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Mulligans Flat Woodland Sanctuary – Goorooyarroo Extension of Predator-proof Fence – Ecological Impact Assessment and Environmental Significance Opinion Supporting Document

Capital Ecology project no. 2709

Dear Mr Egle,

This letter provides an Ecological Impact Assessment (EIA), including an Environmental Significance Opinion (ESO) Supporting Document (Appendix A), for Stage 2 of the Mulligans Flat predator-proof fence (PPF) extension project, in Goorooyarroo Nature Reserve, Australian Capital Territory (ACT).

The ACT Government proposes to extend the existing Mulligans Flat Woodland Sanctuary by constructing a new PPF enclosing most of Goorooyarroo Nature Reserve. The proposed Goorooyarroo extension is shown in Figure 1 and Figure 2. As illustrated in Figure 2, the PPF around the Goorooyarroo extension consists of the following two stages.

- Stage 1 – Throsby Section. Stage 1 extends for approximately 2.5 kilometres from the existing Mulligans Flat Woodland Sanctuary PPF along the northern boundary of the new suburb of Throsby. Stage 1 is aligned to largely follow the boundary approved as a component of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Gungahlin Strategic Assessment and corresponding ACT development approval. All required approvals for Stage 1 have been obtained and construction is nearing completion.

- Stage 2 – Goorooyarroo Section. Stage 2 is proposed to extend for approximately 8.5 kilometres, connecting to the southern end of Stage 1 and running around Goorooyarroo Nature Reserve to connect back with the existing Mulligans Flat Woodland Sanctuary PPF. The current Mulligans Flat Woodland Sanctuary encloses 484 ha of Mulligans Flat Nature Reserve. On completion of Stage 2 of the PPF, the Goorooyarroo extension to Mulligans Flat Woodland Sanctuary will increase the sanctuary area by 820 ha to a total enclosed area of 1,304 ha.

For the purposes of this assessment the 'study area' comprises the land within a 50 m wide corridor centred on Stage 2 of the PPF alignment.

Although general biodiversity values are identified and considered, the primary objective of this EIA and ESO Supporting Document is to provide a thorough investigation into the currently listed significant biodiversity values (i.e. threatened flora and fauna species and threatened ecological communities) that will be impacted, or have the potential to be impacted, by the construction of Stage 2 of the PPF.

The results of this investigation inform an assessment of the likely type and degree of the impacts that the proposed development may have upon the identified biodiversity values, as required in accordance with the:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- ACT *Nature Conservation Act 2014* (NC Act); and
- ACT *Planning and Development Act 2007* (P&D Act).

The scope of this EIA and ESO Supporting Document includes the following.

1. A desktop database, literature and mapping review to identify all of the currently EPBC Act and/or NC Act listed significant biota (i.e. threatened species, populations and ecological communities) known to occur, or considered to have the potential to occur, in the study area.
2. A Likelihood of Occurrence Assessment which addresses all threatened ecological communities, threatened flora species and threatened fauna species with the potential to occur in the study area.
3. Use of the results of the desktop review and Likelihood of Occurrence Assessment to:
    - develop consolidated GIS mapping layers from the data generated during previous vegetation mapping projects in the vicinity of the Stage 2 alignment; and
    - identify and quantify the impacts that the proposed construction of Stage 2 is likely to have upon significant biota.
4. An assessment of the potential for impacts, and the likely significance of these impacts, upon the listed significant biota identified as occurring or potentially occurring in the study area.
5. Advice and recommendations regarding the impact avoidance, minimisation, mitigation, and/or offset measures that may be required to facilitate approval by the Commonwealth Government and ACT Government.

In addition to the above, Appendix A provides the information of an ecological/biodiversity impact focus required to support an application for an Environmental Significance Opinion for the proposed development from the ACT Conservator of Flora and Fauna.

