regeneration, such as where the natural soil and associated seed bank are still at least partially intact. Disturbed sites may be important flora and faunal habitat, have significant occurrences of particular species, form part of corridors or have the potential for recovery. The conservation value of remnants may be independent of remnant size.

The Googong Creek habitat is already a highly modified environment, because of past and current land use practices. The area is disturbed, albeit infrequently, by the maintenance of access ways and fire trials associated with the Googong WTP.

The proposed works of discharging stormwater down Googong Creek is not likely to cause further perturbations or fragmentation of the habitat in the upper riparian slopes (occupied by the species assemblage of the EEC), so as to isolate areas that might be available for the species assemblage characteristic of the EEC, or for the broader EEC itself.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of an ecological community?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for this EEC.

Is there a real chance or possibility that the action will modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

The amount of excess stormwater to be discharged after implementation of water sensitive urban design (WSUD) elements within the New Township is not expected to be much. The Googong Creek currently does not flow for much of the year. However, discharges will be more frequent than current after development, and this will alter the surface water drainage patterns of the creek to some extent. Soil conditions in the creek may also be modified, as more water flows through the creek. Nevertheless, these changes in the conditions of the creek are not likely to be significant to the potential habitat of Box-Gum Woodlands and Derived Grasslands, essentially a terrestrial EEC.

The stormwater to be discharged is not likely to be enriched with nutrients, as the proposal involves stormwater treatment through WSUD elements within the Googong development. Therefore, the abiotic conditions of the Googong Creek habitat are not likely to be modified, so as to pose a threat to habitat availability for the Box-Gum Woodlands and Derived Grasslands EEC or its characteristic species, which typically occupy the upper riparian slopes above the creek, extending to the terrestrial environments.

Therefore, the proposed discharges are not likely to lead to a reduction in habitat or cause other environmental modifications that would disrupt or compromise the viability of the EEC or its characteristic species present in the area to any extent.

Is there a real chance or possibility that the action will cause substantial changes in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

The proposed works of discharging stormwater down Googong Creek is not likely to significantly remove or change the composition and abundance of the species comprising the EEC, because their habitat, which is considered as the upper slopes of the Googong Creek gullies, extending to the terrestrial environment, will not be affected. Therefore, the proposal is not likely to reduce the long-term survival of the species assemblage of the EEC or cause any losses of functionally important species in the locality.

Is there a real chance or possibility that the action will cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

(i) Assisting invasive species that are harmful to the listed ecological community, to become established? or

(ii) Causing regular mobilization of fertilizers, herbicides or other chemicals or pollutants into the ecological community, which kill or inhibit the growth of species in the ecological community?

The discharge of stormwater down Googong Creek is not likely to introduce invasive species that could threaten or be harmful to the terrestrial EEC.

After implementation of the WSUD elements in the new development, the quality of the stormwater from the proposal is not likely to be that different to drainage and runoff from a typical catchment with pastoral agricultural history as in the Googong area. Therefore, the stormwater is not likely to mobilize or introduce fertilizers, herbicides and/or other chemicals that would inhibit or harm the growth of species' assemblage, which occupies the terrestrial habitat.

Is there a real chance or possibility that the action will interfere with the recovery of an ecological community?

A draft recovery plan for the Box-Gum Woodland and Derived Grassland EEC has been prepared and is under review at present before release for public comment (DEWHA, 2006a). The priority recovery and threat abatement actions required for the EEC, which are relevant to this proposal, include the following:

- Protecting all sites from further clearing and soil disturbance in and around remnants, such as ripping planting lines and road grading;
- Protection of remnants from weeds, by the speedy eradication of any new invasion; taking care to spray or dig out only target species;
- Avoiding the use of fertilizers in or near remnants;
- In very small derived grassland sites, avoiding planting trees, as they may reduce the floral diversity through competition for light, nutrients and water;
- Focusing rehabilitation and planting on the edges of patches, expanding them, rather than within the existing patches, gradually expanding to connect the existing remnants;
- Undertaking control of rabbits, hares, foxes, pigs and goats (using methods that do not disturb the native plants and animals of the remnant);
- Not harvesting firewood from remnants (this includes living or standing dead trees and fallen material); leaving fallen timber on the ground;
- Encouraging regeneration by fencing remnants, controlling stock grazing and undertaking supplementary planting, if necessary;
- Erecting on-site markers to alert maintenance staff to the presence of a high quality remnant or populations of a threatened species; and
- Ensuring that remnants are connected to each other; in cases where remnants are not connected, revegetating sites to link them, providing linkages for fauna and flora (pollen and seed dispersal).

Conclusion

The proposal (i.e. discharge of stormwater down Googong Creek after WSUD implementation) is unlikely to lead to a significant modification or reduction of the terrestrial habitat available for the species assemblage of the Box-Gum Woodlands and Derived Grasslands EEC, locally or in the region. Nor is it likely to lead to any extinction of species that constitute the EEC. As such, a referral under the provisions of the EPBC Act is not recommended for this EEC.

Endangered Species

Button Wrinklewort (*Rutidosis leptorrhynchoides*)

The EPBC Act lists Button Wrinklewort (*Rutidosis leptorrhynchoides*) as nationally endangered.

The species is a perennial, multi-stemmed herb, sometimes with narrow basal leaves and with leafy flower stems to 35 cm tall. Basal leaves are to 3.5 cm long and 1.5 mm wide. Flower heads are bright yellow, slightly domed and button-like, to 2 cm wide and are produced at the ends of the stems in summer. Flowers are surrounded at their bases by a cup of broad, overlapping, smooth bracts with light papery edges. Flowering occurs between December and March (DEC, 2005h; DEWHA, 2009d).

The original range of Button Wrinklewort was made up of two areas 500 km apart; one was Canberra-Queanbeyan area, and the other, from far western Victoria, through to Gippsland Plains (Briggs and Leigh, 1990; Scarlett and Parsons, 1990, quoted by Cropper, 1993; ACT Government, 1997a; b). Local populations occur at Goulburn, the Canberra - Queanbeyan area and at Michelago. The Canberra populations occur at Stirling Point and Attunga Point and the NSW population occurs in the Queanbeyan Nature Reserve (Briggs and Leigh, 1990).

In the 2004 flora surveys in the area (Johnstone Centre, 2004), a population of Button Wrinklewort was located at 'The Poplars', a site to the northwest of the study area. A recent Queanbeyan City Council initiative included listing 'The Poplars' on the heritage list within the Jerrabomberra Creek catchment, to protect this site and the endangered population.

The preferred habitat of Button Wrinklewort is Box-Gum Woodland, secondary grassland derived from Box-Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. It grows on soils that are usually shallow, stony red-brown clay loams; tends to occupy areas where there is relatively less competition from herbaceous species (either due to the shallow nature of the soils, or at some sites due to the competitive effect of woodland trees). The plant exhibits an ability to colonise disturbed areas (e.g. vehicle tracks, bulldozer scrapings and areas of soil erosion).

Regenerative buds are at the surface of the soil but not below; hence, plants do not have the ability to re-sprout from underground structures. The stems usually die back in late summer or autumn and new basal leaves are evident by early winter. The rootstock is woody and can be large, allowing plants to re-sprout readily after destruction of all above ground parts by fire.

Fire plays an important role in encouraging regeneration by reducing grass competition and providing an open seedbed (Cropper, 1993). It has been observed flourishing at a site a few years after the area was burnt by a wildfire. The species' survival in rail reserves can be attributed, in part, to the frequent summer burns to reduce fuel loads. Kangaroo Grass (*Themeda australis*) is known to overwhelm the species, if areas are left unburnt for 5-10 years. It is also known to be susceptible to grazing.

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

It is possible that habitat at the roadsides along Old Cooma Road, Googong Dam Road, relatively ungrazed areas at the top end of the Googong Creek (behind 'Talpa' property) and the Googong Creek environment might be suitable for Button Wrinklewort. However, the species was not detected in the present surveys, which covered those specific areas. All other areas (i.e. Googong WTP site, road corridor and the subdivision, including Neighbourhood 1A), which are heavily degraded and/or subject to continuous grazing pressure, are not considered as suitable habitat for Button Wrinklewort.

The proposed works involve excavation of fairly narrow trenches (about 5 m width) for the water cycle infrastructure, and disturbing roadside vegetation that could be 'potential habitat' of Button Wrinklewort. However, given that no populations have been detected and the works are relatively small, the proposal is unlikely to cause a long-term decrease in a local population (not detected) or place it at risk of extinction.

The Googong Creek is likely to receive stormwater from the residential development, but the amount of stormwater is not expected to be much after implementation of WSUD elements within the New Township. Also, the stormwater is not likely to be very high or enriched with nutrients, as the proposal involves stormwater treatment through WSUD elements. Therefore, the Googong Creek habitat is not likely to be modified in a manner that poses a threat to habitat availability for Button Wrinklewort, which is essentially a terrestrial species.

Any discharges down the creek are not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposed discharges are not likely to lead to environmental modifications that would disrupt or compromise the viability of any Button Wrinklewort population that could exist (but not found by the surveys) in the general area.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

Despite the record of Button Wrinklewort in a property not far away from the Googong development area, no populations of the species were found in the areas surveyed. The areas to be excavated for infrastructure and for the development do not have Button Wrinklewort populations or individual plants, although some habitat that might be suitable for the species would be affected by the proposal.

The area to be cleared is not extensive, along roadsides and within the degraded pasture site. This is unlikely to cause any serious and irreversible, adverse impacts on habitat available for Button Wrinklewort. Discharges of stormwater down Googong Creek are also not likely to modify the terrestrial, potential habitat of Button Wrinklewort.

Overall, the areas to be affected by the proposal are relatively small. These areas of 'potential habitat' are not considered important for the long-term survival of the species in the local area or in the broader region.

It is also important to note that none of the local environment plans or Googong Foreshore Plan of Management (ACT Government, 2007a) considered it necessary to propose this area as a biodiversity conservation area, which could be considered vital for the survival of Button Wrinklewort populations.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

The local area proposed for the development has already been highly modified because of past and current land use practices. Button Wrinklewort plants or populations were not detected in the recent surveys or past surveys of the areas to be cleared and disturbed.

The proposed works would disturb an already fragmented poor quality habitat, along road verges of Old Cooma Road and Googong Dam Road, within the Googong WTP site and degraded pasture within Neighbourhood 1, but the degree of fragmentation of habitat is not considered great.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for Button Wrinklewort.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No breeding population of Button Wrinklewort has been detected in the areas to be impacted by the Water Cycle Project. The chances of locating populations in areas away from the Googong Creek environment in the future are remote, because of the past history of landuse and the level of current disturbances.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Loss, degradation, clearing and fragmentation of habitat and/or existing populations by residential and agricultural developments and incompatible land management practices are major threats for the survival of Button Wrinklewort. The decline of the species is also attributed to fragmentation caused by rail reserve maintenance and road works (particularly widening or re-routing). Habitat loss due to grazing pressure and invasion of weeds are also significant threats. Increased competition from other native grassland species within the habitat could also reduce the survival of the species.

The proposal will only affect some areas that could be suitable habitat for the species. However, the area to be cleared is not extensive and therefore, unlikely to cause any serious and irreversible, adverse impacts on habitat available for Button Wrinklewort. Discharges of excess stormwater down Googong Creek are also not likely to modify the terrestrial habitat of Button Wrinklewort.

Given the above, and the fact that populations of the species were not detected by recent surveys or previous surveys in the 'Googong' study area, the proposal will not lead to a significant reduction of the habitat areas for the species, locally or in the region. Nor will it lead to any extinction of local populations.

Is there a real chance or possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat?

Following the disturbances (i.e. clearing of some vegetation, trenching and earthworks associated with the Water Cycle Project), which are not extensive, invasive weeds are likely to invade those disturbed areas. Habitat invasion by weeds is a known threat to the survival of the species.

However, the proposal envisages rehabilitation and reconstruction of the disturbed habitat with native vegetation, and long-term maintenance of the areas, preventing establishment of undesirable weed species. Rehabilitation of the degraded pasturelands after development may, in fact, improve habitat conditions for the establishment of native species, including Button Wrinklewort.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the survival of Button Wrinklewort. It is unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere with the recovery of the species?

A recovery plan has not been prepared to date for the Button Wrinklewort. However, priority actions have been prepared (DEC, 2005h; DEWHA, 2009d) to manage the threats on the species and its populations.

The strategies are essentially related to undertaking additional surveys to establish the distribution of existing populations and providing advice to authorities and land managers on how to protect habitat and effectively manage land to protect the decline of existing populations. Undertaking additional research to propagate the species is also regarded as a priority.

The actions that are considered relevant to this proposal are summarised below:

- Searching for new populations in potential habitat;
- Not undertaking road works, pasture modification or other changes in land use that may affect populations if they are found;
- Undertaking weed control around populations, taking care to spray or dig out only target weeds; and
- Marking sites and potential habitat onto maps (of the farm, shire, region, etc) used for planning (e.g. road works, residential and infrastructure developments, remnant protection, rehabilitation).

However, the known populations of Button Wrinklewort in the Queanbeyan area are outside the Googong development area. The species was not detected in the flora surveys conducted in the areas proposed for clearing to develop the water cycle Infrastructure for the subdivision.

The loss of some habitat that might be considered suitable for the species is not of a scale and magnitude to cause a significant decline of available habitat for the species, to put the species and its populations at risk. The proposal will also not interfere with the recovery of the species in suitable habitat.

Conclusion

Based on the above assessment, Button Wrinklewort is unlikely to be significantly impacted by the proposed activities and as such a referral under the provisions of the EPBC Act is not recommended for this species.

Mountain Swainson Pea (*Swainsona recta*)

The EPBC Act lists Mountain Swainson Pea (*Swainsona recta*) as nationally endangered.

This species is a slender, somewhat rigidly erect perennial herb with a woody root, growing to 30-35 cm tall. The leaves are pinnate, 3-9 cm long, with 5-13 narrow to very narrow-elliptical leaflets, 1-15 mm long. The terminal leaflet is distinctly larger (15-25 mm) than others. All leaves are lightly hairy on the underside. The plant bears one to several sprays of purple coloured pea flowers (between 10 and 20), arranged in the upper half of an erect raceme 10-25 cm long. Flowering is between late September and early December. Pods, oblong, 7-11 mm long, 4-6 mm in diameter, follow the flowers in summer (DEC, 2005i).

Prior to 1939, Mountain Swainson Pea had been recorded from widely scattered places, such as Carcoar, Mudgee, Wellington and Wagga Wagga in NSW. These populations are probably now extinct. Small populations of a few individuals are still known to exist in the ACT, Queanbeyan and Wellington-Mudgee areas. Leigh *et al.* (1984) reported that the species is probably extinct in Victoria. Of five plants found in the ACT during spring 1980, one was on a roadside and the other four on public land in a Canberra suburb (Scarlett, 1981, quoted by Leigh *et al.*, 1984).

The habitat of Mountain Swainson Pea is the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum (*Eucalyptus blakelyi*), Yellow Box (*E. melliodora*), Candlebark Gum (*E. rubida*) and Long-leaf Box (*E. goniocalyx*). It grows in association with understorey dominants like Kangaroo Grass (*Themeda australis*), Poa tussocks (*Poa* spp.) and Spear-grasses (*Austrostipa* spp.) (Harden, 1991; Briggs and Leigh, 1996; Eddy *et al.*, 1998; Eddy, 2002; DEC, 2005i).

Plants die back in summer, surviving as rootstocks until they shoot again in the following autumn. Individual plants have been known to live for up to 20 years. The species is generally tolerant of fire, which also enhances germination by breaking the seed coat and reduces competition from other species.

Heavy grazing by domestic stock, land clearing and cultivation caused the destruction of *S. recta* in Victoria and possibly in NSW (Scarlett, 1981, quoted by Leigh *et al.*, 1984). It has also been observed that the hard seeds of *S. recta* may require a particular burning regime for regeneration, so that changes to burning regimes following settlement may also be responsible for its decline. The late flowering period also suggests that summer burning would destroy developing seed.

The ACT plants are all within the urban areas of Canberra and are seriously threatened by the impact of city development, as well as experiencing severe competition from exotic grasses and weed species. Their survival at these sites seems improbable (J. D. Briggs, in Scarlett, 1981, quoted by Leigh *et al.*, 1984).

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

The typical habitat of Mountain Swainson-pea is the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum (*Eucalyptus blakelyi*), Yellow Box (*E. melliodora*), Candlebark Gum (*E. rubida*) and Long-leaf Box (*E. goniocalyx*). It grows in association with understorey dominants that include Kangaroo Grass (*Themeda australis*), Poa tussocks (*Poa* spp.) and Spear-grasses (*Austrostipa* spp.).

It is possible that habitat at the roadsides along Old Cooma Road, Googong Dam Road and the relatively ungrazed areas at the top end of the Googong Creek (behind 'Talpa' property) might be suitable for Mountain Swainson Pea. However, the species was not detected in the present surveys, which covered those specific areas. All other areas (i.e. Googong WTP site, road corridor and the subdivision, including Neighbourhood 1A), which are heavily degraded and/or subject to continuous grazing pressure, are not considered as suitable habitat for the species.

The proposed works involve excavation of narrow trenches (about 5 m width) for the water cycle infrastructure, disturbing areas that could be 'potential habitat' of Mountain Swainson Pea. However, given that no populations have been detected and the works are relatively small, the proposal is unlikely to place any local population existing in a nearby area at risk of extinction.

The Googong Creek is likely to receive stormwater from the subdivision, but the amount of stormwater is not expected to be much after implementation of WSUD elements within the New Township. Also, the stormwater is not likely to be high or enriched with nutrients, as the proposal involves stormwater treatment through WSUD elements within the Googong development.

Therefore, the Googong Creek habitat is not likely to be modified in a manner that poses a threat to habitat availability for any Mountain Swainson Pea population that could exist (but not detected), because it is essentially a terrestrial species.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

Mountain Swainson Pea occurs within Queanbeyan Shire, but at sites several kilometers away from the Googong development area. No populations of the species were found in the areas surveyed. The areas to be excavated for infrastructure, or for the development, do not have Mountain Swainson Pea populations or individual plants.

Nevertheless, some habitat that might be suitable for the species would be affected by the proposal. The area to be cleared is not extensive, along roadsides and within the degraded pasture site. This is unlikely to cause any serious and irreversible, adverse impacts on habitat available for Mountain Swainson Pea. Discharges of stormwater down Googong Creek are also not likely to modify the terrestrial, potential habitat of Mountain Swainson Pea.

Overall, the areas to be affected by the proposal are relatively small. These areas of 'potential habitat' are not considered important for the long-term survival of the species in the local area or in the broader region. None of the local environment plans or Googong Foreshore Plan of Management (ACT Government, 2007a) considered it necessary to propose this area as a biodiversity conservation area, which could be considered vital for the survival of Mountain Swainson Pea populations.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

Areas to be impacted by the Water Cycle Project and the proposed development site have already been highly modified, because of past and current land use practices. Mountain Swainson Pea plants or populations were not detected in the recent surveys or past surveys of the areas to be disturbed.

The proposed works would cause additional disturbances in an already fragmented poor quality habitat, along the road verges of Old Cooma Road and Googong Dam Road, within the Googong WTP site and the degraded pasture within Neighbourhood 1A, but the degree of fragmentation of habitat is not considered great.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Mountain Swainson Pea.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No breeding population of Mountain Swainson Pea has been detected in the areas to be impacted by the Water Cycle Project. The chances of locating Pea populations in areas away from the Googong Creek environment in the future are very remote, because of the past history of landuse, shading by shrublands, weed invasion of open spaces and the level of other disturbances.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Heavy grazing by domestic stock, land clearing and cultivation and competition from exotic grasses and weed species are major known causes of the decline and destruction of Mountain Swainson Pea populations. Changes in fire regimes may have also contributed to the decline as the late flowering period suggests that summer burning would destroy developing seed.

However, the areas that would be excavated for infrastructure, or for the development, do not have Mountain Swainson Pea populations or individual plants. Nevertheless, some habitat that might be suitable for the species, based on information available, would be affected. The area to be cleared along roadsides and within the degraded pasture site is not extensive. This is unlikely to cause any serious and irreversible, adverse impacts on the overall habitat available for the threatened species in the local area or the region.

Stormwater discharges down the Googong Creek are not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposed discharges are not likely to lead to environmental modifications that would disrupt or compromise the viability of any Mountain Swainson Pea population that could exist (but not found by the surveys) in the general area.

The proposal is not likely to fragment or isolate areas that might be considered suitable habitat for Mountain Swainson Pea; hence, the species is unlikely to decline as a result of the works in the proposal.

Is there a real chance or possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat?