1. Background

Mulligans Flat Nature Reserve (816 ha) was established and gazetted in 1994, at which time stock grazing, firewood collection and other agricultural uses of the land ceased. Goorooyarroo Nature Reserve (706 ha) was established and gazetted in 2004. Together, Mulligans Flat and Goorooyarroo Nature Reserves form the largest, most intact and contiguous patch of the Yellow Box – Blakely's Red Gum Grassy Woodland (Box-Gum Woodland) ecological community in the ACT and region.

Many native fauna species have disappeared from bushland in the ACT and region, including Mulligans Flat and Goorooyarroo Nature Reserves, and it is thought that predation by cats *Felis catus* (both feral and domestic) and the European Red Fox *Vulpes vulpes* is primarily responsible for this. In addition, historic removal of standing and fallen dead timber, together with groundstorey modification and prevention of canopy regeneration resulting from overgrazing, has had a marked impact upon native fauna habitat.

The environmental offset for the Jacka (North), Taylor and Moncrieff residential developments as identified in the Gungahlin Strategic Assessment (Umwelt 2013) includes the creation of the Kinlyside and Kenny Nature Reserves and the extension of Mulligans Flat and Goorooyarroo Nature Reserves via the inclusion of the areas previously known as Throsby North and Throsby East.

The Mulligans Flat Woodland Sanctuary was established in 2008 when the ACT Government built an 11.5 kilometre, feral animal-proof fence to enclose 484 ha and allow removal and/or control of feral animals (e.g. cats, foxes, European Rabbit *Oryctolagus cuniculus*, European Hares *Lepus europaeus*), and the introduction of locally extinct native species. The fence includes pedestrian gateways into the sanctuary allowing continued public recreational access, and vehicular gates at strategic locations provide for maintenance and emergency vehicle access. Telemetry installed at all gates provides surveillance, notification if a gate is left open, and a back to base security arrangement.

The Mulligans Flat and Goorooyarroo Nature Reserves are the site of a major research program of national and international importance. Commencing in 2004, the Mulligans Flat Goorooyarroo Woodland Experiment is a long-term research project established in partnership between the ACT Government, the Australian National University, CSIRO, and associated collaborators. The research aims to provide a whole-of-ecosystem understanding of Box-Gum Woodlands, particularly relating to restoring the structure and function of temperate woodlands and increasing biodiversity. Learnings from the research are applied in other reserves across the ACT and region and support evidence-based management by the ACT Parks and Conservation Service.

Mulligans Flat Nature Reserve is a popular venue for recreational walkers, bird watchers, wildlife enthusiasts and cyclists (using the Centenary Trail). In addition to the above described direct conservation benefits, the extended sanctuary will provide further opportunities for scientific research, education and nature based recreation and tourism.

2. Proposed Development

The proposed extension of the Mulligans Flat Woodland Sanctuary will include the Throsby North and Throsby East offset areas and much of the existing Goorooyarroo Nature Reserve, increasing the sanctuary by 820 ha from the existing 484 ha to a total enclosed area of 1,304 ha (refer Figure 2). Extending the sanctuary will substantially increase the area of high quality Box-Gum Woodland which can be managed in a secure manner, allowing natural regeneration and excluding cats, foxes and other feral predators. The project will further promote the recovery of the Box-Gum Woodland ecological

community itself, as well as provide the largest and most intact patch of lowland woodland habitat in the region for threatened species, notably woodland birds. Extending the sanctuary will increase the value of the Mulligans Flat Woodland Sanctuary as a conservation measure of national and international significance.

On 23 June 2016, the project team (including two Capital Ecology ecologists) completed a site visit to inspect the proposed Stage 2 alignment. It was determined during the site inspection that substantial alterations should be made to the then proposed alignment. As is now reflected in the currently proposed alignment (illustrated in Figure 3), it was identified that the alignment could be improved by:

- aligning the PPF to run along existing stock fence lines where practicable, thereby minimising new vegetation clearance and ground disturbance;
- straightening the PPF alignment where practicable to minimise the number of strainer points required: and
- aligning the PPF to minimise creek crossings, substantial rocky outcrops and other natural features through which it will be difficult and expensive to construct the PPF and maintain it once constructed.

Development of Stage 2 of the PPF will involve the following.

- Clearance of woody vegetation within a five (5) metre wide disturbance zone along the PPF alignment.
- Installation of galvanised steel posts (star pickets).
- Construction of the fence.

The base of the fence will be constructed as the first package of works scheduled to be completed by 30 June 2018. The 'floppy top' and electric wires will be added to the fence as the second package of works, the timing of which is to be determined. The existing Mulligans Flat Woodland Sanctuary fence is shown in Plates 1 and 2, it is envisaged that the completed Stage 2 fence will be of a similar type and form as this fence. However, the base of the mesh will not be buried in excavated trenches either side of the fence as it was for the existing Mulligans Flat Woodland Sanctuary, instead the mesh will lay across the ground and be pinned and covered with a light layer of gravel.

Plate 1. Existing Mulligans Flat Woodland Sanctuary fence.

Plate 2. Existing Mulligans Flat Woodland Sanctuary fence – illustration of mesh extending out each side of the fence base.

3. Ecological Values – Stage 2 alignment

As noted above, Capital Ecology ecologists completed a site visit to inspect the proposed Stage 2 alignment during June 2016, however no additional vegetation mapping or targeted biodiversity surveys have been completed for this project.

3.1 Vegetation

Prior to the establishment of Goorooyarroo Nature Reserve the subject land was managed under rural lease and grazed by stock. The impacts of long-term stock grazing remain evident in the landscape and vegetation communities along the study area, however the condition of the Box-Gum Woodland and other dry forest communities has improved substantially under the current conservation-focussed management.

The vegetation within Goorooyarroo Nature Reserve was broadly surveyed and mapped previously by the ACT Government, the results of which are displayed on ACTMAPi. Inaccuracies were identified in the ACTMAPi EPBC Act Box-Gum Woodland mapping layer during the 2016 site inspection, specifically in that the extent of Goorooyarroo Nature Reserve mapped as EPBC Act Box-Gum Woodland is substantially greater than the actual on-ground extent. Notwithstanding this, for the purposes of this assessment, the ACTMAPi mapping is considered to sufficiently represent the on-ground extent of EPBC Act Box-Gum Woodland within the study area (refer Figure 3).

As identified during the 2016 site inspection, the study area traverses the following two ACT Plant Communities (PCTs) ('climax communities').

1. **PCT-ACT16** – *Eucalyptus melliodora - E. blakelyi* Tableland Grassy Woodland.

   Occurring on gently undulating mid-elevation areas of the ACT, PCT-ACT16 is the dominant PCT along the Stage 2 alignment. This community occurs on soils of moderate to high fertility and generally moderate depth. In its climax form this community would have been characterised by an open canopy, sparse or absent mid and shrubstorey, together with a defined grassy groundstorey supporting a high diversity of native forbs.

   The Stage 2 alignment traverses PCT-ACT16 in varying condition, with some relatively intact sections, and other sections highly modified by past tree clearing and long-term stock grazing now existing as simplified native pasture with or without scattered remnant trees.

2. **PCT-ACT25** – *Eucalyptus macrorhyncha* Tableland Grass / Shrub Forest.

   PCT-ACT25 occurs on exposed dry low hills in the ACT, usually on well-drained skeletal soils. PCT-ACT25 usually occurs upslope of PCT-ACT16 and intergrades with this community along what is often a broad ecotone.

   The Stage 2 alignment traverses a number of patches of PCT-ACT25, the majority of which are in moderate to good condition. Portions of the vegetation in Goorooyarroo mapped as EPBC Act Box-Gum Woodland (PCT-ACT16) on ACTMAPi are actually PCT-ACT25.