Following the disturbances (i.e. clearing of some vegetation, trenching and earthworks associated with the water cycle infrastructure), which are not extensive, weeds are likely to invade those disturbed areas. Severe competition from exotic grasses and weed species is a known threat to the survival of the species.

However, the proposal is not likely to result in invasions by weed species becoming established, so as to threaten the habitat preferred by Mountain Swainson Pea.

The proposal envisages rehabilitation and reconstruction of the disturbed habitat with native vegetation, and long-term maintenance of the areas, preventing establishment of undesirable weed species. However, reconstruction of the landscape after development may generally improve habitat conditions for the establishment of native species. Available information is not adequate to judge whether a species like Mountain Swainson Pea could be established or re-introduced into areas of rehabilitated pasturelands.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the survival of Mountain Swainson Pea. It is unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere with the recovery of the species?

A recovery plan has not been prepared to date for the Mountain Swainson Pea. However, priority actions have been prepared (DEC, 2005i) to manage the threats on the species and its populations.

The strategies are essentially related to undertaking additional surveys to establish the distribution of existing populations and providing advice to authorities and land managers on how to protect habitat and effectively manage land to protect the decline of existing populations. Undertaking additional research to propagate the species is also regarded as a priority. The only recovery action available in those plans that could be relevant to the proposal is:

- Searching for new populations in potential habitat.

However, the species was not detected in the flora surveys conducted in the areas proposed for clearing to develop the water cycle Infrastructure for the subdivision. The known distributions of Mountain Swainson Pea in the region are well outside the Googong development area.

Some of the habitat that might be considered suitable for the species would be lost, but the areas to be cleared by the proposal are limited, and are not of a scale and magnitude to cause habitat loss to put the recovery of the species and its populations at risk.

Conclusion

Based on the above assessment, Mountain Swainson Pea is unlikely to be significantly impacted by the proposed activities and as such a referral under the provisions of the EPBC Act is not recommended for this species.

Hoary Sunray (*Leucochrysum albicans* var. *tricolor*)

The Hoary Sunray *Leucochrysum albicans* var. *tricolor*, (Syn. *Helipterum albicans*), also known as White Sunray, is nationally listed as endangered in the EPBC Act.

It is an erect, low, tufted, perennial or annual plant with greyish-green, narrow linear leaves growing to about 30 cm high. The everlasting daisy flower head is 20-25 cm wide, with a yellow disc, surrounded by papery bracts that are either white or yellow. A yellow-flowered form is found east of Canberra, while the form common in the Canberra region has white flowers; both forms are erect (Eddy *et al.*, 1998; DEWHA, 2009a). Flowering is in spring and summer. There is a second sub-species: *Leucochrysum albicans* subsp. *alpinum* (Alpine Sunray), which is found only in alpine areas.

Hoary Sunray occurs in many parts of the Southern Tablelands, including the Lake George rangelands and in grassy woodlands. It is described as uncommon, but widespread in the region (Eddy *et al.*, 1998) and large numbers sometimes colonise disturbed sites.

Hoary Sunray sites in the Canberra-Queanbeyan area are Stony Creek Nature Reserve, located about five km east of Queanbeyan and possibly in the Cuumbeun Nature Reserve and Wanna Wanna Nature Reserves, which are also located nearby on the range east of Queanbeyan, Australian Defence Forces Academy site in Canberra and Mount Majura and Mount Ainslie in Canberra. A previous survey (Johnstone Centre, 2004), located a population on Mueller's Property, northeast of the study area.

The species is found in Tasmania, where it is widely distributed, but is considered 'endangered'.

The habitat of Hoary Sunray is in grasslands, which intergrade with woodlands. It is recognised as a component of groundcover in the EEC *Natural Temperate Grasslands of the Southern Tablelands of NSW and the ACT*. Literature (DEWHA, 2009a) indicates that the species requires medium grazing pressure and will tolerate some fertilizer application. However, it does not tolerate conversion of native grassland to improved pasture.

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

The Hoary Sunray grows in a wide range of communities and habitats, from peaty upland to stony plains. It is widespread in Southern Tablelands. However, it has suffered extensive losses, due to cultivation and pasture improvement and is now mainly confined to road reserves and areas, which have remained relatively intact. It is possible that habitat at the road verges along Old Cooma Road, Googong Dam Road and the relatively ungrazed areas and the Googong Creek area might be suitable for Hoary Sunray.

Populations of Hoary Sunray are known to occur in the Queanbeyan region. However, no populations have been detected previously in the study areas, earmarked for the Googong New Township. Despite targeted surveys, no populations were detected in the recent surveys, along Old Cooma Road, Googong Dam Road, Googong WTP site and corridor, NH 1A area, or in the Googong Creek habitat.

The proposed works involve excavation of trenches for Water Cycle Project infrastructure, and disturbing roadside vegetation that could be deemed 'potential habitat' of Hoary Sunray. However, all of the previously mentioned areas, likely to be impacted by this proposal, are already severely disturbed and have been seriously invaded by pasture grasses and a large variety of invasive species. There are also no areas within the broad subdivision and NH1A area that can be considered as ungrazed; these areas have been under the most intense grazing pressure for a long time.

A third area with potential habitat is the Googong Creek and its environment (i.e. some grasslands, intergrading with fragmented Box-Gum Woodlands). The Googong Creek is likely to receive stormwater discharges from the subdivision, but the amount of stormwater is not expected to be much after implementation of WSUD elements within the New Township. Also, the quality of the stormwater after WSUD is not likely to be enriched in nutrients or be markedly different from characteristic runoff from the existing catchment. Therefore, the Googong Creek habitat is not likely to be modified in a manner that poses a threat to habitat availability for Hoary Sunray, which is essentially a terrestrial species.

The terrestrial habitat on either side of Googong Creek is very heavily infested with Burchard (*Kunzea ericoides*), sometimes achieving a cover of about 75%. Various shrubs, mainly *Acacia*, and *Eucalyptus* trees also line the creek on either side, providing dense shade; these are probably not ideal habitat for Hoary Sunray. Open areas without much shade or extensive grasslands are limited in this environment. However, given that no populations have been detected and the works are relatively small, the proposal is unlikely to place any local population at risk of extinction.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

Hoary Sunray occurs within Queanbeyan Shire, but at sites some distance away from the Googong development area. No populations of the species were found at the study areas surveyed. Also, the areas to be affected by the proposal (excavation and other disturbances) are relatively small and are mostly degraded pasture of poor quality. These areas of 'potential habitat' are not considered important for the long-term survival of the species in the local area or in the broader region.

The discharge of stormwater down Googong Creek after implementation of WSUD in the subdivision is not likely to modify the conditions in the creek, so as to have an impact on upper riparian or terrestrial environments on either side of the creek, some areas of which could be potential habitat for Hoary Sunray.

It is also important to note that none of the local environment plans or Googong Foreshore Plan of Management (ACT Government, 2007a) considered it necessary to propose this area as a biodiversity conservation area, which could be considered vital for the survival of Hoary Sunray populations.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

Areas to be impacted by the Water Cycle Project have already been highly modified, because of past and current land use practices. Hoary Sunray plants or populations were not detected in the recent surveys or past surveys of the areas proposed to be disturbed.

The proposal would cause additional disturbances in an already fragmented poor quality habitat, along the road verges of Old Cooma Road and Googong Dam Road, within the Googong WTP site and the degraded pasture within Neighbourhood 1A, but the degree of fragmentation of habitat is not considered great.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Hoary Sunray.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No breeding population of Hoary Sunray has been detected in the areas to be impacted by the Water Cycle Project. The chances of Hoary Sunray occurring in the highly disturbed study areas are very remote.

Even in the relatively less disturbed Googong Creek area, habitat available may not be ideal as open grassy plains are limited. Heavy shading by shrublands of Burgan (*Kunzea ericoides*) and severe invasion of open spaces by large tussock forming, weedy grasses (i.e. Serrated Tussock, *Nassella trichotoma*) also reduce the chances of a species like Hoary Sunray being established.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Land clearing, degradation and fragmentation of habitat and/or populations by residential and agricultural developments, including road widening and re-routing, are major known causes of the decline of Hoary Sunray populations. Other threats include frequent fire, weed infestation, bush rock removal, grazing, and rubbish dumping (DEWHA, 2009a).

The areas that would be excavated for infrastructure, or for the development, do not have Hoary Sunray populations or individual plants, although some habitat that might be suitable for the species would be affected. However, the area to be cleared along roadsides and within the degraded pasture site is not extensive. This is unlikely to cause any serious and irreversible, adverse impacts on the overall habitat available for the threatened species in the local area or the region.

Stormwater discharges down the Googong Creek are not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposed discharges are not likely to lead to environmental modifications that would disrupt or compromise the viability of any Hoary Sunray population that could exist (but not found by the surveys) in the general area.

The proposal is also not likely to reduce the extent of or isolate areas that might be considered suitable habitat for Hoary Sunray; hence, the species is unlikely to decline as a result of the proposed works.

Is there a real chance or possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat?

Following the disturbances (i.e. clearing of some vegetation, trenching and earthworks associated with the water cycle infrastructure), which are not extensive, invasive weeds are likely to invade those disturbed areas. Severe competition from exotic grasses and weed species is a known threat to the survival of a small forb in grasslands and open spaces, like Hoary Sunray.

The proposal envisages rehabilitation and reconstruction of the disturbed habitat with native vegetation, and long-term maintenance of the areas, preventing establishment of undesirable weed species. Therefore, the proposal is not likely to result in invasions by weed species becoming established, so as to threaten the habitat preferred by Hoary Sunray.

The reconstruction of the landscape after development may generally improve habitat conditions for the establishment of native species. However, information is not adequate to judge whether a species like Hoary Sunray could be established or re-introduced into areas of rehabilitated pasturelands.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the survival of Hoary Sunray. It is unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere substantially with the recovery of the species?

A recovery plan has not been prepared to date for the Hoary Sunray. No threat abatement plan is available.

Conclusion

Based on the above assessment, Hoary Sunray is unlikely to be significantly impacted by the proposed activities and as such a referral under the provisions of the EPBC Act is not recommended for this species.

Vulnerable Species

Pale Pomaderris (*Pomaderris pallida*)

The TSC Act and the EPBC Act list Pale Pomaderris (*Pomaderris pallida*) as a vulnerable species in NSW. This is a compact rounded perennial shrub, 1-2 m high. The flowers are cream or pale yellow (Briggs and Leigh, 1985; Harden, 1991; Garnett and Hyndes, 1992) and are borne from mid September to early December.

The main distribution of Pale Pomaderris is along the Cotter, Paddys and Murrumbidgee rivers and in Molonglo Gorge. Surveys in 1983/4 found a total of 1200 individuals in eleven populations, ranging in size from 1 to 300 plants (Briggs and Leigh 1985; Garnett and Hyndes 1992). The species is conserved in Namadgi National Park, Bullen Range Nature Reserve and Stony Creek Nature Reserve, ACT, with less than 1000 individuals in each (Briggs and Leigh, 1996). It has been also recorded from near Kydra Trig, northwest of Nimmitabel, Tinderry Nature Reserve and the Queanbeyan River (DEC, 2005k).

The species has previously been collected in Kosciusko, but its current status there is unknown (Briggs and Leigh, 1990). Briggs and Leigh (1985) also reported that there could be a population in an area along the Ingeegoodbee River, Victoria.

Pale Pomaderris is found at numerous small sites along plateau edges and very steep upper slopes and cliffs of river valleys (Briggs and Leigh, 1985; Garnett and Hyndes, 1992) at 480-600 m above sea level. The known ACT sites are only on the eastern banks of the rivers, with an aspect ranging from north-westerly through westerly to southerly.

Details on habitat of specific sites of the eleven populations surveyed by Briggs and Leigh (1985) are well recorded. The soils are usually shallow pale brown sandy loams over granite rock; large exposed granite boulders may be present. In most situations, the species grows in near pure stands in a shrub community surrounded by *Eucalyptus mannifera*, *E. melliodora*, *E. macrorhyncha* canopies, or *Callitris* woodlands, or in open forest (Briggs and Leigh, 1985; Harden, 1991).

The shrublands associated with the species are commonly dominated by species assemblages, which include well-known shrubs like *Bursaria spinosa*, *Grevillea juniperina*, *Cryptandra amara*, *Cassinia aculeata*, *Acacia rubida*, *Acacia dealbata*, *Lomandra longifolia*, *Hardenbergia violacea*, *Pomaderris angustifolia*, *Dodonaea angustissima* and *Leptospermum* spp. and ground cover species, such as *Poa* sp. (Briggs and Leigh, 1985).

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

Pale Pomaderris is a small shrub that occurs on rather harsh environments, like plateau edges and very steep upper slopes and cliffs of river valleys. It is essentially a terrestrial species that could grow up the slopes and gullies in the understory shrublands of woodlands/forests.

The Googong Creek discharges into the Queanbeyan River, downstream of the Googong Dam. Much of the creek's habitat may not be regarded as characteristic of the steep cliff ridges and terrain (such as the deep gorges of Cotter and Murrumbidgee Rivers), where Pale Pomaderris populations have been found.

Nevertheless, Pale Pomaderris populations have been located within Queanbeyan Shire, in habitat associated with the Queanbeyan River, on its eastern bank. Therefore, potential habitat does exist in the Googong Creek habitat that could be affected by this proposal.

However, the current survey, which targeted a 50 m corridor on either side of Googong Creek, did not detect any Pale Pomaderris populations in the Googong Creek habitat.

The shrublands and gullies associated with the fragmented Box-Gum Woodlands along Googong Creek are dominated by Burgan (*Kunzea ericoides*), which in many sections, is a dense stand, achieving >75% cover. Such infestations may reduce the potential for occurrence of Pale Pomaderris populations.

Given that Pale Pomaderris plants or populations were not found in the shrublands of Googong Creek, the discharging of stormwater down Googong Creek is unlikely to be a significant modification of the environment that could lead to placing a Pale Pomaderris population at risk of extinction.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

The Googong Creek habitat is already a highly modified environment, because of past and current land use practices. The area is disturbed, albeit infrequently, by the maintenance of access ways and fire trials associated with the Googong WTP.

No Pale Pomaderris population was detected in habitat associated with the creek. The existing terrestrial environment, with heavy infestations of Burgan (*Kunzea ericoides*), and other dense scrub, is probably not ideal habitat for Pale Pomaderris.

The proposed discharge of stormwater down Googong Creek is not likely to cause further significant fragmentation of the area, or modify habitat, so as to isolate any existing population in the area.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

The Googong Creek habitat is already a highly modified environment, because of past and current land use practices. The area is disturbed by the maintenance of access ways and fire trials associated with the Googong WTP. No Pale Pomaderris population was detected in the creek habitat. The proposed discharge of stormwater down Googong Creek is not likely to cause further significant fragmentation of the area, or modify habitat, so as to isolate any existing population or its habitat in the area.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for Pale Pomaderris.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No breeding population of Pale Pomaderris has been detected to date in the Googong Creek habitat. The current surveys also did not find any. The discharging stormwater down Googong Creek is not likely to disrupt the breeding cycle of any population even if one exists (but not detected), because the terrestrial habitats are not likely to be adversely affected.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Habitat fragmentation, development of land for residential or agricultural purposes, grazing by feral animals (mainly goats) and fire are major threats for the survival of populations of Pale Pomaderris. Some of these threats exist in the Googong Creek environment. However, no local population was found in the surveys; only potential habitat may exist in the steeper gullies of Googong Creek.

The Googong Creek is likely to receive stormwater from the subdivision, but the amount of stormwater is not expected to be much after implementation of WSUD elements within the New Township. The stormwater is not likely to be very high or enriched with nutrients, as the proposal involves stormwater treatment through WSUD. Therefore, the Googong Creek habitat is not likely to be modified in a manner that poses a threat to habitat availability for Pale Pomaderris, which is essentially a terrestrial species.

Any discharges down the creek are also not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposed discharges are not likely to lead to environmental modifications that would disrupt or compromise the viability of any Pale Pomaderris population that could exist (but not found by the surveys) in the general area.

The proposed discharge of stormwater down Googong Creek is not likely to significantly remove, modify or fragment known Pale Pomaderris habitat, which can be expected to be on plateaus, cliff edges and gullies. Therefore, the proposal is not likely to reduce the long-term survival of the species within Queanbeyan or the region in general.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The discharge of stormwater down Googong Creek is not likely to introduce invasive species that could threaten or be harmful to Pale Pomaderris, which is a terrestrial species typically occupying habitats well above the upper riparian zones.

After implementation of the WSUD elements in the new development, the quality of the stormwater from the proposal is not likely to be that different to drainage and runoff from a typical catchment with pastoral agricultural history, such as the Googong area.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the survival of Pale Pomaderris. It is unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere substantially with the recovery of the species?

There is currently no specific recovery plan for Pale Pomaderris. However, priority actions have been prepared (DEC, 2005k) to manage the threats to the species and its populations. The strategies are essentially related to habitat protection and management, where populations exist, and other mitigative measures like managing fire and grazing by goats.

However, one strategy that might be deemed relevant to the proposal is to widen the search areas and conduct a more comprehensive survey of the hill slopes and gullies of Googong Creek habitat.

This action would be relevant, particularly if physical modifications to the Googong Creek are envisaged in the proposal (which might be broadened at a later stage), so as to stabilise the eroding areas of creek banks, before it receives any discharges. It is also possible that one or more of the dis-used dams along the creek might provide opportunity for additional stormwater detention and treatment. Such works will necessarily involve machinery entering the area through the existing fire trails and access ways.

If populations are detected in additional surveys, this information could be useful to protect the populations and habitat, and also reduce the threat of further losses in NSW.

Conclusion

Based on the above assessment, Pale Pomaderris is unlikely to be significantly impacted by the proposed activities and as such a referral under the provisions of the EPBC Act is not recommended for this species.

Tessellated Spider Orchid (*Caladenia tessellata*)

The EPBC Act lists the Tessellated Spider Orchid - *Caladenia tessellata* (Syn. *Arachnorchis tessellata*) as vulnerable (DEWHA, 2009e). The NSW TSC Act considers the species as endangered (NSW Scientific Committee, 2002d, DEC, 2005I).

The species is from a group of orchids characterised by five long spreading petals and sepals around a broad down-curved labellum ('lip'). It has cream-coloured petals with reddish stripes, and the labellum is broad with up to six purple stripes. The long, sparsely hairy, narrow leaf is about 6 cm long and 5 mm wide (Harden, 1993; Bishop, 2000; NSW Scientific Committee, 2002d; DEC, 2005I).

The Tessellated Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations that existed in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s.

Within NSW, *Caladenia tessellata* is currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. The total population size is estimated to be less than 50 individuals. The species is not known to occur within any conservation reserves (NSW Scientific Committee, 2002d).

The species also occurs on the coast in Victoria from east of Melbourne to almost the NSW border (Bishop, 2000; DEC, 2005I).

The Tessellated Orchid is generally found in grassy sclerophyll woodland on clay loam or sandy soils, although the population near Braidwood is in low woodland with stony soil. Flowers appear between late September and November in the extant southern populations (DEC, 2005I).

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

The Tessellated Spider Orchid shares the habitat of grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. It has been recorded from Queanbeyan Shire, but at locations several kilometres away from the proposed Googong development site.

The Googong Creek habitat may not be regarded as characteristic of the grassland habitat intergrading with Box-Gum Woodlands, where the orchid populations have been found. However, the possibility of having a population, in terrestrial habitat that might be suitable for the species, must be considered in assessing the proposal. The current survey, which targeted a 50 m corridor on either side of Googong Creek, did not detect any orchid populations in the area. Nor was the orchid found in any other parts of the study area for the Water Cycle Project.

Continuous disturbance of the Googong Creek habitat by access roads and maintenance of fire trails has resulted in fragmentation of the Box-Gum Woodlands habitat. As a result, the shrublands associated with the fragmented Box-Gum Woodlands along Googong Creek are dominated by Burgan (*Kunzea ericoides*), which in many sections, is a monoculture stand, achieving >75% cover.

Blackberry infestations are also very significant, often over-topping the creek, covering lower and upper riparian zones. There are also significant infestations of Serrated Tussock (*Nasella trichotoma*) in the more open areas, and this species has displaced native grasslands, where it occurs. Overall, such infestations have greatly reduced the occurrence of open grassy habitat, which may be preferred by the orchid.

Given that the Tessellated Orchid plants or populations were not found in the understorey associated with Googong Creek, the proposal to discharge stormwater down Googong Creek is unlikely to be a significant modification of the environment, or cause changes that could lead to a long-term decrease in the size of a population of the species (not found in the surveys).

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

Habitat fragmentation, modification and clearing associated with urban development and recreational users (i.e. pedestrian activity in coastal habitat) are among the major threats for the survival of Tessellated Spider Orchid populations. The species is also at risk from catastrophic events, because of small number of extant populations and low number of plants (DEC, 2005I).