3.3 Threatened ecological communities

For the purposes of this assessment all of the area mapped on ACTMAPi as EPBC Act Box-Gum Woodland is assumed to be consistent with the EPBC Act listing criteria for 'critically endangered' ecological community *White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands* as detailed in the final determination (TSSC 2006).

Woodland meeting the NC Act listed community was defined in Action Plan 10 (ACT Government 1999) and Action Plan 27 (ACT Government 2004) as any polygon in which:

1. more than 40% of the trees are or were Yellow Box and/or Blakely's Red Gum; and
2. there is greater than 50% cover of native ground layer species.

According to this definition, and for the purposes of this assessment, all of the area mapped on ACTMAPi as EPBC Act Box-Gum Woodland is assumed to be consistent with the NC Act listed community.

3.4 Threatened species habitat and occurrence

As detailed in Appendix B (Likelihood of Occurrence Assessment), database searches returned 31 EPBC Act and/or NC Act listed threatened species as having the potential to occur in the locality. Each threatened species, or group of similar threatened species, considered to have a moderate or higher likelihood of occurrence in the study area is discussed below.

Threatened flora

One threatened flora species, Hoary Sunray *Leucochrysum albicans* var. *tricolor*, has been recorded within the study area or nearby as identified via a search of the ACT Government Wildlife Atlas and the Canberra Nature Map Radar Environment Report. Although listed as 'endangered' under the EPBC Act, the Hoary Sunray is a relatively common daisy in the ACT and region, particularly across the Mt Ainslie, Mt Majura, Goorooyarroo reserve network. It is likely that Hoary Sunray plants occur within the study area and that some will be disturbed by the construction works. However, it is unlikely that the works will adversely impact upon the species. Indeed, as has been observed at numerous sites (R. Speirs pers. obs.), the soil disturbance may encourage the establishment and spread of the species where plants occur or seed is present in the soil seed bank.

The below table provides a list of flora species considered rare in the ACT which have been recorded in the study area or nearby. The proposed development is unlikely to adversely impact upon a significant proportion of the ACT population/extent of any of these species.

Common Name *Species Name*	Common Name *Species Name*
Milkwort *Polygala japonica*	Narrow plantain *Plantago gaudichaudii*
Twining Fringe Lily *Thysanotus patersonii*	Slender Wire Lily *Laxmannia gracillis*
Corkscrew Grass *Austrostipa setacea*	Blue Grass Lily *Caesia calliantha*
Yam Daisy *Microseris lanceolata*	Bunch Wiregrass *Aristida behriana*
Blue Flax Lily *Dianella longifolia* var. *longifolia*	Prickly Moses *Acacia ulicifolia*
Horned Midge Orchid *Corunastylis cornuta*	Golden Moth *Diuris chryseopsis*
Parson's Bands *Eriochilus cucullatus*	

Threatened reptiles

Striped Legless Lizard

The proposed Stage 2 alignment will run along the edge of the small patch of Striped Legless Lizard *Delma impar* habitat mapped in the southern extent of Block 742, Gungahlin (the offset area known as 'Kenny Broadacre'). The PPF will replace the existing stock fence, thereby avoiding clearance of the Striped Legless Lizard habitat.

Pink-tailed Worm-lizard

The Pink-tailed Worm-lizard *Aprasia parapulchella*, listed as vulnerable pursuant to the EPBC Act and the NC Act, occurs at numerous sites in the ACT and region and is usually confined to sites which are characterised by a moderate to high scatter density of surface rock of volcanic origin, generally interspersed by native grasses including Kangaroo Grass *Themeda triandra* and Red-leg Grass *Bothriochloa macra*.

The species has not been recorded in the locality (the closest record being 9 km away at Kinlyside), however no extensive targeted surveys have been undertaken. The study area and surrounding landscape supports extensive areas of characteristically suitable rocky habitat which may support the species. Notwithstanding this, given that the soil disturbance will be largely temporary and limited to a 5 m wide corridor, the proposed PPF does not have the potential to significantly impact upon the species if it is present.

Threatened invertebrates

Golden Sun Moth

The extent of Golden Sun Moth *Synemon plana* (EPBC Act 'critically endangered' and NC Act 'endangered') habitat currently shown on ACTMAPi does not reflect the areas of Goorooyarroo Nature Reserve with the key habitat characteristics for the species (i.e. open grassland or woodland with a substantial component of Wallaby Grasses *Rytidosperma* spp.). Two short segments of the Stage 2 alignment traverse part of one of the Golden Sun Moth habitat polygons on ACTMAPi, however these areas are dominated by Kangaroo Grass (not a Golden Sun Moth food species) under a moderately intact eucalypt canopy and midstorey, such areas do not constitute potential habitat for the species. In this regard, it is considered unlikely that the proposed development of Stage 2 will impact upon the Golden Sun Moth.

Perunga Grasshopper

The Perunga Grasshopper *Perunga ochracea* (NC Act 'vulnerable') has not been recorded in Goorooyarroo Nature Reserve, however it has been recorded in similar habitat at Kenny approximately 1 km to the south. Whilst the species may occur within the study area, given the limited extent and largely temporary nature of the groundstorey disturbance, it is unlikely to be significantly affected by the proposed PPF.

Threatened woodland birds

Given that the habitat traversed by the Stage 2 alignment comprises a large expanse of Box-Gum Woodland in moderate to good condition, it is highly likely that many of the ACT's threatened or regionally declining woodland bird species utilise the habitat in the vicinity of the alignment. The following points are noted regarding the potential for the proposed development to impact upon threatened woodland birds.

1. Several of the region's more sedentary threatened species, such as the NC Act listed Scarlet Robin *Petroica boodang*, Brown Treecreeper *Climacteris picumnus victoriae*, Hooded Robin Melanodryas *cucullata cucullata*, Speckled Warbler *Chthonicola sagittate,* Varied Sitella *Daphoenositta chrysoptera*, and White-winged Triller *Lalage sueurii,* are likely to forage and may nest within the study area and locality. The construction of the PPF is unlikely to adversely impact upon any of the woodland birds which forage and/or breed in the study area.

2. Migratory threatened species, such as the EPBC Act 'endangered' listed Regent Honeyeater *Anthochaera Phrygia* and Swift Parrot *Lathamus discolor* may visit the study area on an intermittent basis to forage during movements through the region. The construction of the PPF is unlikely to adversely impact upon any of the migratory birds which may visit the study area to forage.

3. The Stage 2 alignment passes within 150 m of a tree used by a pair of Superb Parrots *Polytelis swainsonii* (EPBC Act and NC Act 'vulnerable') during the 2010 breeding season. This tree is approximately 1.5 km from the main Superb Parrot breeding area adjacent to the new suburb of Throsby. The construction of the PPF is unlikely to reduce the likelihood that the species will use this tree or other trees in the study area in future given the separation distance and timing of construction works (refer Section 6).

4. The Little Eagle *Hieraaetus morphnoides* (NC Act 'vulnerable') is not known to nest nearby, however a pair is likely to include the study area within a large territory (ACT Government 2013). The proposed development will not remove or degrade breeding or foraging habitat for this species, and therefore, is unlikely to adversely impact upon the species.

5. As detailed in Section 6, construction works will be timed to occur outside of the breeding season of the woodland birds which may breed in the study area. This construction timing, together with the disturbance minimisation measures detailed in Section 6, will ensure that the proposed development will not significantly impact upon any EPBC Act and/or NC Act listed threatened bird species.

6. One of the key objectives of the PPF is to facilitate the regeneration of the Box-Gum Woodland within the extended sanctuary. This regeneration will improve the overall biodiversity values of the habitat within, notably as breeding and foraging habitat for woodland birds.