However, no local population was found in the surveys; only potential habitat may exist in the more open areas, where grassy habitat intergrades with Box-Gum Woodlands, on either side of the Googong Creek.

The proposal involves the discharge of stormwater from the subdivision down Googong Creek, but the amount of stormwater is not expected to be much after implementation of WSUD elements within the New Township. Also, the stormwater is not likely to be very high or enriched with nutrients, as stormwater treatment is envisaged through WSUD elements within the development.

Following WSUD, the quality of the stormwater after development is not likely to be different from the existing catchment. Therefore, the Googong Creek habitat is not likely to be modified in a manner that poses a threat to the habitat availability for the orchid, which is essentially a terrestrial species.

Any discharges down the creek are not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposed discharges are not likely to lead to environmental modifications that would disrupt or compromise the viability of any Tessellated Spider Orchid population that could exist (but not found by the surveys) in the general area.

The proposal is also not likely to reduce the habitat availability, and therefore the long-term survival of the species within Queanbeyan, or in the general area.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

The Googong Creek habitat is already a highly modified environment, because of past and current land use practices. The area is disturbed by the maintenance of access ways and fire trials associated with the Googong WTP. No Tessellated Spider Orchid plants or population was detected in the grassy open habitat associated with the creek.

The proposed works of discharging stormwater down Googong Creek is not likely to cause further significant fragmentation of the area, or modify habitat, so as to isolate any existing population or its habitat in the area.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Tessellated Spider Orchid.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No breeding population of the Tessellated Spider Orchid has been detected in the Googong Creek area to be impacted by the Water Cycle Project. The chances of the species occurring in the highly disturbed study areas are remote.

In addition, the habitat available in the Googong Creek area may not be ideal as open grassy plains are limited. Heavy shading by shrublands of Burgan (*Kunzea ericoides*) and severe invasion of open spaces by large tussock forming, weedy grasses (i.e. Serrated Tussock, *Nassella trichotoma*) would reduce the chances of a species like Tessellated Spider Orchid being established.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Habitat fragmentation, modification, vegetation clearing and disturbances, and weed invasion of preferred habitat are among the major threats for the survival of Tessellated Spider Orchid. Some of these threats exist in the Googong Creek environment. However, no local population was found in the surveys; only potential habitat may exist in the more open areas, where grassy habitat intergrades with Box-Gum Woodlands, on either side of the Googong Creek.

Any stormwater discharges down the creek are not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposal is not likely to lead to environmental modifications that would remove, isolate or decrease the availability of habitat for any Tessellated Spider Orchid population that could exist (but not found by the surveys) in the general area.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The discharge of stormwater down Googong Creek is not likely to introduce invasive species that could threaten or be harmful to the Tessellated Spider Orchid, which would typically occupy habitats well above the upper riparian zones.

After implementation of the WSUD elements in the new development, the quality of the stormwater from the proposal is not likely to be that different to drainage and runoff from a typical catchment with pastoral agricultural history as in the Googong area.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the survival of Tessellated Spider Orchid. It is unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere substantially with the recovery of the species?

A recovery plan has not been prepared to date for the Tessellated Spider Orchid. However, priority actions have been prepared (DEC, 2005I) to manage the threats on the species and its populations.

The strategies are essentially related to undertaking additional surveys to establish the distribution of existing populations and advice to authorities and land managers on how to protect habitat and effectively manage land to protect the decline of existing populations. Undertaking additional research to propagate the species is also regarded as a priority.

The action in the plans that may be relevant to the proposal is:

- Undertake survey work in suitable habitat and potential habitat to locate any additional populations/occurrences/remnants.

This action would be relevant, particularly if physical modifications to the Googong Creek are envisaged in the proposal (which might be broadened at a later stage), so as to stabilise the eroding areas of creek banks, before it receives any discharges.

It is also possible that one or more of the dis-used dams along the creek might provide opportunity for additional stormwater detention and treatment. Such works will necessarily involve machinery entering the area through the existing fire trails and access ways.

If Tessellated Spider Orchid populations are detected in additional surveys, this information could be useful to protect those populations and habitat, and also reduce the threat of further losses in NSW.

Conclusion

Based on the above assessment, Tessellated Spider Orchid is unlikely to be significantly impacted by the proposed activities and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

Mauve Burr-daisy (*Calotis glandulosa*)

The Mauve Burr-daisy (*Calotis glandulosa*) is nationally listed as vulnerable in the EPBC Act.

This species is an erect or ascending, or sprawling perennial, branched herb to 35 cm high, woody at base, hirsute stem with short glandular hairs and scattered longer septate ones. Leaves are bright green, soft, deeply divided, 1.5–3 cm long, 5–9 mm wide, glandular-hairy and sessile.

Flower heads are yellow centred (disc florets), ray florets mauve, pink or whitish, 20 mm diameter, the petals curling back, solitary; involucre bracts ovate to lanceolate, acute, entire, glandular; receptacle conical, without scales. Ligule 5–8 mm long. Fruit (Achene) is a flattened or spherical burr, 1–2.5 mm long, red-brown, tuberculate; covered with peg-like projections, 4 or 5 awns of unequal length, 1.5–5 mm long, barbed towards apex, and with long narrow ciliate scales (Harden, 1992; Eddy *et al.* 1998; DECC, 2005a)

Mauve Burr-daisy is endemic to NSW and occurs in Kosciusko National Park, Monaro Plain (Eddy *et al.*, 1998), the upper Shoalhaven catchment, and near Oberon (DECC, 2005a; DEWHA, 2008f; DEWHA, 2009b). In the Kosciusko National Park, this species is locally abundant near Tantangara Dam, Nungar Plains, and surrounding areas in grassland and along roadsides (McDougall and Walsh, 2002).

There are unsubstantiated records from Dubbo and Mt Imlay (Benson, 1994; DECC, 2005a). This species also occurs within the Central West, Murrumbidgee and Southern Rivers (NSW) Natural Resource Management Regions.

The preferred habitat of Mauve Burr-daisy is montane grasslands, subalpine grasslands dominated by *Poa* spp., temperate grasslands, *Eucalyptus pauciflora* woodlands, and dry sclerophyll forests at high altitude in the Australian Alps (Harden, 1992; DECC, 2005a). The distribution of this species overlaps with the following EPBC Act-listed threatened EECs (DEWHA, 2008f):

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland;
- Upland Wetlands of the New England Tablelands and the Monaro Plateau; and
- Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT.

This species prefers grazing-restricted sites, Kangaroo Grass (*Themeda australis*) dominated grasslands (Benson, 1994), and has also been recorded at recently disturbed sites (McDougall and Walsh, 2007).

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

Mauve Burr-daisy grows in montane grasslands, subalpine grasslands dominated by *Poa* spp., temperate grasslands, *Eucalyptus pauciflora* woodlands, and dry sclerophyll forests at high altitudes. There is potential habitat for the Mauve Burr daisy in areas (i.e. roadside vegetation, relatively ungrazed grassland areas and Googong Creek habitat) that could be affected by this proposal.

Despite targeted surveys, no populations were detected in the current surveys, along Old Cooma Road, Googong Dam Road, Googong WTP site and corridor, NH 1A area, or in the Googong Creek habitat. However, the possibility of having a population, in terrestrial habitat that might be suitable for the species, must be considered in assessing the proposal.

The proposed works involve excavation of trenches for Water Cycle Project infrastructure, and disturbing roadside vegetation that could be deemed 'potential habitat' of Mauve Burr-daisy. However, all of the roadside vegetation along Old Cooma Road, Googong Dam Road, Googong WTP site and road corridor, which are likely to be impacted by this proposal is already severely disturbed and has been largely invaded by pasture grasses and a large variety of invasive species. There are also no areas within the broad subdivision and NH1A area that can be considered as ungrazed; these areas have been under the most intense grazing pressure for a long time.

The third area, with potential habitat is the Googong Creek and its environment (some grasslands, intergrading with fragmented Box-Gum Woodlands). The Googong Creek is likely to receive stormwater from the subdivision, but the amount of stormwater is not expected to be much after implementation of WSUD elements within the New Township.

Following WSUD, the quality of the stormwater after development is not likely to be different from the existing catchment. Therefore, the Googong Creek habitat is not likely to be modified in a manner that poses a threat to habitat availability for a terrestrial species like Mauve Burr-daisy.

The terrestrial habitat on either side of Googong Creek is very heavily infested with Burgan (*Kunzea ericoides*), sometimes achieving a cover of about 75%. Various shrubs, mainly *Acacia*, and *Eucalyptus* trees also line the creek on either side, providing dense shade; these heavily-shaded areas are probably not ideal habitat for Mauve Burr-daisy. Open areas without much shade or extensive grasslands, which the species would prefer, are limited in this environment.

However, given that no populations have been detected and the works are relatively small, the proposal is unlikely to place any local population at the risk of long-term decrease or extinction.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

Mauve Burr-daisy occurs within Queanbeyan Shire, but the sites are several kilometers away from the Googong development area. No populations of the species were found in the areas surveyed.

Also, the areas affected by the proposal are relatively small and are mostly degraded pasture of poor quality. These areas of 'potential habitat' are not considered important for the long-term survival of the species in the local area or in the broader region. The proposed discharging of stormwater down Googong Creek is not likely to cause further fragmentation of the terrestrial habitat, or modify habitat, so as to isolate any existing population in the area.

It is also important to note that none of the local environment plans or Googong Foreshore Plan of Management (ACT Government, 2007a) considered it necessary to propose this area as a biodiversity conservation area, which could be considered vital for the survival of Mauve Burr-daisy populations.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

Areas to be impacted by the Water Cycle Project and the proposed development site have already been highly modified, because of past and current land use practices. Mauve Burr-daisy plants or populations were not detected in the recent surveys or past surveys of the areas to be disturbed.

The proposal would cause additional disturbances in an already fragmented poor quality habitat, along road verges of Old Cooma Road and Googong Dam Road, within the Googong WTP site and degraded pasture within Neighbourhood 1A, but the degree of fragmentation of habitat is not considered great.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Mauve Burr-daisy.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No breeding population of Mauve Burr-daisy has been detected in the areas to be impacted by the Water Cycle Project. The chances of Mauve Burr-daisy occurring in the highly disturbed study areas are remote.

Even in the relatively less disturbed Googong Creek area, habitat available may not be ideal as open grassy plains are limited. Heavy shading by shrublands of Burgan (*Kunzea ericoides*) and severe invasion of open spaces by large tussock forming, weedy grasses (i.e. Serrated Tussock, *Nassella trichotoma*) also reduce the chances of a species like Mauve Burr-daisy being established.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The main identified threats to Mauve Burr-daisy include grazing by domestic stock along travelling stock routes; council roadside weed control programs (Benson, 1994); loss and degradation of habitat and/or populations from roadwork; weed invasion; residential and agricultural development; and habitat degradation and population loss caused by feral pigs (*Sus scrofa*) (DECC, 2005a).

The areas that would be excavated for the water cycle infrastructure, or for the development, do not have Mauve Burr-daisy populations or individual plants, although some habitat that might be suitable for the species would be affected.

However, the area to be cleared along roadsides and within the degraded pasture site is not extensive. This is unlikely to cause any serious and irreversible, adverse impacts on the overall habitat available for the threatened species in the local area or the region.

Stormwater discharges down the Googong Creek are not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposed discharges are not likely to lead to environmental modifications that would disrupt or compromise the viability of any Mauve Burr-daisy population that could exist (but not found by the surveys) in the general area.

Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the proposal, it is unlikely that the action would fragment and decrease the availability of habitat to the extent that Mauve-Burr-daisy in the area is likely to decline.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The discharge of stormwater down Googong Creek is not likely to introduce invasive species that could threaten or be harmful to Mauve Burr-daisy, which is a terrestrial species typically occupying habitats well above the upper riparian zones.

After implementation of the WSUD elements in the new development, the quality of the stormwater from the proposal is not likely to be that different to drainage and runoff from a typical catchment with pastoral agricultural history as in the Googong area.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the survival of Mauve Burr-daisy. It is unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere substantially with the recovery of the species?

Currently, a recovery plan for Mauve Burr-daisy is not in preparation. However, approved conservation advice is available for assisting the recovery of Mauve Burr-daisy populations (DECC, 2005a). The recovery objective that may be relevant to the proposal is:

- Undertake survey work in suitable habitat and potential habitat to locate any additional populations/occurrences/remnants;

However, the known distributions of Mauve Burr-daisy are largely outside the Googong development area. The species was not detected in the flora surveys conducted in the areas proposed for clearing to develop the water cycle infrastructure for the subdivision.

If anything, some of the habitat that might be considered suitable for the daisy would be lost, but the areas to be cleared by the proposal are limited and are not of a scale and magnitude to cause habitat loss to put the species and its populations at the risk of long-term decline or extinction.

Conclusion

Based on the above assessment, Mauve Burr-daisy is unlikely to be significantly impacted by the proposed activities and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

Austral Toadflax (*Thesium australe*)

Austral Toadflax (*Thesium australe*) is listed as vulnerable in the EPBC Act.

The species is a hairless, yellowish-green perennial herb with wiry, slender, sparingly branched stems up to 30 cm high. Its leaves are yellowish-green, alternate, narrow-linear, 1-3 cm long, 0.5-1.5 mm wide; the upper leaves are much smaller. Flowers are small, inconspicuous, greenish-yellow, borne singly on very short peduncles between two linear bracteoles that are inserted on a subtending leaf base, 2-4 mm above the leaf axil. Each flower has a narrow tubular perianth, 1.5-2 mm long with 5 broadly linear lobes about the same length as the tube. The fruit is an ovoid, vertically ribbed barrel-shaped nut, 2-3 mm long, which is crowned by the persistent, incurved perianth lobes. Flowering is recorded from February to March (DEC, 2009h; DEWHA, 2009c).

Austral Toadflax was once a widespread species, but is reported always as rare (Beadle *et al.*, 1978, quoted by Leigh *et al.*, 1984). In Victoria, it had been recorded from widely scattered grassland sites, but had declined over time (Scarlett, 1980, quoted by Leigh *et al.*, 1984). Other known habitats include open grassy heath, dominated by shrubs, or grasslands surrounded by *Eucalyptus* woodland, including *E. pauciflora* (Snow Gum), *E. rubida* (Candlebark), *E. dives* (Broadleaf Peppermint), *E. macrorhyncha* (Red Stringy-bark), *E. camphora* (Mountain Swamp Gum) and *E. stellulata* (Black Sally).

In NSW, Austral Toadflax has been recorded from the north coast, northern tablelands; central western slopes, central coast and southern tables, but was never common (Leigh *et al.*, 1984; Harden, 1993; Eddy *et al.*, 2002). It had not been seen in the Sydney region since the last collections made in 1974. Leigh *et al.* (1984) expressed the view that the survival of the species in NSW is likely to continue to become more precarious. In Queensland and Tasmania, the species had been collected prior to 1933; however, there are no recent collections from these states, where it is presumed extinct (Leigh *et al.*, 1984).

Not much is known about the Austral Toadflax habitat and ecology. The species was formerly widespread in Victoria in grasslands over a wide range of altitudes with varying rainfall on relatively rich soils throughout that state. Soils on which populations occur vary from black clay-loams to peaty loams. Scarlett (1980), quoted by Leigh *et al.* (1984) indicated that in common with other members of the Santalaceae, Austral Toadflax is a semi-parasite, deriving water and minerals from roots of other plants.

The decline of Austral Toadflax is presumed to be due to heavy grazing and cultivation of native grasslands. It was also noted that the species is not likely to survive in areas with dense shrub and/or tree cover; but it may tolerate some level of grazing in grasslands (Scarlett, 1980, quoted in Leigh *et al.*, 1984).

Whilst summer burning may prevent regeneration, some burning may be necessary to maintain open conditions for the species. Increase in animal stocking rates, cultivation, pasture improvement with fertilization are activities posing threats for the survival of this nationally endangered species (Scarlett, 1980, quoted in Leigh *et al.*, 1984).

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

Austral Toadflax usually occurs in grasslands over a range of altitudes with varying rainfall on relatively rich soils varying from black clay-loams to peaty loams. It prefers open grassy heath, or grasslands surrounded by Box-Gum Woodlands, but not dense shade of shrublands or trees (Leigh *et al.* 1984).

The Googong Creek habitat may not be regarded as characteristic of the grassland habitat intergrading with Box-Gum Woodlands, which is Austral Toadflax's typical habitat. However, the possibility of having a population, in terrestrial habitat that might be suitable for the species, must be considered in assessing the proposal. The current survey, which targeted a 50 m corridor on either side of Googong Creek, did not detect the species in the area. Nor was the species found in the surveys conducted in any other parts of the study area for the Water Cycle Project.

Continuous disturbance of the Googong Creek habitat by access roads and maintenance of fire trails has resulted in fragmentation of the Box-Gum Woodlands habitat. As a result, the shrublands and gullies associated with the fragmented Box-Gum Woodlands along Googong Creek are dominated by Burgan (*Kunzea ericoides*), which in many sections, is a monoculture stand, achieving >75% cover. Blackberry infestations are also very significant, often over-topping the creek, covering lower and upper riparian zones. There are also significant infestations of Serrated Tussock (*Nasella trichotoma*) in open areas, and this species has displaced native grasslands, where it occurs. Overall, such infestations have greatly reduced the occurrence of open grassy habitat, which is the preferred habitat of Austral Toadflax.

Given that Austral Toadflax plants or populations were not found in the understorey associated with Googong Creek, the proposal to discharge stormwater down Googong Creek, is unlikely to be a significant modification of the environment, or cause changes that could lead to placing any local population at the risk of long-term decrease or extinction.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

The Googong Creek habitat is already a highly modified environment, because of past and current land use practices. The area is disturbed, albeit infrequently, by the maintenance of access ways and fire trials associated with the Googong WTP.

No Austral Toadflax population was detected in habitat associated with the creek. The existing terrestrial environment, with heavy shade of scrublands is not ideal habitat for Austral Toadflax, which prefers open grasslands, intergrading with woodlands.

The proposed works of discharging stormwater down Googong Creek is not likely to cause any reduction in the area of occupancy available for the species, or modify habitat, so as to isolate any existing population in the area.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

The Googong Creek habitat is already a highly modified environment, because of past and current land use practices. The area is disturbed by the maintenance of access ways and fire trials associated with the Googong WTP. No Austral Toadflax population was detected in the creek habitat.

The proposed works of discharging excess stormwater down Googong Creek is not likely to cause further significant fragmentation of the area, or modify habitat, so as to isolate any existing population or its habitat in the area.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Austral Toadflax.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No breeding population of Austral Toadflax has been detected in the areas to be impacted by the Water Cycle Project. The chances of the species occurring in the highly disturbed study areas are remote.

In addition, the habitat available in the Googong Creek area may not be ideal as open grassy plains are limited. Heavy shading by dense shrublands and severe invasion of open spaces by large tussock forming, weedy grasses would reduce the chances of a species like Austral Toadflax being established.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Habitat fragmentation, modification, vegetation clearing, weed invasion of preferred habitat and increased shade from shrubs and trees are among the major threats for the survival of Austral Toadflax. Some of these threats exist in the Googong Creek environment. However, no local population was found in the surveys; only potential habitat may exist in the more open areas, where grassy habitat intergrades with Box-Gum Woodlands, on either side of the Googong Creek.

Any stormwater discharges down the creek are not likely to greatly modify the terrestrial environment above the upper riparian zones. Therefore, the proposal is not likely to lead to environmental modifications that would remove, isolate or decrease the availability of habitat for any Austral Toadflax population that could exist (but not found by the surveys) in the general area.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The discharge of stormwater down Googong Creek is not likely to introduce invasive species that could threaten or be harmful to Austral Toadflax, which is a terrestrial species typically occupying habitats well above the upper riparian zones.

After implementation of the WSUD elements in the new development, the quality of the stormwater from the proposal is not likely to be that different to drainage and runoff from a typical catchment with pastoral agricultural history as in the Googong area.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the survival of Austral Toadflax. It is unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere substantially with the recovery of the species?

Currently, a recovery plan for Austral Toadflax is in not preparation. However, approved conservation advice and actions are available for assisting the recovery of the species populations (DEC, 2009h).

The strategies and actions are essentially related to advice to authorities and land managers on how to protect habitat and effectively manage land to protect the decline of existing populations. Monitoring of existing populations is an essential part of the recovery strategy.

None of the actions are relevant to the proposal, as the species was not detected in the flora surveys conducted in the Googong Creek area.

Conclusion

Based on the above assessment, Austral Toadflax is unlikely to be significantly impacted by the proposed activities, and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

Appendix 15 - EPBC Act Impact Assessments - Fauna

Impacts being assessed here are those that relate to the Water Cycle Project only. The Water Cycle Project is proposed in order to support the construction of the Googong New Township, which is being assessed separately under Part 4 of the EP&A Act.

All assessments should be read with the assumption that the development of Googong New Township has been approved, and that impacts arising from the Water Cycle Project are additional to the impacts from the development of the township. As such, much of the study area, although currently grazing land, is assumed cleared and lacking in potential habitat for many species discussed.

In this Section, 'Tests of Significance' are conducted according to the Significant Impact Criteria for Endangered species (DEH, 2006a) for those species, which are listed as endangered under the EPBC Act and have potential habitat in the study area.

The species, being assessed, are as follows:

Critically Endangered species:

- Golden Sun Moth (*Synemon plana*)

Threatened Species:

- Grassland Earless Dragon (*Tympanocryptis pinguicolla*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Pink-tailed Legless Lizard (*Aprasia parapulchella*);
- Striped Legless Lizard (*Delmar impar*); and
- Superb Parrot (*Polytelis swainsonii*)

Critically Endangered or Endangered Species

Golden Sun Moth (*Synemon plana*)

The Golden Sun Moth is listed as critically endangered under the EPBC Act and as endangered under the TSC Act.

The NSW populations of the Golden Sun Moth are found in the area between Queanbeyan, Gunning (north of the study area), Young and Tumut (north-west of the study area). At the time of European settlement the Golden Sun Moth was widespread in south-eastern Australia and areas of suitable habitat were relatively well connected throughout its range.

It is now known from only five sites in Victoria, 44 sites in NSW, about 16 sites in the ACT (ACT Government, 2005; DECC 2005b; DEWHA, 2008e; 2009e). Most of the sites where Golden Sun Moth has been recorded are small and isolated, such as the St Johns site in the ACT, where the Golden Sun Moth was recorded within a small patch (approximately 600 m²) of natural grassland.

The Golden Sun Moth occurs in Natural Temperate Grasslands and grassy Box Gum Woodlands in which Wallaby Grass (*Austrodanthonia* spp.) dominates the ground layer. Habitat may contain other grasses, which are typically associated with Wallaby Grass, such as Spear Grass (*Austrostipa* spp.) or Kangaroo Grass (*Themeda australis*). Habitat could also occur in degraded grasslands dominated by the exotic Chilean Needlegrass (*Nassella neesiana*), a weed of national significance (DEWHA, 2008e).

Grasslands dominated by Wallaby Grass are typically low and open and the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males (DECC, 2005b). The Golden Sun Moth have also been recorded in paddocks alongside sheep and cattle (DECC, 2005b; DEWHA, 2009e).

The life cycle of the Golden Sun Moth is relatively well understood. The flying season is relatively short, typically lasting from six to eight weeks (during November and December in the ACT region). Males fly only in bright sunshine during the warmest part of the day. Adults emerge continuously throughout the flying season (DECC, 2005b), but only live for two to five days, as they cannot feed (DEWHA, 2008e).

After mating, it is believed that the females lay up to 200 eggs at the base of the *Austrodanthonia* tussocks. The eggs hatch after 21 days. The larvae tunnel underground where they remain feeding on the roots of *Austrodanthonia* before digging a vertical tunnel to the surface where the pupa remains for six weeks until the adult moths emerge (DEWHA, 2008e).

Female Golden Sun Moths have reduced hind wings and are reluctant to fly, even when disturbed. Males, which are capable of flight, will not fly greater than 100 m away from areas of suitable habitat. Thus populations separated by distances of greater than 200 m can be considered effectively isolated and populations which have gone extinct, or vacant patches of suitable habitat, are highly unlikely to be recolonised (DECC, 2005b).

No Golden Sun Moths were detected flying in the study area, although potential habitat is found within the study area along Old Cooma Rd and to the north of Reservoir Hill. Golden Sun Moths have been detected in areas to the west of the study area, approximately 400 m west of Old Cooma Road (Johnstone Centre, 2004). Therefore, the potential habitat that exists within the study area is considered to be isolated from the known habitat areas within the locality. If Golden Sun Moths are not currently present within the study area, it is unlikely that the suitable habitat within the study area would be recolonised,

Is there a real chance or possibility the action will lead to a long-term decrease in the size of a population of a species?

Within the study area, potential habitat for the Golden Sun Moth occurs within certain areas of the grassland vegetation community (see Section 5.2.2.2). Suitable habitat occurs in small areas, particularly around Reservoir Hill to the south-west of Neighbourhood 1A, the sewage pumping station to the south-east of Neighbourhood 1A, and along Old Cooma Rd.

Although these areas are heavily grazed, largely degraded pasture, they contain some native species, including *Austrodanthonia carphoides*, *Austrostipa* spp., *Chrysocephalum apiculatum*, *Convolvulus erubescence* and *Leptorhynchos squamosus*, which are considered to be preferred host plants for the Golden Sun Moth (eggs are laid at the base of the plants and larvae feed on the roots).

The Golden Sun Moth was not recorded in the study area in the current surveys. However, a population had been previously recorded approximately 400 m to the west of Old Cooma Road, in grassland to grassy woodland habitats of higher conservation value (Johnstone Centre, 2004). In contrast, the study area was described at that time as being heavily grazed pasture with some native species, including *Austrodanthonia carphoides* (Johnstone Centre, 2004).

Despite the lack of good quality habitat and records of the species in the study area, the proposal could impact on a population of Golden Sun Moth, if it were to be present within the study area. This species needs specific conditions to fly, and although it was not detected in the study area during surveys, it may occur. If the Golden Sun Moth were to occur within the study area, any disruption to potential habitat could impact on the breeding cycle and dispersal potential for this species, as areas of potential habitat within the study area are considered to be isolated from known habitat in the locality.

However, should it be determined that the Golden Sun Moth does not inhabit the study area it is unlikely that the proposal would lead to the long term decrease in the size of the species population.

Furthermore, a series of mitigation measures are to be implemented in potential Golden Sun Moth habitat (see **Section 7**). These include clearly marking out Golden Sun Moth potential habitat, and the removal of any topsoil in those areas with minimal disturbance, maintaining its natural soil profile, for later replacement. Implementation of such mitigation measures, both prior to and during the construction phase of the project is likely to minimise impacts to the potential Golden Sun Moth habitat.

Is there a real chance or possibility the action will reduce the area of occupancy of the species?

The Golden Sun Moth was not recorded in the study area. In 2004, a population was recorded to the west of Old Cooma Road (approximately 400 m) (Johnstone Centre, 2004). Within the study area, potential habitat for the Golden Sun Moth occurs within certain areas of the grassland vegetation community (see Section 5.2.2.2). Suitable habitat occurs in small areas, particularly around Reservoir Hill to the south-west of Neighbourhood 1A, the sewage pumping station to the south-east of Neighbourhood 1A, and along Old Cooma Rd.

Despite the lack of good quality habitat and records of the species in the study area, the proposal could impact on a population of Golden Sun Moth, if it were to be present within the study area. This species needs specific conditions to fly, and although it was not detected in the study area during surveys, it may occur. If the Golden Sun Moth were to occur within the study area, any disruption to potential habitat could impact on the breeding cycle and dispersal potential for this species, as areas of potential habitat within the study area are considered to be isolated from known habitat in the locality.

However, should it be determined that the Golden Sun Moth does not inhabit the study area, it is unlikely the proposal will reduce the area of occupancy for this species. Furthermore, mitigation measures will be implemented prior and during construction phase of the project, and these are likely to minimise impacts to potential Golden Sun Moth habitat.

Is there a real chance or possibility the action will fragment an existing population into two or more populations?

The nearest population of the Golden Sun Moth is approximately 400m to the west of Old Cooma Road. The only other record within 10 km is approximately 5 km to the north-west of the study area. Golden Sun Moths are poor flyers, and gaps of 200 m can fragment a population. The areas of potential habitat within the study area are considered isolated from these known habitat areas.

Degraded pasture, access roads, intensive grazing and sheep trails already fragment the potential habitat for the Golden Sun Moth in the study area, with suitable habitat occurring in small areas, particularly around Reservoir Hill to the south-west of Neighbourhood 1A, the sewage pumping station to the south-east of Neighbourhood 1A, and along Old Cooma Rd.

The draft guidelines for determining a significant impact on the Golden Sun Moth (under the EPBC Act) suggest that fragmentation of a population through the introduction of barriers to dispersal (such as through creating gaps of greater than 200 m, or structures that prohibit movement) would be considered a significant impact (DEWHA, 2009e).

The Water Cycle Project infrastructure proposed within areas of potential habitat for the Golden Sun Moth is predominantly linear infrastructure and will include a 20 m wide trench with working areas around the trench. The edges of this working area would be bound by temporary exclusion fencing. If the Golden Sun Moth is found to occur within the study area, the construction of this pipeline would temporarily disturb its habitat to some extent, but the proposal is not likely to result in structures that would prohibit movement.

However, with the implementation of the recommended mitigation measures, the fragmentation of habitat is only likely to be temporary. Therefore, if the Golden Sun Moth is present within the study area (i.e. that it is proved that an existing population is present), it is unlikely that the Water Cycle Project would fragment an existing population into two or more.

It is also noted that the proposed subdivision for Googong New Township (being assessed in a separate report under Part 4 of the EP&A Act) could fragment an existing population of the Golden Sun Moth if the species is found to occur within the study area. Therefore, cumulative impacts of the subdivision and the Water Cycle Project should be considered in both assessments.

Is there a real chance or possibility the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Golden Sun Moth (DECC, 2008; DEWHA, 2008d).

Wallaby Grass (*Austrodanthonia* spp.) tussocks are believed to be important for the survival of the species, as it lays its eggs at the base of these plants and the larvae feed on them. Habitat may contain other grasses, which are typically associated with Wallaby Grass, such as Spear Grass (*Austrostipa* spp.) or Kangaroo Grass (*Themeda australis*). Habitat could also occur in degraded grasslands dominated by the exotic Chilean Needlegrass (*Nassella neesiana*), a weed of national significance (DEWHA, 2008e).

If the Golden Sun Moth is present in the study area, even partially degraded patches of native grassland habitat would be critical to the survival of the local population and such habitat would be adversely affected by the proposal.

Is there a real chance or possibility the action will disrupt the breeding cycle of a population?

Grassland vegetation within the study area contains species, including *Austrodanthonia carphoides*, which are important for the breeding cycle of the Golden Sun Moth. After mating, the Golden Sun Moth deposits its eggs at the base of tussocks of *Austrodanthonia* grasses, but may also use tussocks of *Austrostipa* spp. and other grasses as well. When the eggs hatch and the larvae emerge, they tunnel underground where they remain feeding on the roots of the grass species (DEWHA, 2008e).

If the Golden Sun Moth is present within the study area, the breeding cycle of this population could be affected by the removal of vegetation and other disturbance during the construction of the Water Cycle Project infrastructure. Clearing and grubbing of vegetation, stripping and stockpiling of topsoil, bulk excavation and trench excavation would disrupt the remaining native grasses, including *Austrodanthonia* habitat, thus disrupting potential breeding and foraging habitat for the Golden Sun Moth.

Is there a real chance or possibility the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Within the study area, potential habitat for the Golden Sun Moth occurs within certain areas of the grassland vegetation community (see Section 5.2.2.2). Suitable habitat occurs in small areas, particularly around Reservoir Hill to the south-west of Neighbourhood 1A, the sewage pumping station to the south-east of Neighbourhood 1A, and along Old Cooma Rd.

The draft guidelines for determining a significant impact on the Golden Sun Moth (under the EPBC Act) suggest that habitat loss, degradation or fragmentation of greater than 0.5 ha for a large area of habitat (greater than 10 ha), or any habitat loss, degradation or fragmentation for small or fragmented habitat areas could be considered a significant impact (DEWHA, 2009e).

The potential habitat that occurs within the study area is considered to be small and fragmented. As such, a significant impact could result from disturbance associated with the proposal, should the Golden Sun Moth be present within the study area.

If the species is not present, it is unlikely that disturbance to the potential habitat within the study area would not affect the habitat sufficiently to lead to the decline of the species. Furthermore, the implementation of mitigation measures prior to and during the construction phase of the project is likely to minimise impacts to potential Golden Sun Moth habitat.

Is there a real chance or possibility the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat?

Grassland habitat in the study area has been previously disturbed and is currently subjected to heavy grazing and pasture improvement. The study area currently contains a variety of exotic species, which dominate the landscape.

Provided that best practice weed management practices (to be outlined in the Flora and Fauna Management Plan) are implemented prior to and during construction, such as washing down of vehicles and machinery; and integrated weed control (using no drift herbicides and/ or fire regimes to avoid spread of weed), it is unlikely that the proposal would result in an increase in the establishment of invasive species that may be harmful to the potential habitat of the Golden Sun Moth.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

At present, there are no currently known disease records for the Golden Sun Moth. If the species is present within the study area it is unlikely that the proposal would introduce any known diseases that may cause the species to decline.

Is there a real chance or possibility the action will interfere substantially with the recovery of the species?

A national recovery plan for the Golden Sun Moth is currently in preparation by DECC (DEWHA, 2008e; 2009e). Until this plan becomes available, a range of priority actions are recommended to help the Golden Sun Moth recovery, including the following:

- Search for the species in suitable habitat in areas that are proposed for development or management actions;
- Do not change management of sites where species exists unless changes are likely to be beneficial;
- Do not destroy habitat and surrounding areas by ploughing and do not allow heavy, prolonged grazing on habitat;
- Retain and protect natural grassland remnants within the known distribution of the species; and
- Ensure remnant populations remain connected or linked to each other; in cases where remnants have lost connective links, re-establish links by revegetating sites to act as stepping-stones for dispersal.

As previously discussed, the current landuse (intensive animal farming and grazing) has resulted in severely degraded grassland habitat, where some patches of native species occur. The level of fragmentation of habitat is already high.

The nearest population of the Golden Sun Moth is approximately 400m to the west of Old Cooma Road. The only other record within 10 km is approximately 5 km to the north-west of the study area. Golden Sun Moths are poor flyers, and gaps of 200 m can fragment a population. The areas of potential habitat within the study area are considered isolated from these known habitat areas.

Initial surveys have been undertaken for the Golden Sun Moth and it has not been found within the study area. Further surveys are proposed to be conducted during the appropriate survey season, in accordance with the first priority action as noted above. If present, the areas of potential habitat within the study area provide opportunities to assist in the recovery of the species

Should the Golden Sun Moth be found during these additional surveys, ecological advice will be sought regarding the appropriate management and mitigation measures that should be undertaken for the areas of suitable habitat within the study area. However, if the Golden Sun Moth is not found in these surveys, and the recommended mitigation measure are implemented, it is unlikely the Proposal would interfere with the recovery of the species as the disturbance to its potential habitat is likely to be only temporary.

Conclusion

If present, the proposed activities are likely to modify and/or remove potential habitat for the Golden Sun Moth. Further surveys for the Golden Sun Moth should be undertaken to confirm this approach and/or to provide data for the referral process. If the species is found to be present, given the sensitivity of the species to development and considering the precautionary principle, a referral under the provisions of the EPBC Act is recommended for this species.

Grassland Earless Dragon (*Tympanocryptis pinguicolla*)

The Grassland Earless Dragon is listed as endangered under the EPBC and TSC Acts.

Historically, the Grassland Earless Dragon ranged from Bathurst to Cooma, including the ACT region and Victoria. The only populations now known are in the ACT and adjacent NSW at Queanbeyan, and on the Monaro between Cooma and south-west of Nimmitabel (DECC, 2005c).

The Grassland Earless Dragon is restricted to a small number of Natural Temperate Grassland sites dominated by Wallaby Grass (*Austrodanthonia* spp.), Spear Grass (*Austrostipa* spp.), Poa Tussock (*Poa sieberiana*), Red Grass (*Bothriochloa macra*), and occasionally, Kangaroo Grass (*Themeda australis*). Introduced pasture grasses occur at many of the sites supporting this species, which has also been captured in secondary grassland habitat.

The dragon prefers open areas, characterised by small patches of bare ground between the grasses and herbs. Partially embedded surface rocks, and spider and insect holes are used for shelter. Rocks and arthropod holes provide important thermal refuges during temperature extremes (DECC, 2005c).

Females are oviparous, and have been found gravid in both spring and early summer, with the eggs laid in late spring or early summer. Clutches of between three and six eggs are laid. Young emerge in summer and early autumn. Some adults must live longer than one year (Robertson and Cooper, 2000).

Is there a real chance or possibility the action will lead to a long-term decrease in the size of a population of a species?

Pitfall traps were inspected every day from early November to early December, and spider burrows every three days for the remainder of December and January. No Grassland Earless Dragons were detected in the study area, and none have been recorded in the locality.

Potential habitat for the Grassland Earless Dragon occurs within the grassland habitat. However, this habitat, which is degraded pasture dominated by introduced species, with some native grassland species in patches, is continually subject to intensive grazing.

Given the lack of good quality habitat, and lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project, it is unlikely that the proposal would lead to a decrease in the size of a population of the Grassland Earless Dragon within the study area.

Is there a real chance or possibility the action will reduce the area of occupancy of the species?

No Grassland Earless Dragons have been recorded in the locality. The species is restricted to a small number of Natural Temperate Grassland sites dominated by Wallaby Grass (*Austrodanthonia* spp.), Spear Grass (*Austrostipa* spp.), Poa Tussock (*Poa sieberiana*), Red Grass (*Bothriochloa macra*), and occasionally, Kangaroo Grass (*Themeda australis*).

Given the lack of good quality habitat, and lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project works, it is unlikely that the action would reduce the area of occupancy of a population of the Grassland Earless Dragon within the study area.

Is there a real chance or possibility the action will fragment an existing population into two or more populations?

Little is known about the movements of the Grassland Earless Dragon (DEWHA, 2008h). No Grassland Earless Dragons have been recorded in the locality. Grazing and roads already fragment potential habitat in the locality. Given the lack of good quality habitat, and lack of records of the species in the locality, and the small area that will be directly impacted by the water reticulation works, it is unlikely that the action would fragment a population of the Grassland Earless Dragon within the study area.

Is there a real chance or possibility the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Grassland Earless Dragon (DECC, 2008, DEWHA, 2008d).

Is there a real chance or possibility the action will disrupt the breeding cycle of a population?

The majority of the study area is grazing land with little surface rock cover. In most paddocks, there is very little cover of native grasses; most of the study area being dominated by a variety of introduced species, including Barley Grass (*Hordeum* spp.).

Potential grassland habitat for the Grassland Earless Dragon within the study area occurs in small patches of pasture containing native species and outcropping surface rocks. This habitat occurs south-west of Neighbourhood 1A, near Reservoir Hill, the sewage pumping station site to the south-east of Neighbourhood 1A, and along the road sides. Habitat features within these areas, such as partially embedded surface rocks, spider and insect holes could be used for shelter and laying of eggs.

Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the proposed works, it is unlikely that the action would disrupt the breeding cycle of the Grassland Earless Dragon within the study area.

Is there a real chance or possibility the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The majority of the study area is grazing land with little surface rock cover. In most paddocks, there is very little cover of native grasses; most of the study area being dominated by a variety of introduced species.

Potential grassland habitat for the Grassland Earless Dragon occurs within the study area to the south-west of Neighbourhood 1A around Reservoir Hill; the sewage pumping station site to the south-east of Neighbourhood 1; and along the road sides. These areas contain some native grass species, including *Austrodanthonia carphoides*, *Austrostipa* spp., and native forbs, including *Chrysocephalum apiculatum*, *Convolvulus erubescens* and *Leptorhynchus squamatus*. However, this habitat is considered to be in poor to moderate condition for this species, due grazing and pasture management.

Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the water reticulation works, it is unlikely that the action would decrease the availability or quality of habitat to the extent that the Grassland Earless Dragon is likely to decline.

Is there a real chance or possibility the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat?

The study area has been previously disturbed and is currently subjected to pasture improvement and grazing. The groundcover currently contains a number of exotic species. It is unlikely that other invasive plant species, which may be harmful to the Grassland Earless Dragon, will become established in this area as a result of the proposed works. However, the change of land use from grazing to residential may result in higher numbers of cats and dogs, which may be harmful to the dragon, if present.

Is there a real chance or possibility the action will introduce disease that may cause the species to decline?

There are no currently known disease records for the Grassland Earless Dragon. It is not possible to know whether the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility the action will interfere substantially with the recovery of the species?

DEWHA has developed a National Recovery Plan for the Grassland Earless Dragon (Robertson and Cooper, 2000). The recovery objectives outlined in this plan that may be relevant to the proposal include:

- Determine the distribution and abundance of Grassland Earless Dragon;
- Identify the nature and extent of the processes, which threaten the species and its habitat; and
- Increase landholder and other community awareness and knowledge, and involve the community in aspects of the recovery program.