4. Summary of proposed direct impacts

As illustrated in Figure 3, the proposed alignment of Stage 2 will traverse 6,275 m of EPBC Act Box-Gum Woodland as mapped on ACTMAPi. An unformed and low impact fire trail (two tyre tracks only) will be established on the inside of the PPF, similar to that shown in Plate 1. This track will be used occasionally for essential reserve management. A disturbance corridor with a maximum width of five metres will be established centred on the PPF alignment, all construction disturbance will be short-term and contained within this corridor. Following construction, the groundstorey will be permitted to re-establish comparable to that along the existing Mulligans Flat Woodland Sanctuary fence. Noting that the impact to Box-Gum Woodland will be of a largely temporary nature, the total maximum area of disturbance is expected to be 3.14 ha (i.e. 5 m along the 6,275 m alignment).

The construction of the PPF is unlikely to result in adverse direct impacts upon any EPBC Act and/or NC Act threatened or migratory listed species.

5. Summary of likely indirect impacts

The PPF extension may have some indirect negative impacts on native fauna. Due to the insufficient ecological information available on many native species, the type and potential severity of these impacts is not known and cannot be entirely predicted, however they may include:

- the disruption of natural movement and dispersal processes;

- mortality through entanglement in the fence;
- mortality through exposure due to an inability to pass through the fence; and
- enforced inbreeding and isolation within the enclosed area.

The disruption of the natural movement and dispersal processes of fauna was considered in the design and location of the Mulligans Flat and Goorooyarroo PPFs. As a result, the PPFs are located well within their respective reserves to provide space outside the fenced areas for the natural movement of wildlife. Nevertheless, this does not remove the impact that the PPFs may have on fauna within the fenced areas, or on fauna attempting to enter or leave the fenced areas.

A study on the impact of the Mulligans Flat PPF found that it did have a negative impact on some species of reptile, particularly on Eastern Long-necked Turtles *Chelodina longicollis* attempting to either enter or leave the sanctuary (Ferronato *et al*. 2014). Eastern long-necked turtles are known to move significant distances, and these movements were disrupted by the PPF leading to increased mortality through exposure. While this study did not place their findings in the regional context of mortality outside the PPF or quantify the benefits which arise due to the protection provided by the PPF, it did highlight the need for appropriate research and monitoring to help inform adaptive management processes.

In response, the managers of Mulligans Flat Woodland Sanctuary established 'Turtle Patrol', a volunteer program which patrols the fence during peak movement periods moving individuals blocked by the PPF past the barrier. Monitoring of the Short-beaked Echidna *Tachyglossus aculeatus* population has also begun in response to the marked increase in the number of the species inside the sanctuary.

During 2016 the ACT Government commissioned a report on the ecological impacts that would result from the construction of the Goorooyarroo PPF extension (Vertego Environmental Consultancy 2016). This report contained the following two key recommendations aimed at reducing the negative indirect impacts of the PPF:

- Recommendation 12 – *"That continuing investigation occurs of the range and distribution habits and needs of terrestrial vertebrates – e.g. echidnas, turtles and large skinks – whose movements are likely to be interrupted by the fence, along with mechanisms (such as the existing 'turtle patrol' in Mulligans Flat) to alleviate these issues"*; and
- Recommendation 15 – *"That ongoing monitoring and recording of animals trapped in the fence be initiated with a view to quantifying the problem, if any, and finding solutions"*.

6. Avoidance, Minimisation and Mitigation Measures

A number of measures are proposed to reduce the impacts of the proposed development upon the ecological values of the study area, specifically Box-Gum Woodland and threatened woodland birds. These measures have been developed in consultation with the ACT Government (EPSDD) and it is envisaged that they will become conditions of any approval. The direct impacts of the proposed PPF construction cannot be avoided, however indirect impacts can be avoided or substantially reduced.

The proposed measures are detailed below.

- Construction works for the PPF will occur outside of the September to mid-January breeding season of the numerous woodland birds which may breed in the study area.