Given the level of survey effort, lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project, it is unlikely that the action would interfere with the recovery of the Grassland Earless Dragon.

Conclusion

Based on the above assessment, the Grassland Earless Dragon is unlikely to be significantly impacted by the proposed activities, and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

Regent Honeyeater (*Anthochaera phrygia*)

The Regent Honeyeater is listed as endangered under the EPBC and TSC Acts.

The Regent Honeyeater occurs in dry open eucalypt forests and woodland, usually being associated with Box-Ironbark assemblages or wet lowland coastal forests (DECC, 2005d; Menkhorst *et al.*, 1999). The main food resources for the Regent Honeyeater are nectar (from eucalypts and mistletoe) and arthropods (which are most important during the breeding season) (DECC 2005d; Menkhorst *et al.*, 1999).

The Regent Honeyeater relies on nectar from a small number of eucalypt species - Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Yellow Box (*E. melliodora*) and Yellow Gum (*E. leucoxylon*) (Franklin *et al.*, 1989; Webster and Menkhorst, 1992). Recent studies have added to the number of eucalypt species from which Regent Honeyeaters obtain nectar, but have also reinforced the significance of nectar from Mugga Ironbark, White Box and Yellow Box (Menkhorst *et al.*, 1999).

Only three breeding strongholds remain for the Regent Honeyeater, one in north-east Victoria and two in NSW (Capertee Valley and the Bundarra-Barraba region). Breeding usually occurs between July and January within these regions, after which, responding to flowering events, or a lack of food resources in the breeding areas (or a combination of both) the species may move to other areas. Breeding pairs construct nests in eucalypts with rough or fibrous bark (for weaving into nests) or within clumps of mistletoe on smooth-barked eucalypts (DECC, 2005d; Menkhorst *et al.*, 1999). Breeding has also been recorded in a number of other locations when conditions are not favourable at the key breeding sites.

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

The Regent Honeyeater has not been recorded within 10 km of the study area and is not known to breed in the region. The proposal would remove predominantly cleared or modified grassland and woodland. Within the study area, limited potential habitat occurs within roadside vegetation and paddock trees (including Yellow Box), and the vegetation associated with Googong Creek. North of the study area, potential foraging habitat occurs in the Queanbeyan River corridor where flowering native trees (including Yellow Box) are abundant.

Regent Honeyeaters may visit isolated flowering trees such as those that occur in the study area opportunistically on rare occasions. Given the poor quality of the foraging habitat that would be impacted, the action is not likely to lead to a long-term decrease in the size of a population of the species.

Is there a real chance or possibility that the action will reduce the area of occupancy of the species?

The species has not been recorded within 10 km of the study area. The study area contains isolated native trees that may provide some foraging opportunities for this species. The low number of these trees would be unlikely to support Regent Honeyeaters for longer than a brief visit. There are extensive wooded areas nearby that represent much richer potential foraging grounds for this species. This species is nomadic and highly mobile. It is unlikely the proposal would reduce the area of occupancy for this species.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

The Regent Honeyeater is a highly mobile species that migrates on a seasonal basis. Fragmentation of habitat can open the species up to invasion by the aggressive native Noisy Miner (*Manorina melanocephala*), a species which can exclude other birds from areas they inhabit (Piper and Catterall, 2003), and can invade between 150 to 300 m from forest edges (Clarke and Oldland, 2007).

However, in this instance the study area is already exposed to these fragmentation impacts and therefore, fragmentation and isolation of vegetation within the study area is unlikely to further impact on this species. The proposal is unlikely to fragment an existing population of this species into two or more populations.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of threatened species, populations or ecological communities. The Minister, under the EPBC Act maintains a Register of Critical Habitat. To date, no critical habitat has been declared for the Regent Honeyeater (DECC, 2008; DEWHA, 2008d).

The study area contains isolated and often struggling native trees that may provide foraging opportunities for this species. The low number of these trees would be unlikely to support Regent Honeyeaters for longer than a brief visit. There are extensive wooded areas nearby that represent much richer potential foraging grounds for this species. The proposal is considered unlikely to affect habitat critical to the survival of the species.

Is there a real chance or possibility that the action will disrupt the breeding cycle of a population?

Only three breeding strongholds remain for the Regent Honeyeater, one in north-east Victoria and two in NSW (Capertee Valley and the Bundarra-Barraba region).

The Regent Honeyeater has not been recorded within 10 km of the study area. The species is not known to breed in the region. Potential foraging habitat occurs in the Queanbeyan River corridor to the north of the study area where flowering native trees are abundant, however, native trees in the study area are uncommon, isolated, and often in poor condition. It is therefore unlikely the proposal would result in an impact on the breeding cycle of the species.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Regent Honeyeater relies on nectar from a small number of eucalypt species - Mugga Ironbark, White Box, Yellow Box and Yellow Gum (Franklin *et al.*, 1989; Webster and Menkhorst, 1992). Within the study area, limited potential habitat occurs within roadside vegetation and paddock trees (including Yellow Box), and the vegetation associated with Googong Creek. Regent Honeyeaters may visit isolated flowering trees such as those that occur in the study area opportunistically on rare occasions.

The proposal would remove predominantly cleared or modified grassland and woodland. Much of the construction work associated with the proposal would take place in paddocks of the study area. There would be some clearing of roadside vegetation and paddock trees, which includes Yellow Box (*Eucalyptus melliodora*), a preferred feed tree. Vegetation along Googong Creek is unlikely to be impacted. As such, the proposal is unlikely to modify, remove, isolate or decrease the availability or quality of habitat to the extent that the species would decline.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat?

Grazing practices has previously disturbed the study area. As such, the groundcover contains exotic species, with some native species. However, the change of land use from grazing to residential may result in higher numbers of cats and dogs and increased competition from larger aggressive honeyeaters. Although not recorded during the current surveys, if this species occurs within the study area, an increase in such competition and predation may be harmful to the Regent Honeyeater.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

No diseases have been identified as threats to the Regent Honeyeater by DECC (DECC 2005d; Menkhorst *et al.*, 1999). It is considered unlikely that the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility that the action will interfere substantially with the recovery of the species?

DEWHA has developed a National Recovery Plan for the Regent Honeyeater (Menkhorst *et al.*, 1999). The recovery objective outlined in this plan relevant to the proposal is:

Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range, by active participation in land-use planning processes and by active vegetation rehabilitation at strategic sites.

Given the lack of good quality habitat and lack of records of the species in the locality, it is unlikely that the action would interfere with the recovery of the Regent Honeyeater.

Conclusion

Based on the above assessment, the Regent Honeyeater is unlikely to be significantly impacted by the proposed activities, and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

Swift Parrot (*Lathamus discolor*)

The Swift Parrot is listed as Endangered under both the EPBC and TSC Acts.

The Swift Parrot occurs from southern Queensland to South Australia and Tasmania. Breeding occurs only in Tasmania. Swift Parrots migrate in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland (DECC, 2005f). During the non-breeding season large flocks congregate at suitable feeding resources throughout eastern NSW.

The Swift Parrot prefers open eucalypt forests where it feeds on nectar and lerps. Preferred feed trees include Swamp Mahogany (*Eucalyptus robusta*), Mugga Ironbark (*E. sideroxylon*), White Box (*E. albens*) and Spotted Gum (*Corymbia maculata*) (Higgins, 1999), and Red Ironbark (*E. tricarpa*), Grey Box (*E. microcarpa*), and Yellow Gum (*E. leucoxydon*) are important sources of nectar in the box-ironbark forests and woodlands of Victoria and NSW (Swift Parrot Recovery Team, 2001). The Swift Parrot returns to some foraging sites on a cyclic basis depending on food availability (DECC, 2005f).

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population of a species?

There is an estimated 2000 breeding Swift Parrots known in Tasmania (DEC, 2005o; DECC, 2005f; DEWHA, 2008c). During the autumn and winter migration to south-eastern Australia the species can be found from Victoria and the eastern parts of South Australia to south-east Queensland. The main concentration of Swift Parrots outside the breeding season is in Victoria (Forshaw and Cooper, 2002).

Within the study area, limited potential habitat occurs within roadside vegetation, paddock trees, and the vegetation associated with Googong Creek. Swift Parrots may visit isolated flowering trees such as those that occur in the study area opportunistically on rare occasions. The proposal would remove predominantly cleared or modified grassland and woodland. Given the poor quality of the foraging habitat that would be impacted, the action is not likely to lead to a long-term decrease in the size of a population of the species.

Is there a real chance or possibility that the action will reduce the area of occupancy of the species?

Swift Parrots breed in Tasmania during spring and summer, and migrate in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW, the species mostly occurs on the coast and south-west slopes. The proposal is not likely to reduce the area of occupancy of this species.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

The Swift Parrot is an autumn and winter migrant to NSW. It returns to some foraging sites on a cyclic basis depending on food availability (DECC, 2005f). This species is highly mobile and moves large distances readily. The study area is already fragmented and somewhat isolated. The proposal would not increase the fragmentation or isolation of potential habitat within the study area for this species. Therefore, the proposal is unlikely to fragment an existing population of this species into two or more populations.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been declared for the Swift Parrot (DECC, 2008; DEWHA, 2008d).

The study area contains isolated and often struggling native trees that may provide foraging opportunities for this species. The low number of these trees would be unlikely to support Swift Parrots for longer than a brief visit. There are extensive wooded areas nearby that represent much richer potential foraging grounds for this species. The proposal is considered unlikely to affect habitat critical to the survival of the species.

Is there a real chance or possibility that the action will disrupt the breeding cycle of a population?

Swift Parrots breed only in Tasmania. During the non-breeding season large flocks congregate at suitable feeding resources throughout eastern NSW. The Swift Parrot has not been recorded within the study area or 10 km from the study area, but the species is known to pass through the Canberra region (Swift Parrot Recovery Team, 2001).

Clearing for the works in the proposal would remove some isolated native trees that could potentially provide a very limited source of food for this species. This is unlikely to disrupt the breeding cycle of a population of the species as more extensive foraging resources exist nearby and the species is only likely to visit the locality in response to changes in food availability, with no breeding occurring in the area.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Swift Parrot prefers open eucalypt forests where it feeds on nectar and lerps. Preferred feed trees include *Eucalyptus robusta*, *E. sideroxylon*, *E. albens* and *Corymbia maculata* (Higgins 1999). Within the study area, limited potential habitat occurs within roadside vegetation, paddock trees, and the vegetation associated with Googong Creek.

These trees are few, are not preferred species with high nectar production, and many are in poor condition. Swift Parrots may visit isolated flowering trees such as those that occur in the study area opportunistically on rare occasions. Woodland adjacent to the study area is in moderate to good condition with a variety of native trees in much higher densities. These nearby woodlands therefore represent better quality foraging habitat for this species than the study area.

The proposal would remove predominantly cleared or modified grassland and woodland. Much of the construction work associated with the proposal would take place in paddocks of the study area. There would be some clearing of roadside vegetation and paddock trees. Vegetation along Googong Creek is unlikely to be impacted. As such, the proposal is unlikely to modify, remove, isolate or decrease the availability or quality of habitat to the extent that the species would decline.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat?

Predation or competition by invasive species is not listed as a threat to the Swift Parrot by the DECC or DEWHA (Swift Parrot Recovery Team, 2001). The study area is currently mostly pasture-improved with exotic groundcover, with some native flora species.

Although not recorded during the current survey, if this species occurs within the study area, the change of land use from grazing to residential may result in higher numbers of cats and dogs and more vehicle collisions, which may be harmful to the Swift Parrot.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

Infection by *Psittacine circoviral* (beak and feather) disease (PCD) affecting endangered psittacine species is listed as a Key Threatening Process (NSW Scientific Committee, 2008c; DEH 2005b).

Swift Parrots are considered to have a high potential for being adversely impacted by PCD due to their low population numbers and that PCD has been recorded in wild birds in NSW (NSW Scientific Committee, 2008c). The PCD virus is thought to spread through the sequential use of nest sites (Bassami *et al.*, 1998). The virus can also be transferred into wild populations of susceptible parrots by release of birds that have been infected through captive breeding or care.

The proposal is unlikely to result in the introduction/spread of PCD into the study area, or increase the incidence of PCD in birds in NSW.

Is there a real chance or possibility that the action will interfere substantially with the recovery of the species?

DEWHA has developed a National Recovery Plan for the Swift Parrot (Swift Parrot Recovery Team, 2001). The recovery objective outlined in this plan relevant to the proposal is:

To implement management strategies at the landscape scale to protect and improve priority habitats and sites resulting in a sustained improvement in carrying capacity.

Given the lack of good quality habitat and lack of records of the species in the locality, it is unlikely that the action would interfere with the recovery of the Swift Parrot.

Conclusion

Based on the above assessment, the Swift Parrot is unlikely to be significantly impacted by the proposed activities, and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

Vulnerable Species

Species listed as vulnerable under the EPBC Act that have potential habitat in the study area and could occur on the site include Pink-tailed Legless Lizard, Striped Legless Lizard and Superb Parrot.

The Pink-tailed Legless Lizard was recorded in the study area. Populations of these species that do or may occur within the proposal footprint are considered important populations, because they:

May be necessary for maintaining genetic diversity; and/or

The study site is at or near the limit of the species range.

These are assessed, as given below, according to the Significant Impact Criteria for Vulnerable species (DEH, 2006a).

Pink-tailed Legless Lizard (*Aprasia parapulchella*)

The Pink-tailed Legless Lizard is listed as vulnerable under the EPBC and TSC Acts.

The Pink-tailed Legless Lizard is a fossorial species, which lives beneath surface rocks and occupies ant burrows. It feeds on ants, particularly their eggs and larvae (Osborne and Jones 1995b). The Pink-tailed Legless Lizard is oviparous (egg laying) with a clutch size of two. Females may need to reach an age of about 3 or 4 years before they can reproduce. There is little data on the breeding behaviour of this species. The Pink-tailed Legless Lizard is thought to lay eggs within the ant nests under rocks that it uses as a source of food and shelter (DEC, 2005e).

Key habitat features for the presence of the Pink-tailed Legless Lizard are a cover of native grasses, particularly Kangaroo Grass (*Themeda australis*), sparse or no tree cover, little or no leaf litter, and scattered small rock with shallow embedment in the soil surface.

The distribution of the species is centred on the ACT and this appears to be related to less soil (and rock) disturbance evidenced by the presence of a native grass cover, particularly Kangaroo Grass, Red-leg Grass (*Bothriochloa macra*) and Wattle Mat-rush (*Lomandra filiformis*). The likelihood of occurrence of Pink-tailed Legless Lizard increases with increasing cover of Kangaroo Grass. By contrast, increase in cover of spear grasses (*Austrostipa* spp.) and Common Tussock Grass (*Poa labillardierei*) decreases the likelihood of finding the species (ACT Government, 2007d).

The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region (DEC, 2005e). The study area is at the south-eastern limit of the distribution for this species.

The species was recorded at two locations in rocky outcrop at the proposed sewage pumping stations (near the Montgomery Creek) in the study area. This population is considered important for dispersal and maintaining of genetic diversity in the area. Another population is known from north of the study area within the 'Talpa' property (Johnstone Centre, 2004)

Is there a real chance or possibility the action will lead to a long-term decrease in the size of an important population of a species?

The population of Pink-tailed Legless Lizard associated with the rocky outcrops and the area to the south-east is likely to extend to other outcrops in the area. Any disturbance to the surface rock in this location could impact on the available habitat for the localised population. Any reduction in habitat could impact the size of the population, and therefore its genetic diversity.

Given the lack of information regarding the placement of the sewage pumping stations and the works associated with the pipelines, the precise impacts cannot be determined. A long-term decrease in the size of the population could result from the proposal. It is recommended that the sewage pumping station be located away from the outcropping surface rock to avoid disturbance to this species. If this is done, the proposal is unlikely to decrease the size of the population.

Is there a real chance or possibility the action will reduce the area of occupancy of an important population?

Pink-tailed Legless Lizard was recorded near the proposed sewage pumping station and in continuous habitat to the south-east. The area where the species occurred was an outcrop of surface rock on the side of a hill in a cleared paddock.

The outcrop near the proposed sewage pumping station is linked to other outcrops on hillsides to the east. Any disturbance to the surface rock at this location could impact on the available habitat for the localised population. Significant disturbance to the amount of surface rock could impact the area of occupancy of the species in the study area. It is recommended that the sewage pumping station is located away from the outcropping surface rock to avoid disturbance to this species.

While the population could be impacted, the works are expected to occur on the edge of the habitat area, and thus, the area of occupancy for the important population is not likely to reduce significantly.

Is there a real chance or possibility the action will fragment an existing important population into two or more populations?

The presence of Pink-tailed Legless Lizard was recorded near the proposed sewage pumping station in the south-east of the study area. One live individual and one shed skin were recorded. The two records were within 1 m of each other. These recordings were from an outcrop of surface rock on the side of a hill in a cleared paddock. The outcrop was less than 0.5 ha in size and was linked to other outcrops on hillsides to the south-east.

The population of Pink-tailed Legless Lizard associated with this gully system may extend to other rock outcrops in the area. Any disturbance to the surface rock in this location could impact on the available habitat for the localised population and could significantly impact this species in this area.

Given the lack of information regarding the placement of the sewage pumping stations and the works associated with the pipelines, the precise impacts cannot be determined. An important population could be, therefore, fragmented into two or more populations.

It is recommended that the sewage pumping station is located away from the outcropping surface rock to avoid disturbance to this species. If this is done the action is unlikely to fragment the population.

Is there a real chance or possibility the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Pink-tailed Legless Lizard (DECC, 2008; DEWHA, 2008d).

Surface rocks, which are shelters for both the Pink-tailed Legless Lizard and ants, provide burrows and food for the lizard. These shelters are considered vital for the survival of the species (DEC, 2005e).

Given the lack of information regarding the placement of the pumping stations and the works associated with the pipelines, the precise impacts cannot be determined. Therefore, critical habitat could be impacted. It is recommended that the sewage pumping station be located away from the outcropping surface rock to avoid disturbance to this species. If this is done the action is unlikely to impact habitat vital to the population in the study area.

Is there a real chance or possibility the action will disrupt the breeding cycle of an important population?

Pink-tailed Legless Lizard was recorded near the proposed sewage pumping station. One live individual and one shed skin were recorded. The two records were within 1 m of each other. The area where these were recorded was an outcrop of surface rock on the side of a hill in a cleared paddock. The outcrop was less than 0.5 ha in size and was linked to outcrops on hillsides to the south-east, where additional individuals were recorded.

The population of Pink-tailed Legless Lizard associated with this gully system may extend to other outcrops in the area. Any disturbance to the surface rock in this location could impact on the available habitat for the localised population. Any reduction in habitat could impact the size of the population, and therefore its genetic diversity.

Significant disturbance to the amount of surface rock could significantly impact on the populations of this species in this area. Given the lack of information regarding the placement of the sewage pumping stations and the works associated with the pipelines, the precise impacts cannot be determined. Disruption of surface rocks could impact on the breeding cycle of an important population.

It is recommended that the pumping station is located away from the outcropping surface rock to avoid disturbance to this species. If this is done, the proposal is unlikely to disrupt the breeding cycle of the population.

Is there a real chance or possibility the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

A sewage pumping station is proposed for construction in the vicinity of the Pink-tailed Legless Lizard population recorded in the study area. This will involve some excavation at the site of the sewage pumping station and installation of pipes to and from the pumping station. An access road will also be required.

Most of the groundcover in the area is introduced pasture species with some native species, such as *Austrodanthonia carphoides*, *Austrostipa* spp., *Chrysocephalum apiculatum*, *Convolvulus erubescens* and *Leptorhynchos squamatus*. Grazing in this area will cease when the new township is built, which should allow some regeneration of the native groundcover in the undeveloped areas.

The precise location of the pumping station will determine the level of direct impacts on the Pink-tailed Legless Lizard. The outcropping surface rock is very localised, and the sewage pumping station could be located on hillsides where there is no outcropping surface rock. This would avoid or minimise impacts to the species.

Given the lack of information regarding the placement of the pumping stations and the works associated with the pipelines, the precise impacts cannot be determined. Disruption of habitat could impact on the breeding cycle of an important population. However, the impacts are not likely to lead to the overall decline of the species.

Is there a real chance or possibility the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The area where the Pink-tailed Legless Lizard is currently located contains a mix of exotic and native plant species. It is unlikely the proposal would result in the establishment of further invasive plant species that may be harmful to the Pink-tailed Legless Lizard.

However, the change of land use from grazing to residential may result in higher numbers of cats and dogs, which may prey upon the lizard, particularly at night.