- No driving on the fire trail for non-urgent maintenance/access will occur within the September to mid-January breeding season of the Superb Parrot.
- A five metre wide construction corridor will be established. It will be stipulated in the Construction Environmental Management Plan (CEMP) that this corridor is to be disturbed as little as possible, and that no driving or impacts are to occur outside of this corridor. No regular storage of materials or regular parking of plant or vehicles is to occur within this corridor. If some material storage is required, it is to occur within the corridor outside of the Box-Gum Woodland. The CEMP will stipulate measures (i.e. toolbox talks etc.) to ensure that these requirements are followed.
- Best practice weed management will be implemented during all works to ensure that weeds (notably African Love Grass, Serrated Tussock, St John's Wort, and Chilean Needle Grass) are not introduced or spread. This will include:
    - appropriate vehicle hygiene – all vehicles and machinery for fence construction will be cleaned of all weed seed or propagules prior to entry to the work site;
    - no top-soil or other potentially weed seed laden organic material will be imported;
    - only sterile materials such as hessian/jute or rice straw will be used for soil stabilisation or similar purposes; and
    - for 12 to 18 months following conclusion of the works, significant weeds will be controlled within and adjacent to the construction corridor by a qualified and experienced weed control contractor.

7. Legislative requirements

7.1 EPBC Act Referral

The Commonwealth EPBC Act requires that proposed 'actions' be assessed in terms of their potential to impact upon 'Matters of National Environmental Significance' (MNES) as defined under the Act.

Where a potential impact on a MNES may occur as a result of a proposed action, the significance of that impact must be assessed. Guideline criteria for determining whether an impact is significant are provided under the Act. Where a proposed action will, or is likely to, have a significant impact on a MNES, the proposed action must be referred to the Commonwealth Minister for the Environment and Energy. The purpose of the referral is to determine whether a proposed action requires approval and/or controls under the EPBC Act.

As described herein, the MNES of relevance to the proposed development are EPBC Act Box-Gum Woodland and the numerous EPBC Act listed woodland birds which may occur in the study area. The avoidance, minimisation and mitigation measures detailed in Section 6 will be implemented to ensure that significant impacts upon woodland birds do not occur. The potential for impacts upon EPBC Act Box-Gum Woodland is discussed below.

Box-Gum Woodland

In accordance with the *Matters of National Environmental Significance Significant impact guidelines 1.1* (Commonwealth of Australia 2013), any loss or fragmentation of a critically endangered or endangered ecological community (such as Box-Gum Woodland) is likely to have a significant impact upon the

community. These guidelines provide guidance regarding the requirement to refer a project only, and therefore the impact should be examined on a case by case basis. An assessment of the proposed impact upon Box-Gum Woodland against the EPBC Act significant impact criteria is included as Appendix C. As detailed in Appendix C, the following are important points regarding the likely significance of the proposed impact.

1. The impact is a small loss (approx. 3.14 ha) from the large (approx. 1,330 ha) patch of Box-Gum Woodland extending across the Mulligans Flat – Goorooyarroo reserve network.

2. Construction impacts will be temporary and it is anticipated that the groundcover throughout much of the disturbed area will re-establish naturally.

3. The impact is proposed for the purposes of conserving and improving the Box-Gum Woodland within the enclosed area, therefore the positives will substantially outweigh the negatives. Construction of the PPF will essentially result in a net conservation gain.

Whilst the project will initially result in a relatively small loss of a critically endangered ecological community, this loss is small in the context of the anticipated conservation gain for the subject ecological community and its constituent biota. Nevertheless, although our objective assessment of the proposed impacts (refer Appendix C) suggests that the proposed action is unlikely to significantly impact the listed community, to remove any legal uncertainty, we recommended that the proposed action be referred to the Minister for the Environment and Energy for a determination regarding whether approval is required under the EPBC Act.

7.2 ACT Environmental Impact Statement

Pursuant to the ACT *Planning and Development Act 2007* (P&D Act), a development proposal will be assessed via the 'impact track' and require the preparation of an Environmental Impact Statement (EIS) if the development will have any of the impacts listed under Part 4.3 of Schedule 4 of the Act.