Is there a real chance or possibility the action will introduce disease that may cause the species to decline?

At present there are no currently known disease records for the Pink-tailed Legless Lizard. It is not possible to know whether the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility the action will interfere substantially with the recovery of the species?

No recovery plan has been prepared for this species. However, the DECC has provided a number of priority actions and recovery strategies to assist with its recovery (DEC 2005g). Relevant actions include:

- Provide incentive payments for protection and enhanced management of known sites;
- Reserve or ensure long-term management of known populations;
- Ensure remnant populations remain connected or linked to each other;
- Develop and implement a site management plan for Googong Foreshore Reserve;
- Develop guidelines for habitat identification, enhancement and management;
- Do not plant trees and shrubs into habitat; and
- Keep domestic dogs and cats indoors at night.

It is recommended that the sewage pumping station is located away from the outcropping surface rock to avoid disturbance to the population that exists in the area. However, there is no guarantee that the population will be preserved or maintained in the long-term, if potential habitat is significantly modified and/or removed.

Conclusion

Given the possible direct impact to a localised population, and applying the precautionary principle, it is recommended that a referral under the provisions of the EPBC Act be prepared for this species. However, if the sewage pumping station (SPS2) and associated works are restricted to greater than 20 m outside of potential habitat for the Pink-tailed Legless Lizard, and appropriate management measures are implemented, there would be minimal impact upon this species.

Striped Legless Lizard (*Delma impar*)

The Striped Legless Lizard is listed as Vulnerable under the EPBC and TSC Act.

The Striped Legless Lizard occurs in the Southern Tablelands, the South Western Slopes and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas (DECC, 2005e). The formerly continuous distribution around the ACT has been reduced to four discrete areas: Gungahlin, the lower Majura Valley, the lower Jerrabomberra Valley and Yarramundi Reach. It also occurs in Victoria and south-eastern South Australia (DEWHA, 2008b). The study area is at the eastern limit of distribution for this species.

The Striped Legless Lizard is found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component, and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass (*Themeda australis*), spear-grasses (*Austrostipa* spp.) and Poa tussocks (*Poa* spp.), and occasionally wallaby grasses (*Austrodanthonia* spp.). It is sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter (DECC, 2005e).

Striped Legless Lizards usually have small home ranges, with lizards often recaptured less than 10 m from the original capture site. However, individuals have also been recorded moving over 60 m from their original capture point. The species forages for ground invertebrates, such as wolf spiders and crickets (DEWHA, 2008b).

The lifespan of the species is estimated to be at least 10 years, with reproduction starting from two to three years for males and three to four years for females. Females lay one clutch of two eggs in early to mid-summer and hatching occurs in late summer, 35 to 60 days after laying (Smith and Robertson, 1999).

Is there a real chance or possibility the action will lead to a long-term decrease in the size of an important population of a species?

Pitfall traps were inspected every day from early November to early December, and spider burrows every three days for the remainder of December and January. No Striped Legless Lizards were detected in the study area, and none have been recorded in the locality.

Most of the groundcover in the area is introduced pasture species with some native species occurring in patches. Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project, it is unlikely that the proposal would decrease the size of an important population of the Striped Legless Lizard within the study area.

Is there a real chance or possibility the action will reduce the area of occupancy of an important population?

Given that Striped Legless Lizards appear to have a small home range, there is potential for the proposal to impact the area of occupancy for this species if present. However, despite targeted surveys for this species (which appears to have a reasonable level of site fidelity), it was not recorded; nor has it been recorded in the locality previously.

Potential grassland habitat within the study area consists largely of introduced pasture species mixed with some native species. Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project, it is unlikely that the proposal would reduce the area of occupancy of an important population of the Striped Legless Lizard within the study area.

Is there a real chance or possibility the action will fragment an existing important population into two or more populations?

No Striped Legless Lizards have been recorded in the locality. While the species appears to occupy a small home range, it has been recorded moving over 60 m from its original point of capture. Some research indicates the species may range widely, possibly for hunting (Smith and Robertson 1999).

Most of the groundcover in the area is introduced pasture species, with some native species occurring in patches. Access roads, sheep trails, severe grazing and improved pasture in the locality already fragment the potential grassland habitat.

Given the lack of good quality habitat, lack of records of the species in the locality, the small area that will be directly impacted by the Water Cycle Project, combined with the species' ability to travel at least 60 m, it is unlikely that the proposal would fragment an important population of the Striped Legless Lizard within the study area.

Is there a real chance or possibility the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat. To date, no critical habitat has been listed for the Striped Legless Lizard (DECC, 2008; DEWHA 2008d). The Striped Legless Lizard is found mainly in Natural Temperate Grasslands, but has also been captured in grasslands that have a high exotic species component. Therefore, habitat that is critical to the survival of the species is unlikely to be adversely impacted by the proposal.

Is there a real chance or possibility the action will disrupt the breeding cycle of an important population?

The majority of the study area is grazing land with little surface rock cover. Potential grassland habitat within the study area occurs in small areas of pasture with some native species, particularly around the Reservoir Hill to the south-west of Neighbourhood 1A, the sewage pumping station site to the south-east of Neighbourhood 1A, and along the road sides. These areas could provide foraging and breeding habitat for the Striped Legless Lizard.

However, given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project, it is unlikely that the proposal would disrupt the breeding cycle of the Striped Legless Lizard within the study area.

Is there a real chance or possibility the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The water cycle infrastructure is to support the Googong New Township. Much of the area will be developed in the long-term. While some areas will be left for open space, they are unlikely to support habitat for this species.

Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project, it is unlikely that the proposal would decrease the availability or quality of habitat to the extent that the Striped Legless Lizard is likely to decline.

Is there a real chance or possibility the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The study area is currently intensively grazed, grassland habitat that contains a mixture of exotic and native species. It is unlikely that the proposal would result in the establishment of other invasive plant species in the study area that may be harmful to the Striped Legless Lizard.

However, the change of land use from grazing to residential may result in higher numbers of cats and dogs, which may prey upon the lizard, if present.

Is there a real chance or possibility the action will introduce disease that may cause the species to decline?

At present there are no currently known disease recorded for the Striped Legless Lizard. It is not possible to know whether the proposal would introduce any diseases that may cause the species to decline.

Is there a real chance or possibility the action will interfere substantially with the recovery of the species?

DEWHA has developed a National Recovery Plan for the Striped Legless Lizard (Smith and Robertson 1999). The recovery objectives in this plan that may be relevant to the proposal include:

- Determine the distribution of potential Striped Legless Lizard habitat;
- Identify the nature and extent of the threatening processes affecting Striped Legless Lizard; and
- Increase community awareness and involve the community in aspects of the recovery program.

Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the Water Cycle Project works, it is unlikely that the proposal would interfere with the recovery of the Striped Legless Lizard.

Conclusion

Based on the above assessment, the Striped Legless Lizard is unlikely to be significantly impacted by the proposed activities, and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

Superb Parrot (*Polytelis swainsonii*)

The Superb Parrot is listed as vulnerable under the EPBC and TSC Acts.

The Superb Parrot occurs mostly in riparian forest or woodland and surrounding plains of the Murrumbidgee and Murray Rivers. It feeds mainly on the ground in Box-Gum woodlands and wooded farmland within 10 km of the river, taking grass seeds and herbaceous plants as well as fruit, insects, grain, flowers, nectar, berries and buds (DEC, 2005g; Higgins, 1999). It nests in hollows, usually in dead branches, but sometimes in holes in the trunk of a tall tree (Higgins, 1999). The species is monogamous and is thought to maintain bonds year round (Higgins, 1999).

Is there a real chance or possibility the action will lead to a long-term decrease in the size of an important population of a species?

No Superb Parrots have been recorded in the locality. Potential habitat for the Superb Parrot in the study area consists of isolated paddock trees and some heavily grazed grass pastures, mostly consisting of Barley Grass but supporting some native grass species in some areas.

Nearby wooded areas contain better foraging habitat and nesting resources for this species, relatively free of nesting competition from the Common Starling. The latter are abundant in the study area and have been observed nesting in tree hollows.

It is considered unlikely that the study area represents important habitat for this species in the locality due to the lack of records of the species in the area and the low quality of the potential habitat compared to better quality potential habitat nearby. Therefore, the removal of some trees in the study area is not likely to lead to a long-term decrease in the size of an important population of the Superb Parrot.

Is there a real chance or possibility the action will reduce the area of occupancy of an important population?

The Superb Parrot has not been recorded in the study area and there is very limited foraging habitat in the study area. The proposal would involve removing a small number of hollow-bearing trees that may provide nesting resources for this species. Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the proposal, it is unlikely that the action would reduce the area of occupancy of an important population of the Superb Parrot within the study area.

Is there a real chance or possibility the action will fragment an existing important population into two or more populations?

Potential habitat for this species is probably widespread in the broader region, although habitat in the study area is likely to be marginal habitat, as the species prefers Red Gum forests and Box-Gum Woodlands with a grassy understorey. Tall native grasses are uncommon in the understorey in the woodlands in the area. Potential habitat in the study area is already fragmented due to past practices of clearing associated with pasture improvement and animal farming.

Given the lack of good quality habitat, lack of records of the species in the locality, high mobility of the species, and the small area that will be directly impacted by the proposal, it is unlikely that the action would fragment an important population of the Superb Parrot within the study area.

Is there a real chance or possibility the action will adversely affect habitat critical to the survival of a species?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. The Minister, under the EPBC Act, maintains a Register of Critical Habitat (DECC, 2008; DEWHA, 2008d). To date, no critical habitat has been listed for the Superb Parrot.

Is there a real chance or possibility the action will disrupt the breeding cycle of an important population?

The Superb Parrot has not been recorded in the study area, or within 10 km of the study area. This species is a rare breeding summer migrant to the ACT and is generally restricted to the northern parts near Hall, Gungahlin and Belconnen (Taylor, 1992).

However, potential and marginal foraging and breeding habitat occurs in the nearby river corridor to the north of the study area, and the species could find some foraging and nesting resources in the study area.

Given that the species has not been recorded in the study area and wooded areas nearby contain better foraging and nesting habitat for this species than the study area, the removal of some existing vegetation in the study area is not likely to have an adverse effect on the life cycle of the Superb Parrot.

Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the proposal, it is unlikely that the action would disrupt the breeding cycle of the Superb Parrot within the study area.

Is there a real chance or possibility the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The majority of the study area is grazing land with few hollow-bearing trees. Much of the area will be developed in the long-term. Some areas will be left for open space, but they are unlikely to support habitat for this species. Given the lack of good quality habitat, lack of records of the species in the locality, and the small area that will be directly impacted by the proposal, it is unlikely that the action would decrease the availability or quality of habitat to the extent that the Superb Parrot is likely to decline.

Is there a real chance or possibility the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The study area is currently intensively grazed, grassland habitat that contains a mixture of exotic and native species. It is unlikely that the proposal would result in the establishment of other invasive plant species in the study area that may be harmful to the Superb Parrot.

However, the change of land use from grazing to residential may see an increase in cat, dog and Common Starling numbers in the area. Competition from Starlings for nesting opportunities and predation by domestic pets may be harmful to the Superb Parrots.

Is there a real chance or possibility the action will introduce disease that may cause the species to decline?

Infection by *Psittacine circoviral* (beak and feather) disease (PCD) affecting endangered psittacine species is listed as a Key Threatening Process (KTP) (NSW Scientific Committee, 2008c; DEH, 2005). Although Superb Parrots are not identified in the KTP, as a parrot, it may be susceptible to the disease.

The PCD virus is thought to spread through the sequential use of nest sites. The virus can also be transferred into wild populations of susceptible parrots by release of birds that have been infected through captive breeding or care. The proposal is unlikely to result in the introduction/spread of PCD into the study area, or increase the incidence of PCD in birds in NSW.

Is there a real chance or possibility the action will interfere substantially with the recovery of the species?

No recovery plan has been prepared for this species. However, DECC has provided a number of priority actions and strategies to assist with its recovery (DEC, 2005g). Relevant actions include the following:

- Provide financial incentives for protection and enhanced management of known sites;
- Retain known or potential box-gum foraging habitat;
- Retain and protect hollow-bearing trees; and
- Retain and protect woodland remnants.

No provision is included within the proposal for hollow tree recruitment. However, it is proposed that some hollows would be transferred to adjacent habitat and nest boxes installed. Remnant sizes and connectivity would not be reduced as a result of the proposal, but there is potential to increase connectivity and the availability of foraging resources with sympathetic planning and management of the environment as the new urban area is developed.

As no known habitat (only potential) was identified during the assessment, protection of known habitat with fencing has not been considered. As such, the proposal is considered consistent with the recovery actions outlined by the DECC (in absence of a recovery plan).

Conclusion

Based on the above assessment, the Superb Parrot is unlikely to be significantly impacted by the proposed activities, and as such, a referral under the provisions of the EPBC Act is not recommended for this species.

**Appendix 16 -
EPBC Act Impact Assessment -
Commonwealth Land**

The Googong Dam Area (commonly referred to as Googong Foreshores) is Commonwealth Land within NSW, managed by the ACT Government (ACT Government, 2007a).

The Googong Water Cycle Project (the proposal) is adjacent to and contains a small portion of the Googong Foreshores. The Googong Foreshores must, therefore, be assessed for direct and indirect impacts that could result from the proposal.

Impacts upon Commonwealth Land due to the Googong Water Cycle Project that relate to endangered ecological communities and threatened flora and fauna species are assessed here, in accordance with EPBC Act Policy Statement 1.2 (DEH, 2006b).

The components that need to be assessed include the 'environmental context' of the site, the potential impacts on that environment, and any impact avoidance or mitigation measures.

Self-Assessment

What are the components or features of the environment in the area where the action will take place?

The action will take place adjacent to and within a north-western section of the Googong Foreshores. The Googong Foreshores are located in New South Wales, to the south-east of the ACT and 13 km by road from Queanbeyan. The area encompasses the Googong Dam, a short section of the Queanbeyan River below the dam, the foreshore land extending about 1 to 3 km on either side of the reservoir. In the south, the Foreshore areas extend around 300 to 900 m on either side of the Queanbeyan River and Burra Creek (ACT Government, 2007a).

The Commonwealth Government acquired the area (5089 hectares) from New South Wales in 1973 for the purpose of constructing the Googong Dam. The foreshores are now part of the Canberra Water Supply and comprise about 6% of the total Queanbeyan River catchment of 87,300 ha (ACT Government, 2007a). Most of the catchment remains under the control of New South Wales.

The eastern foreshore rises to an elevation of about 950 m ASL, with steep local relief. The area is mostly tree-covered with dry sclerophyll forest that is typical of shallow, rocky and infertile soils on steep, hilly country in the NSW Southern Tablelands. On the western foreshore area, the elevation is lower (750 m) with gentler local relief. This area was formerly in pastoral holdings and had been previously extensively cleared for agriculture.

The Googong Foreshores Draft Plan of Management (ACT Government, 2007a) notes that the foreshores contain: *"...An extensive area of intact forest and woodlands, a diversity of habitats, threatened plant and animal species, and distinctive geological and geomorphological features. There are about 3000 ha of relatively open forest and woodland, mainly along the eastern escarpment, and about 1500 ha of partly cleared former grazing land, in which regeneration is occurring, to the west of the reservoir..."*

Placing the Googong Foreshores and its conservation value within its wider ecological context, the Draft Plan of Management notes that: *"...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 Googong Water Cycle Project (the proposal) is to provide water and wastewater infrastructure for the proposed Googong New Township, being developed on land located just to west of the Googong Foreshores. The main urban development would be located to the south of Googong Dam Road. This is the initial part of a new township that will be staged over 20 to 25 years to create a community of about 16,000 people (CIC, 2008b).

Some sections of the western foreshores are likely to be impacted by the proposed works to develop the water infrastructure for the development. These include the Googong Dam Road and its road verges, the access road leading to the Googong Water Treatment Plant (Googong WTP), land within the Googong WTP and a section of the Montgomery Creek and its riparian zone.

The Googong WTP site and its access road are essentially areas that had been cleared of their original vegetation for the development of the water infrastructure, and subsequently, rehabilitated.

The Googong Dam Road and its road verges are also much disturbed sites, which had been rehabilitated in the past. It is understood that the ownership of the Googong Dam Road corridor is in the process of being transferred from the Commonwealth to the Queanbeyan City Council.

Detailed descriptions of these portions of Commonwealth Land, likely to be impacted by the proposal are provided below.

Which components or features of the environment are likely to be impacted by the action?

The construction of water cycle infrastructure for the Googong New Township has been positioned in such a way that all of the water reticulation works drain to the north, which is outside the Googong Dam catchment. However, there may be some run-off towards sections of the western side of the Googong foreshores (i.e. Montgomery Creek).

Components of the environment likely to be impacted on the western side of the Googong Foreshores where the action will take place are the following:

- Googong Dam Road and its road verges;
- Access road linking the Googong WTP and the Googong Dam Road and road verges;
- Land within the Googong WTP; and
- A section of Montgomery Creek and its riparian zone.

Whilst much of the Montgomery Creek is to the south-west of the proposed Googong development site, towards the north, a section of the creek drains through the western foreshores.

This section of the creek and its riparian zone is included in this assessment, because there is potential for runoff from the Water Recycling Plant (WRP) site to drain through the creek. In addition, there is a possibility that the creek could receive potential runoff in the later stages of the proposed development.

The following summarises the results of the current flora surveys, which indicate the nature of the vegetation in the above areas of Commonwealth Land:

- **Roadside Vegetation** - The roadside vegetation along the Googong Dam Road is much disturbed, and is heavily infested with invasive grasses and other weedy species. Despite relatively recent plantings of various native trees and shrubs (mainly *Acacia* spp.), and the occurrence of residual clumps or isolated specimens of *Eucalyptus* trees, this vegetation is of little conservation value. Among the dominant 'weedy' grass species present along the roadside are: *Phalaris aquatica*, *Paspalum dilatatum*, *Eragrostis curvula*, and a variety of pasture grasses like *Bromus* spp., *Lolium* spp., *Poa* spp., *Avena* spp., *Holcus lanatus*, *Hordeum* spp. However, there are several roadside locations, where significant populations of the native Kangaroo Grass (*Themeda australis*) occur. As a result of spread by human disturbances, invasive herbaceous weeds are also common on the Googong Dam Road verges. The commonest species are: Purpletop (*Verbena bonariensis*), Mullein (*Verbascum* spp.), Buchan Weeds (*Hirschfeldia incana*), Spear Thistle (*Cirsium vulgare*), Scotch Thistle (*Onopordum acanthium*), Cotton Fire weed (*Senecio quadridentatus*) and Prickly Lettuce (*Lactuca seriola*). Mixed with the weeds, there are some common sedges, such as *Juncus* spp. and *Cyperus eragrostis*, prominent in the ditches and depressions that run along the road.
- **Googong WTP site and access road** - The proposal for the development of the water cycle infrastructure to support the Googong New Township includes the roadway that leads to the Googong WTP from the Googong Dam Road and the WTP site itself. The Googong WTP site has been extensively disturbed in the past during the construction of the WTP and its infrastructure. The vegetation within the boundary fences of the WTP (likely zone of influence for the proposed water infrastructure) is highly fragmented and comprises a mix of residual *Eucalyptus* trees (mainly, *E. melliodora*, *E. polyanthemos*, *E. nortonii*, *E. mannifera*). During post construction rehabilitation of the site, the residual vegetation has been supplemented by a variety of new plantings, as a result of which there are many specimens of *Eucalyptus* and *Acacia* species scattered within the site. Whilst the conservation values of the nearby western foreshore vegetation is well recognised (ACT Government, 2007a) as potentially part of the original 'White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands and Derived Grasslands' EEC, the heavily fragmented vegetation within the WTP site and its access road corridor does not represent any particular vegetation community. Despite the rehabilitation of the landscape and revegetation of the Googong Dam Road corridor and the WTP access road, possibly since the construction of the WTP and the Visitors' Centre, this area is subject to continuous human disturbance, arising mainly from public access, maintenance vehicles and activities of the Visitors' Centre, the WTP site's routine maintenance, vehicles and operations. The on-going disturbances at the WTP site are evident by the large array of colonising species and common roadside weeds, which occur within the site boundaries.

Broadly, in so far as conservation of species and ecological communities, the vegetation in this area cannot be considered as a 'community' of any kind, due to the high level of fragmentation. Except for some significant, remnant *Eucalyptus* trees, the area is devoid of high conservation value vegetation.

- **Section of Montgomery Creek and its riparian zone** – The Montgomery Creek, located to the south-west of the Googong urban development site, largely runs through cleared areas that have been converted to pasture. On the north-eastern side of the development site, the creek runs through a section of the western foreshores.

The creek and associated paddocks are heavily grazed and degraded due to the grazing pressure of sheep and cattle. For much of the year, there is very little or no water in the creek. However, some depressions in the gently sloping gullies are moist. Animal trails cross the creek at many locations.

The riparian zone of the Montgomery Creek is similar to other drainage lines at the development site. There are sporadic clumps of the sedge - *Juncus usitatus*, and moisture-loving species like Dock (*Rumex crispus* and *R. brownii*) scattered along the drainage line. Introduced pasture species (i.e. *Poa* spp., *Hordeum* spp., *Holcus lanatus*) from the degraded pasture are common in the riparian areas of the creek. These are mixed with many common herbaceous weeds of pasture and disturbed habitats, as a result of heavy grazing over decades. Native grasses, such as *Austrostipa* spp. and *Austrodanthonia* spp., are present, but only as a minor component of the vegetation. This vegetation is not considered to be of significant value.

The area has scattered, residual Gum trees in the adjacent grazed paddocks. Patches of the native coloniser – Burgan (*Kunzea ericoides*) are prominently present. In addition, the north-eastern corner, just south of the Googong Dam Road, has patches of native trees and shrubs, which have been planted as a part of vegetation rehabilitation of the western foreshores area. The species that have been planted are common species from both dry sclerophyll forest and lowland woodland, representative of the relatively undisturbed sections of the Googong Foreshores, closer to the Googong Dam.

Is the environment, which is likely to be impacted, or are elements of it, sensitive or vulnerable to impacts, and/or are components of it, rare, endemic, unusual, important or otherwise valuable?

The Googong Foreshores are recognised for their important biodiversity and landscape values (ACT Government, 2007a). The foreshores are part of a corridor of relatively intact vegetation from the Tinderry Range to the north-eastern ACT. The area contains a number of threatened plant and animal species (ACT Government, 2007a).

The environment, likely to be impacted by the proposed works to develop the water infrastructure for the development (i.e. Googong Dam Road and its road verges, the access road leading to the Googong WTP, land within the Googong WTP and a section of the Montgomery Creek and its riparian zone), is a small section of Commonwealth Land.

The condition of flora and fauna habitats and the diversity of species in this section of Commonwealth Land in the western foreshores are mostly similar to those in the broader study area (i.e. Googong urban development area, Neighbourhood 1A) that has been assessed in this report.

However, further to the east from the development site, towards the Googong Dam, the condition of habitat and the diversity of flora and fauna are likely to be much better, due to the cessation of pasture improvement activities, clearing and grazing in those areas.

Within the Googong Foreshores, two particular EECs could occur (GHD, 2007). They are:

- Natural Temperate Grasslands of the Southern Tablelands of NSW and the ACT, listed as endangered by the EPBC Act; and
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (or Box-Gum Grassy Woodlands), listed as critically endangered by the EPBC Act.

However, the above EECs do not occur in the sections of Commonwealth Land, which are likely to be impacted by the proposal, and are being assessed here.

Within the Googong Foreshores area, plant species listed as threatened under the EPBC Act include:

- Button Wrinklewort (*Rutidosia leptorrhynchoides*) - listed as nationally endangered;
- Hoary Sunray (*Leucochrysum albicans* var. *tricolor*) - listed as endangered; and
- Pale Pomaderris (*Pomaderris pallida*) - listed as vulnerable.

In the surveys conducted, these species were not detected in the areas that are likely to be affected by the proposal. However, some potential habitat could be present for the Button Wrinklewort and Hoary Sunray, along the Googong Dam Road corridor.

As has been assessed in this report (see **Appendices 12 and 14**), the likelihood of occurrence of these species on the sections of Commonwealth Land being assessed is low, due to the poor quality of the habitat and on-going high levels of disturbances. Habitat for Pale Pomaderris does not exist in the areas of Commonwealth Land likely to be affected by the works (see **Appendices 12 and 14**).

Potential habitat does exist for the vulnerable Pink-tailed Legless Lizard in sections associated with rocky areas along Montgomery Creek, which runs from the study area into Googong Foreshores.

The Eastern Bent-wing Bat and Eastern False Pipistrelle have also been recorded within the study area. The Eastern Bent-wing Bat may forage aerially for insects, but is unlikely to breed in the study area, as it requires caves (which are absent).

The Eastern False Pipistrelle may also forage aerially for insects within the study area, and/or roost within tree hollows. However, the species prefers wet habitats and is therefore, unlikely to breed within the study area. All hollow-bearing trees in the area are in dry habitat, which are not usually favoured by this species.

No other threatened fauna species were detected in the study area, although potential habitat does exist for a number of species, listed below:

- o Golden Sun Moth;
- o Grassland Earless Dragon;
- o Striped Legless Lizard;
- o Brown Treecreeper;
- o Gang-gang Cockatoo;
- o Regent Honeyeater;
- o Swift Parrot; and
- o Superb Parrot.

What is the history, current use and condition of the environment, which is likely to be impacted by the action?

The primary purpose (and value) of the Googong Foreshores arises from being associated with the Googong Dam, which is part of the potable water supply for the ACT, Queanbeyan and the adjacent estates of Ridgeway and Weetalabah (Palerang Council areas). The Googong Dam and Reservoir were established within a mostly pastoral landscape (sheep and cattle grazing), in which there was extensive clearing at lower elevations and in less rugged areas (ACT Government, 2007a).

The western foreshores were formerly a number of pastoral holdings, which had been extensively cleared for agriculture. However, the pasture lands have scattered, residual paddock trees, representing remnants of Box-Gum Grassy Woodlands, which would have existed in the area prior to European settlement.

In more recent times, tree and shrub plantings have been carried out in sections of the western foreshores, closer to the Googong Dam (GHD, 2007). It is also evident that after the construction of the Googong WTP, the Rangers' Station and the Visitors Centre, trees and shrubs have been planted along the Googong Dam Road and the Googong WTP site, as part of rehabilitation of this disturbed area.

The most significant land use trends in areas adjacent to the Googong Foreshores have been the subdivision of former pastoral holdings for rural residential purposes and the recent establishment of nature reserves on the escarpment country, construction of roads and the Googong WTP and its infrastructure (ACT Government, 2007a).

Sections of the Commonwealth Land and habitat on the western foreshores, which are likely to be impacted by the Water Cycle Project, are generally of low or no conservation value, because much of it is highly fragmented and severely degraded due to previous land uses. These sections include the degraded pasture with some native species and scattered Gum trees, roadside vegetation and areas that have been rehabilitated after previous constructions.

What are the components of the action?

The Water Cycle Project (this proposal) addresses the provision of wastewater, recycled water and potable water infrastructure for the Googong New Township development, specifically proposed for a portion of the first neighbourhood - NH1A.

The terrestrial flora and fauna ecological assessments detailed in this report are to assist in the assessment of the potential impacts of the proposal via Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act, 1979). The ecological assessments covered the following components of the Water Cycle Project:

- Proposed channel works for stormwater management - assessment of 50 m either side of centre of watercourses (100 m corridor).
- Proposed wastewater infrastructure:
 - Water Recycling Plant (WRP) site (250 m radius) east of NH1A;
 - Sites for sewage pumping stations 1 and 2 (100 m radius) and the proposed routes of the rising mains, 50 m either side of centre of the routes to north and south (100 m corridor);
 - A 50 m corridor along the eastern side of Old Cooma Road;
 - A 60 m corridor either side of the Googong Dam Road from the junction with Old Cooma Road to the Googong Foreshores Gate;
 - Googong Creek for future stormwater flows.
- Proposed potable and recycled water infrastructure:
 - The hill where the reservoirs are to be located (south of Neighbourhood 1A) referred to in this report as Reservoir Hill.
 - Potable water pumping station (within the existing Googong WTP) and pipeline to the north-east of NH1A along access road of the WTP (50 m corridor).
 - Road corridors for wastewater infrastructure (as above).

A general description of major works associated with the Water Cycle Project components (given above) includes the following:

- Clearing and grubbing of land, stripping and stockpiling topsoil;
- Bulk earthworks (cut to fill) to design levels, including re-grading;
- Trench excavation for sewer, stormwater, potable water main, recycled water main services and backfill of all underground services;
- Construction of the Water Recycling Plant (WRP) and pumping stations;
- Construction of rip rap and placement of other erosion protection material;
- Excavation for and planting of trees, shrubs, grasses and for dry mulches; and
- Rehabilitation and re-installation of all disturbed and/or re-graded areas.

Specific descriptions of the proposed works at different sites are provided in **Section 3.4** of this report.

What are the predicted adverse impacts associated with the action including indirect consequences?

The environmental impacts that could arise from the proposal on the Commonwealth Land being assessed include the following:

- Ground disturbances associated with the construction of potable and wastewater infrastructure, including potable water pumping station and delivery mains for potable and recycled water.

The above works are likely to involve clearing and removal of some low value trees and dead trees. In some cases of excavations, the use of explosives may be required to break through rock. Given the nature of the development proposal, disturbing some flora and fauna habitat is unavoidable.

However, adverse impacts are largely dependent on the quality of the habitat being disturbed and the quality of the vegetation that is being cleared. Impacts are also dependent on the scale and magnitude of the clearing and the way clearing is conducted, and possibly the level and quality of post-clearing rehabilitation.

In their current state, the Commonwealth Land areas likely to be impacted are mostly heavily grazed, comprising degraded pasture with scattered trees, or are highly fragmented, previously cleared sites (Googong WTP site, its access road, and Googong Dam Road corridor).

The proposal for construction of infrastructure for the Water Cycle Project will result in the clearing of some of the degraded pasture and already disturbed, poor quality roadside vegetation, which is largely of no conservation value, except for the potential loss of populations and seed banks of some Australian native grasses (i.e. *Themeda australis*) and the loss of some *Eucalyptus* trees.

No large-scale clearing of native vegetation is intended by the proposal, except the removal of some trees, partly due to low quality or being partially or fully dead (JEA, 2009). All of the trees likely to be removed in the proposal are *Eucalyptus* species, which are very common in the region. The greater majority of trees, which are of value as part of the Googong landscape's biodiversity, are likely to be retained for their fauna habitat values and as elements of the New Township's biodiversity attractions.

No significant losses of the threatened EECs or individual flora species, listed in the EPBC Act (previously mentioned) on the western side of the Googong Foreshores, could be predicted as a result of the proposed works. This is because the Commonwealth Land areas likely to be impacted do not have the communities or the species and also do not represent good quality habitat for the same.

The construction works associated with the proposal will involve excavations and trenching for pipelines, as well as soil and vegetation disturbance. Such works will disturb some fauna habitat. In particular, known and potential habitat of the vulnerable Pink-tailed Legless Lizard will be indirectly impacted. Habitat for this species is associated with rocky areas along Montgomery Creek, which runs from the study area into Googong Foreshores.

Individuals recorded in the study area are likely to be part of a larger population that includes individuals in Googong Foreshores. The individuals recorded in the study area are at or close to the edge of the extent of habitat westwards, given the lack of surface rock throughout much of the study area.

The Pink-tailed Legless Lizard is a fossorial species, which lives beneath surface rocks and occupies ant burrows. It feed on ants, particularly their eggs and larvae (Osborne and Jones, 1995). The species is thought to lay eggs within the ant nests under rocks that it uses as a source of food and shelter (DEC, 2005e). Key habitat features for the presence of the Pink-tailed Legless Lizard are a cover of native grasses, particularly Kangaroo Grass (*Themeda australis*), sparse or no tree cover, little or no leaf litter, and scattered small rock with shallow embedment in the soil surface (DEWHA, 2008a).

The Eastern Bent-wing Bat and Eastern False Pipistrelle have also been recorded within the study area. The Eastern Bent-wing Bat may forage aerially for insects, but is unlikely to breed in the study area, as it requires caves (which are absent).

The Eastern False Pipistrelle may also forage aerially for insects within the study area, and/or roost within tree hollows. However, the species prefers wet habitats and is therefore, unlikely to breed within the study area. All hollow-bearing trees in the area are in dry habitat, which are not usually favoured by this species.

No other threatened fauna species were detected in the study area, although potential habitat does exist for a number of species, listed below:

- Golden Sun Moth;
- Grassland Earless Dragon;
- Striped Legless Lizard;
- Brown Treecreeper;
- Gang-gang Cockatoo;
- Regent Honeyeater;
- Swift Parrot; and
- Superb Parrot.

The impacts to the potential habitat of these species in the western part of the Googong Foreshores are likely to be minimal, if impacted at all. Therefore, no significant effects to any of the above species are likely by the proposed work in Commonwealth Land.

How severe are the potential impacts?

As discussed above, the Commonwealth Land likely to be impacted by the proposal does not have the Natural Temperate Grasslands of Southern Tablelands EEC, or the Box-Gum Grassy Woodland EEC, which could occur in habitat associated with the Googong Foreshores (GHD, 2007).

Although potential habitat does occur within the Commonwealth Land being assessed for Button Wrinklewort (*Rutidosis leptorrhynchoides*) and Hoary Sunray (*Leucochrysum albicans* var. *tricolor*), the species were not detected in the recent surveys conducted in the area.

The likelihood of occurrence of these species on the Commonwealth Land being assessed is low due to the poor quality of the habitat and on-going high levels of disturbances. Also, the works are not of a scale and magnitude to change or modify habitat on these sections of Commonwealth Land very greatly to put at risk any existing population (not detected) in the area. Therefore, these species are not likely to be significantly affected.

The proposal is unlikely to significantly impact individuals of the Pink-tailed Legless Lizard occurring within Commonwealth Land on the western side of the Googong Foreshores. There may potentially be a reduction in genetic variability in future offspring, if genetic transfer is currently occurring between individuals of the study area and the undisturbed areas of the Googong Foreshores.

While the proposal would result in a loss of some hollow-bearing trees in the Googong development area, it is considered unlikely to lead to a significant impact on the Eastern False Pipistrelle, or other threatened hollow-dwelling fauna, given the poor quality of surrounding habitat within the area. No hollow-bearing trees would be removed from Commonwealth Land on the western Googong Foreshores.

No other threatened fauna species were detected in the study area, although potential habitat does exist for a number of species (see above). Impacts to these species are likely to be minimal.

What is the extent of uncertainty about potential impacts?

The Commonwealth Land, likely to be impacted by the proposal was surveyed for both flora and fauna. In the surveys conducted, the threatened flora and fauna species listed in the EPBC Act were not detected on the areas that are likely to be affected by the development of the water cycle infrastructure.

However, as discussed above, some potential habitat could be present for two flora species (i.e. Button Wrinklewort and Hoary Sunray) along the Googong Dam Road corridor. The likelihood of occurrence of these species on the sections of Commonwealth Land being assessed is low due to the poor quality of the habitat and on-going high levels of disturbances. Also, the proposal does not involve major modifications of habitat on these areas of Commonwealth Land, to put at risk any existing population (not detected) in the area. Therefore, these species are not likely to be significantly affected.

No threatened fauna species were detected in the surveyed conducted in the study area, inclusive of Commonwealth Land, although potential habitat does exist for the Golden Sun Moth, Grassland Earless Dragon, Striped Legless Lizard, Brown Treecreeper, Gang-gang Cockatoo, Regent Honeyeater, Swift Parrot and Superb Parrot.

Given the absence of records, lack of good quality habitat, level of fragmentation and the on-going disturbances, it can be predicted with certainty that there would be minimal impacts in these areas for the threatened flora and fauna that are listed in the EPBC Act, as part of the Googong Foreshores.

A population assessment for the entire area of known and/or potential habitat for the Pink-tailed Legless Lizard (or any other species) was not conducted, and was outside the scope of the study.

As such, while it is assumed the all rocky areas associated with Montgomery Creek are potential habitat for the Pink-tailed Legless Lizard (and some other rocky, grassland species), there is considerable uncertainty regarding the occurrence of the species, which may not occur in all parts of the habitat.

Will any measures to avoid or mitigate impacts ensure, with a high degree of certainty, that impacts are not significant?

The majority of the work associated with the Water Cycle Project is located within land that has been already cleared for pasture in the past, and is currently subject to heavy grazing pressure. The land is heavily degraded in terms of its vegetation, and its habitat is much fragmented by continuing grazing by large herds of sheep and cattle and by access roads.

Are the impacts significant?

In order to determine whether or not an action is likely to have a significant impact on the environment, it is necessary to consider the total adverse impact of the action in the context of the environment, which will be impacted, particularly those elements of the environment, which are sensitive or valuable.

As discussed above, sections of the Commonwealth Land likely to be impacted by the proposal to develop the water infrastructure for the development are a highly fragmented and disturbed section of the western Googong Foreshores. These areas include the Googong Dam Road and its road verges, the access road leading to the Googong WTP, land within the Googong WTP and a section of the Montgomery Creek and its riparian zone.

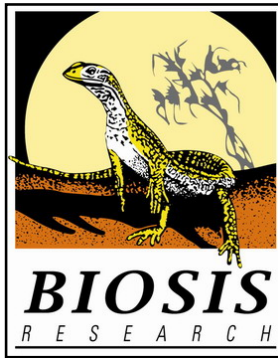
The majority of the proposal is located within land (i.e. Googong township site) that is currently heavily degraded pasture. This land has historically been subject to a range of impacts, which led to its degradation. Such impacts include clearing of vegetation, pasture establishment and improvement, and various effects of intensive agriculture and grazing.

The scale and magnitude of vegetation clearing and removal and other works in the proposal, such as excavations for trenching, are not very high, and if anything, the works will only disturb an already fragmented environment.

Given the historical land-use and on-going disturbances (i.e. high-intensity vehicular movements related to operations and maintenance of the Googong WTP and the public use of the Googong Dam Road) occurring in the areas being assessed, the likely impacts of the proposal are relatively minor.

No significant impacts on threatened flora species, populations and habitat, or EECs and their habitat, are likely to occur as a result of the works. On the other hand, cessation of intensive agriculture and development of the area may afford opportunities to re-establish vegetation and biodiversity in the area that would be complementary to the existing foreshores vegetation, closer to the Googong Dam.

Furthermore, post-construction rehabilitation (see **Section 7** in this report) may provide opportunity to reduce, remove altogether, or mitigate many of the disturbances, which are currently operating in the area. Impacts to fauna values of Googong Foreshores are highly likely to be minimal.



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14 July 2010

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**RE: Addendum – Googong Township Water Cycle Project Terrestrial Fauna Assessment:
Proposed New Reservoir Site**

Dear Emily,

This report is provided as an Addendum to the *Googong Water Cycle Project – Ecological Assessments – Flora and Fauna* report completed by Ecowise Environmental and Biosis Research in 2009 (Ecowise and Biosis 2009).

Due to a design change since the completion of the 2009 report, a terrestrial flora and fauna assessment of a proposed temporary reservoir site is now required. The impacts on terrestrial flora have been assessed (ALS Water Sciences Group 2010). This report assesses the potential impacts on terrestrial fauna.

Proposed Works

A temporary reservoir has been proposed to be constructed on a hill (RL 765 m) south of the intersection of Googong Dam Road and Old Cooma Road (Figure 1) covering an area of approximately 0.05 ha. The reservoir would be taken down once the population of Neighbourhood 1A reaches a certain number (estimated at approximately 6-8 years into development), after which the reservoirs in the existing design would be commissioned. The proposed temporary reservoir site location is within 50 m of the subject site previously assessed (Ecowise and Biosis 2009).

Aims

Biosis Research has been commissioned by Manidis Roberts to perform the following tasks:

- Review the proposed temporary reservoir site location in relation to field investigations of nearby areas previously conducted by Biosis Research;
- Determine potential impacts on terrestrial fauna by the proposed temporary reservoir; and,
- Prepare a desktop addendum to the existing report (Ecowise and Biosis 2009).

Previous Fauna Surveys

The temporary reservoir is proposed to occur within 50 m of the previously assessed subject site. Biosis Research conducted a number of targeted terrestrial fauna surveys (Figure 2) within the subject site (area of direct impact). The newly proposed temporary reservoir site location occurs within the area of potential *indirect* impact of the original assessment and was therefore previously assessed in a broader sense.

Targeted surveys were carried out within 50 m of the current site including a walking transect parallel to Old Cooma Road for Golden Sun Moth *Synemon plana* and Pink-tailed Legless Lizard *Aprasia parapulchella* habitat. The area traversed immediately to the west of the proposed new reservoir site was not considered to provide potential habitat for either threatened species. Areas of potential habitat are mapped in Figure 2.

To supplement previous nearby field investigations, a number of photos of the proposed temporary reservoir location have been provided. The previous field surveys and the recent photos (taken 9 July 2010) are considered adequate to assess the potential impacts of the proposed temporary reservoir on terrestrial fauna.

Vegetation

The vegetation of the study area and surrounds is described and assessed by ALS Water Science Group (2010) but is comprised of exotic pasture grasses and scattered Yellow Box with the occasional Red Box.

Fauna Habitat

Based on photographic evidence of the proposed reservoir site, the dominant vegetation are grasses (Plate 1), which appear to be highly modified by existing agricultural practises and heavy sheep grazing. According to correspondence with Emily Moore of Manidis Roberts, only one tree may be removed by the proposed works. Scattered surface rocks and partially-imbedded rocks occur in low numbers within the proposed temporary reservoir site. Rocky habitat improves to the south-east of the study area (Plate 2).

Assessment of Potential Impacts on Terrestrial Fauna

Thirty threatened and/or migratory fauna as listed on the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been previously recorded within a 10 km radius of the study area (Ecowise and Biosis 2009).

Although a targeted fauna survey to the west of the study area has not identified this area as potential habitat for the Pink-tailed Legless Lizard, and that few surface rocks occur within the proposed reservoir location, the study area is considered to provide limited potential habitat for this species for the following reasons:

- Potential habitat for the Pink-tailed Legless Lizard (sloping grassland with rock outcrops and partially embedded rocks) occurs immediately adjacent to the study area, to the south-east (Plate 2);

- This habitat occurs on the opposite side of the hill to the previous fauna survey transect and may not have been visible;
- Given the close proximity of this potential habitat to the study area, Pink-tailed Legless Lizards (if present) may utilise grass tussocks and rocks within the study area; and,
- The Pink-tailed Legless Lizard was recorded during previous fauna surveys approximately 2 km to the south-east (in the vicinity of the proposed pumping station).

Pink-tailed Legless Lizards were also recorded to the north of Googong Road within the Talpa property (Johnstone Centre 2004). The species has also been recorded in the Googong Foreshores (ACT Government 2008). These populations are outside the study area and would not be impacted by the proposed works.

Assessments of Significance (Part 3A assessment and Significant Impact Criteria assessment) were carried out for the Pink-tailed Legless Lizard for the Googong Water Cycle Project and concluded a significant impact on this species to be likely (Ecowise and Biosis 2009). The additional clearing of up to 0.05 ha limited potential habitat for the temporary reservoir is unlikely to be of additional major consequence, however, the proposal remains significant in its potential impact on this species. Few surface rocks (shelter and breeding habitat) occur within the area of direct impact, which is degraded and dominated by exotic pasture grasses (ALS Water Science Group 2010). Kangaroo Grass, which often characterises a site where Pink-tailed Legless Lizards occur (DEC 2005), does not occur in the surrounding, previously surveyed areas (ALS Water Science Group 2010). Similarly, Short Wallaby Grass, which was recorded at the site of the proposed pumping station (where Pink-tailed Legless Lizards were recorded) was not recorded in flora survey transects adjacent to the proposed temporary reservoir (Ecowise and Biosis 2009).

Given the small size (0.05 ha), lack of habitats (e.g. trees, shrubs, water) and disturbed nature of the study area; and taking previous threatened species habitat assessments (Ecowise and Biosis 2009) into account, the proposed temporary reservoir site is considered unlikely to provide potential habitat for any other threatened fauna species. While some of the more mobile species (e.g. Brown Treecreeper *Climacteris picumnus victoriae* and Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*) may occasionally fly over/through the study area, no limiting breeding or foraging resources occur.

Recommendations

The following recommendations are made to minimise potential impacts to fauna (threatened or otherwise) and fauna habitat:

- The proposed reservoir footprint orientation and extent be considered in order to avoid disturbance to surface rock, wherever possible;
- The area of surface rock to the south-east of the proposed reservoir site be fenced off during construction and be made a no-go zone (including signage);
- Pre-clearing surveys by a qualified ecologist for Pink-tailed Legless Lizards immediately prior to clearing;
- Stockpiling of equipment and materials to occur within the assessed area only, in areas of exposed dirt (avoid all vegetation including grasses);

- An ecologist be present for the removal of the one tree (if removal is required). The ecologist would check the tree for hollows prior to removal. If tree hollows are present, the tree must be carefully felled and the hollows immediately checked by the ecologist;
- Any injured fauna should be taken to a vet or wildlife care group; and,
- In the event a threatened species is located during pre-clearing surveys, works must cease immediately until the situation can be further assessed.

Conclusion

The proposed temporary reservoir would involve the removal of up to 0.05 ha of heavily degraded pasture and possibly one tree. Few surface rocks occur and may provide limited potential habitat for the Pink-tailed Legless Lizard. Overall, the Googong Water Cycle Project has been considered likely to result in a significant impact on this species (Ecowise and Biosis 2009), however, the additional clearing of up to 0.05 ha limited potential habitat for the temporary reservoir is unlikely to be of additional major consequence. Potential habitat for other threatened fauna is not considered to occur within the proposed reservoir site. A number of recommendations have been made to minimise impacts to fauna.

Yours faithfully,



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References

ACT Government (2008). *Googong Foreshores Draft Plan of Management 2007*.

ALS Water Science Group (2010). *Addendum: Googong Water Cycle Project – Ecological Assessments, Terrestrial Flora Proposed New Reservoir Site*. ALS Water Sciences Group (formerly Ecowise Environmental).

DEC (2005). Pink-tailed Worm-lizard - Threatened Species Profile <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10061>. NSW Department of Environment and Conservation.

Ecowise and Biosis (2009). *Googong Water Cycle Project – Ecological Assessments – Flora and Fauna*. Joint study by Ecowise Environmental and Biosis Research.

Johnstone Centre (2004). *Environmental Assessment Googong Urban Investigation Area*. Charles Sturt University, Wagga Wagga.

Plates

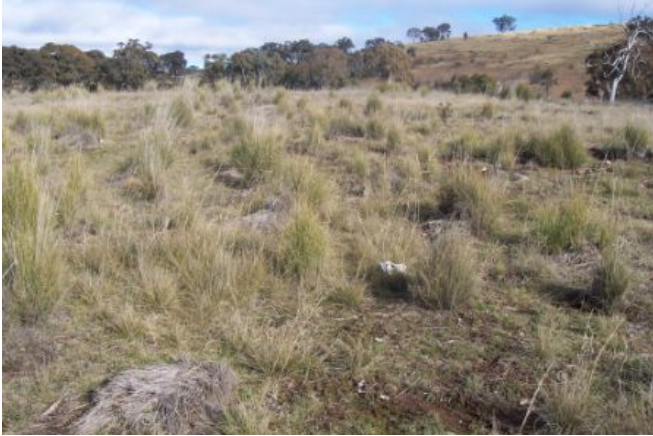


Plate 1: Grass is dominant feature of proposed reservoir site (source: Brown Consulting).

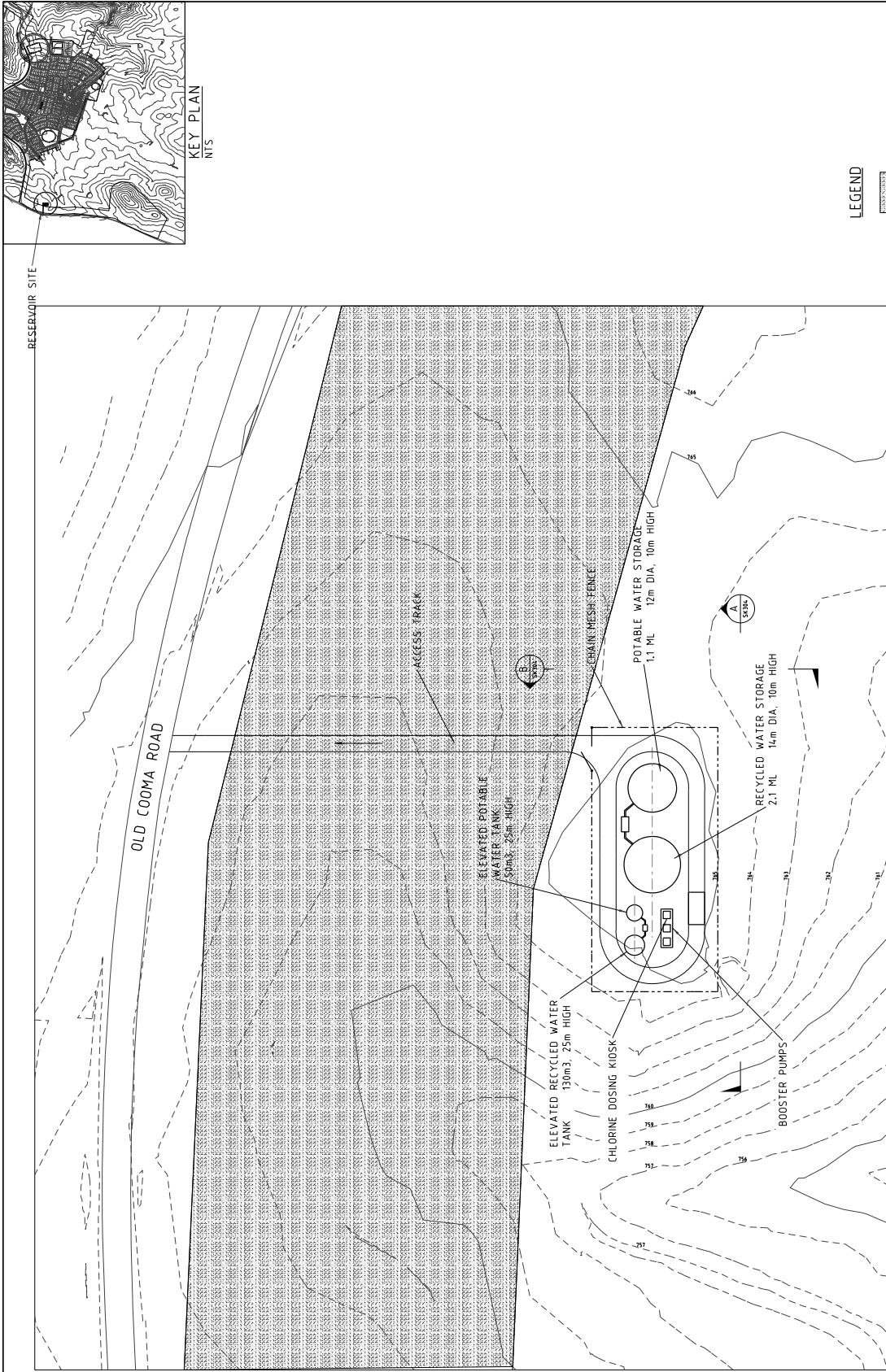


Plate 2: Surface rocks to the south-east of proposed reservoir site (source: Brown Consulting).



FIGURE 1

FIGURE 1



PLAN
1:500

PRELIMINARY

NOT FOR CONSTRUCTION

LEGEND



FLORA AND FAUNA
STUDY AREA



REV.	DATE	ISSUED FOR REVIEW	DESCRIPTION	REV.	DATE	APPROVED	DESCRIPTION	REV.	DATE	APPROVED
B	21.04.09	PP	ISSUED FOR REVIEW							
A	17.04.09	PP	ISSUED FOR REVIEW							

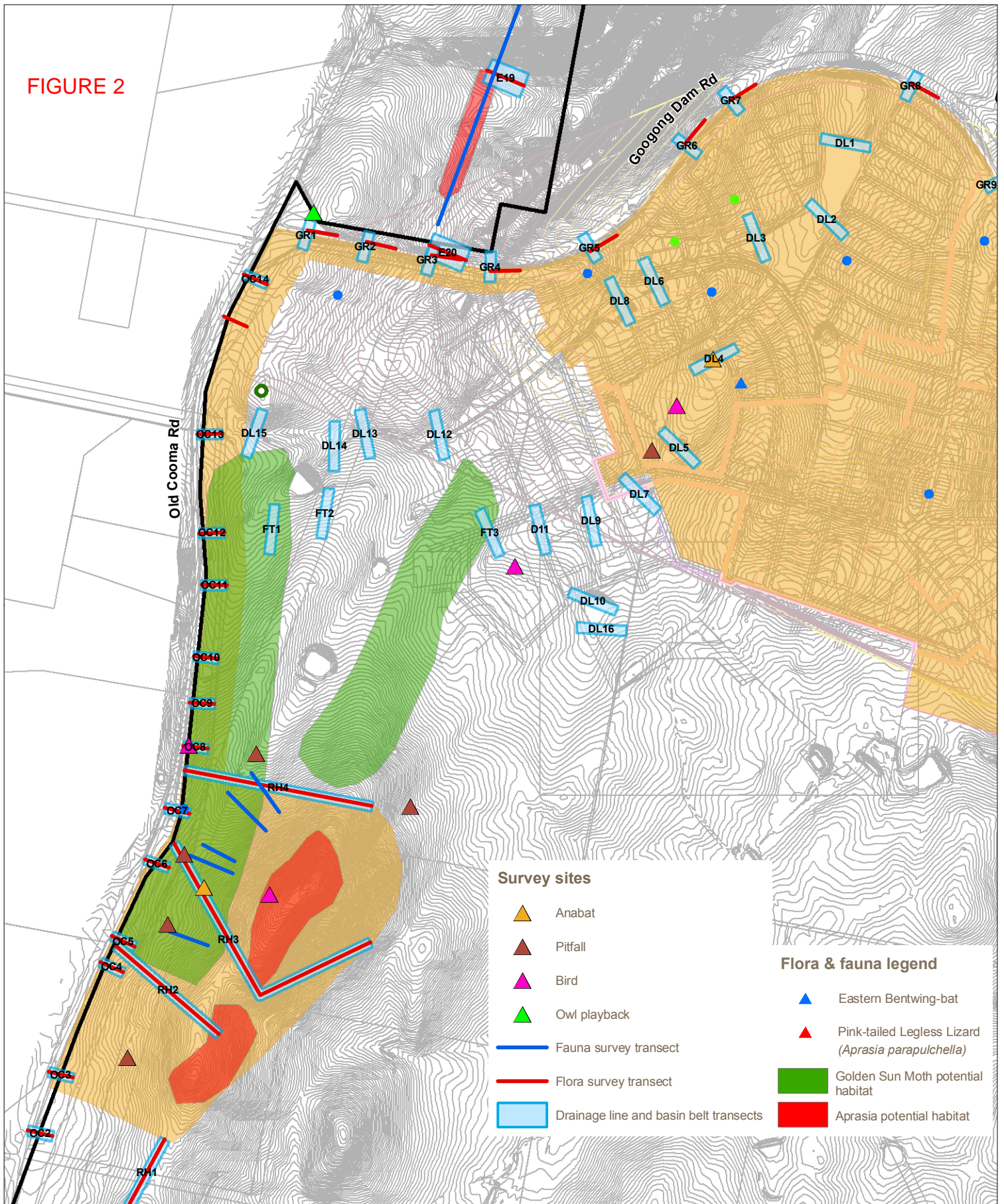
MWH
BUILDING A BETTER WORLD
ABN: 51 085 776 601
34-11 CHANDOS STREET, AUSTRALIA
TEL: 02 935 7025 FAX: 02 933 9799

cic
Carberra Investment Corporation Limited

PROJECT: GOOGONG INTEGRATED WATER CYCLE
FILE: GOOGONG INTERIM RESERVOIR
SITE LAYOUT PLAN
SCALE: 1:500
DRAWING NO.: A10814.02-SK303
REV. B

FOR THE NAME: P:\Projects\Water\Googong\Googong Interim Reservoir\A10814.02-SK303.dwg

FIGURE 2



Googong Environmental Assessment

Proponent Canberra Investment Corporation

Date 9 June 2010

Drawing no. 08003g_NH2res

Source Ecowise, Biosis

Legend

- NH2 reservoir site
- Subject site
- Study area

- Indigenous site previously recorded
- Non-indigenous site previously recorded

1:10,000

0 100 200 300 400m



NH2 reservoir – site analysis

Manid's Roberts



8 July 2010

Emily Moore
Manidis Roberts

ADDENDUM

Googong Water Cycle Project – Ecological Assessments, Terrestrial Flora Proposed new Reservoir Site

This Report is provided as an Addendum to the Googong Water Cycle Project – Ecological Assessments that were conducted in 2008-09.

Background

A new design change has occurred on the Googong Township Water Cycle Project, which has resulted in a new temporary reservoir site, to be constructed on a hill (RL 765m), south of the intersection of Googong Dam Road and Old Cooma Rd. The location of the new reservoir site is shown in Figure 1 of this Addendum.

This temporary reservoir site is to be taken down after the population of NH1A reaches a certain number and the reservoirs in the original (existing) design will then be commissioned. The new temporary reservoir site location is within 50 m of the existing subject site study area (approximately 37 m from the existing subject site study area).

ALS Water Sciences Group (formerly, Ecowise Environmental), who conducted the initial flora surveys, have been requested to conduct the following:

1. Review the new site location for the temporary reservoir site in relation to the field investigations conducted in nearby areas that were part of the initial assessment;
2. Determine what are the likely impacts on the flora of significance, based on the investigations conducted on nearby areas; and
3. Present the information as an addendum to the original report indicating that the new temporary reservoir site location, although not originally not within the existing subject site study area has been covered through the course of nearby area investigations.

Impact Assessment of proposed new Works

The initial assessments covered the following nearby areas:

- Transect OC13
- Transect DL 14, and
- Transect DL15

Reference is made to **Figure 4** and **Figure 5** of the initial Ecological Assessment Report (Ecowise, 2009); and **Appendix 3** and **Appendix 4** of the same Report for lists of species and their occurrence.

Given that the nearby areas, listed above, were surveyed extensively during the initial assessments by a series of Transects, it would be reasonable to draw conclusions on the new reservoir site, based on the existing information.

Vegetation in the general area

In general, the area is characterised by heavily degraded pasture, with only a few scatterings of Yellow Box (*Eucalyptus melliodora*) and the occasional Red Box (*E. polyanthemus*).



Non-native pasture grasses (*Phalaris aquatica*, *Phalaris minor*, *Bromus* sp., *Lolium* sp., *Poa* sp., *Avena* sp., *Holcus lanatus*, *Hordeum* spp., *Paspalum dilatatum*, *Eragrostis* spp., etc.) are common in the general vicinity. Among native grasses, minor patches of *Austrostipa scabra* (Speargrass) were found in both the Transects DL14 and DL15; these would probably extend to the hill.

Despite the presence of grassland communities, the general area is ~ 40% bare ground, due to over grazing and compaction. Much of the area (and the associated drainage lines) are heavily infested with a variety of Thistles (such as *Cirsium vulgare*, *Silybum marianum*).

Other common weeds dominating the landscape include St. John's Wort (*Hypericum* spp.), Great Mullein (*Verbascum* spp.), Horehound (*Marrubium vulgare*) and Plantain (*Plantago* spp.). These indicate long-term impacts of degradation of the native grasslands and introduced pasture.

Common forbs, which are part of grasslands of Southern Tablelands, are largely absent in this landscape, due to heavy grazing, trampling and compaction. However, there are many poor quality herbs, like Sheep Sorrel (*Acetosella vulgaris*), Common Woodruff (*Asperula conferta*), Wireweed (*Polygonum arenastrum*) and Prostrate Knotweed (*Persicaria prostrata*), scattered in the nearby area, associated with the drainage lines. It is likely that these would extend to the hill site as well.

Assessment of likely impacts on Flora

As documented in the Googong Water Cycle Project – Ecological Assessments, Flora and Fauna (Ecowise 2009), the vegetation in the area is of poor quality, both in terms of species composition, nativeness and abundance. Generally, given that the area of the hill that will be developed is relatively small, the area to be cleared is not likely to be of significance from the point of view of significant flora.

However, the works would further disturb an already degraded environment and clearing is likely to increase edge effects on the existing vegetation in the area. The overall modifications of the currently degraded pastureland habitat are unlikely to be of major consequence.

Assessment of the impacts of the proposal on the *Natural Temperate Grasslands of the Southern Tablelands of NSW and the ACT*; and the five threatened species listed by the TSC Act (1995) found within the Googong site (Ecowise, 2009) were considered, according to the Guidelines (DECC, 2006).

The assessments took into account the existence of potential habitat, although no populations of the threatened species were found to occur in the nearby study areas (Transects OC13, DL14 and DL15).

Conclusions

The proposal involves clearing possibly, a single *Eucalyptus* trees and some small patches of native grass vegetation. However, this activity is not of a magnitude that would cause significant habitat modifications, putting at risk the natural temperate grassland EEC, or the species that characterise the EEC, or its potential habitat, available in the broader areas.

Furthermore, the likely impacts on potential habitat of the individual threatened species would also be minimal. Although some potential habitat would be lost through the works in the proposal, these would not cause a risk of extinction of any of the threatened species (not found in nearby areas).

Limitations

The above assessment is limited to a consideration of only the new hill site for the proposed reservoirs. It has not considered the areas to be trenched for pipes (inflows or outflows).

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