The ecological impacts that trigger the requirement to prepare an EIS of relevance to the proposed development are detailed below, together with an assessment of the proposed development against each of these triggers. The ecological impacts that trigger the requirement to prepare an EIS, of relevance to the proposal are:

> ***Item 1.*** *Proposal that is likely to have a significant adverse environmental impact on 1 or more of the following, unless the conservator of flora and fauna provides an environmental significance opinion indicating that the proposal is not likely to have a significant adverse environmental impact:*
>
> *(a) a critically endangered species;*
>
> *(b) an endangered species;*
>
> *(c) a vulnerable species;*
>
> *(d) a conservation dependent species;*
>
> *(e) a provisionally listed threatened species;*
>
> *(f) a listed migratory species;*
>
> *(g) a threatened ecological community;*
>
> *(h) a protected native species;*
>
> *(i) a Ramsar wetland;*
>
> *(j) any other protected matter*

The proposal will involve the clearance of a small area (3.14 ha) of NC Act 'endangered' listed Box-Gum Woodland. Notwithstanding this, as discussed in Appendix C, this loss is small in the context of the anticipated conservation gain for the subject ecological community and its constituent biota. With the implementation of the proposed avoidance, minimisation and mitigation measures (Section 6), it is unlikely that the proposed development will have a 'significant adverse environmental impact' upon NC Act listed Box-Gum Woodland.

> ***Item 2.*** *Proposal involving—*
>
> *(a) the clearing of more than 0.5ha of native vegetation in a native vegetation area, other than on land that is designated as a future urban area under the territory plan, unless the conservator of flora and fauna produces an environmental significance opinion that the clearing is not likely to have a significant adverse environmental impact.*

Pursuant to the NC Act, native vegetation is defined as present if:

- trees or shrubs indigenous to the area have a canopy cover of 10% or greater in any stratum; or
- native plants indigenous to the area comprise 50% or more of the cover of the groundstorey (grasses, small shrubs, forbs, sedges etc.).

According to this definition, it is likely that most of the land traversed by the Stage 2 alignment supports native vegetation. Assuming clearance of a five metre wide construction corridor along the 8.5 kilometer length of the alignment, the proposed development will result in the clearance of approximately 4.25 ha of native vegetation (i.e. 5 m x 8,500 m) on land that is not designated as a future urban area under the ACT Territory Plan.

Summary and implications

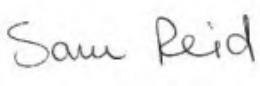
Given the proposed clearance of native vegetation and the proposed impacts upon a threatened ecological community, the proposed development triggers the requirement to prepare an EIS. However, as these impacts are unlikely to be significant, we believe there are reasonable grounds to apply for an Environmental Significance Opinion (ESO) from the ACT Conservator of Flora and Fauna. To this end, Appendix A provides supporting documentation for an ESO application.

7.3 ACT Pest Plants and Animals Act 2005 requirements

The proposed PPF construction is unlikely to increase the spread or dominance of significant weed species within the study area. However, as described in Section 6, appropriate weed control measures will be implemented to prevent weed introduction and/or spread within the study area and into the adjoining areas of Goorooyaroo Nature Reserve.

We trust that this EIA and ESO Supporting Document provides the information and assessment required. If, however, you should have any questions relating to any of the matters discussed herein, please do not hesitate to contact us to discuss.

Yours sincerely,



Robert Speirs

Director / Principal Ecologist

Dr Sam Reid

Consultant Ecologist

Attachments:

Figure 1. Locality Plan

Figure 2. Mulligans Flat – Goorooyarroo Woodland Sanctuary

Figure 3. Predator-proof Fence Alignment – Stage 2 – Direct Impacts

Appendix A. Environmental Significance Opinion Supporting Document

Appendix B. Threatened Species Likelihood of Occurrence Assessment

Appendix C. EPBC Act Significant Impact Criteria Assessment

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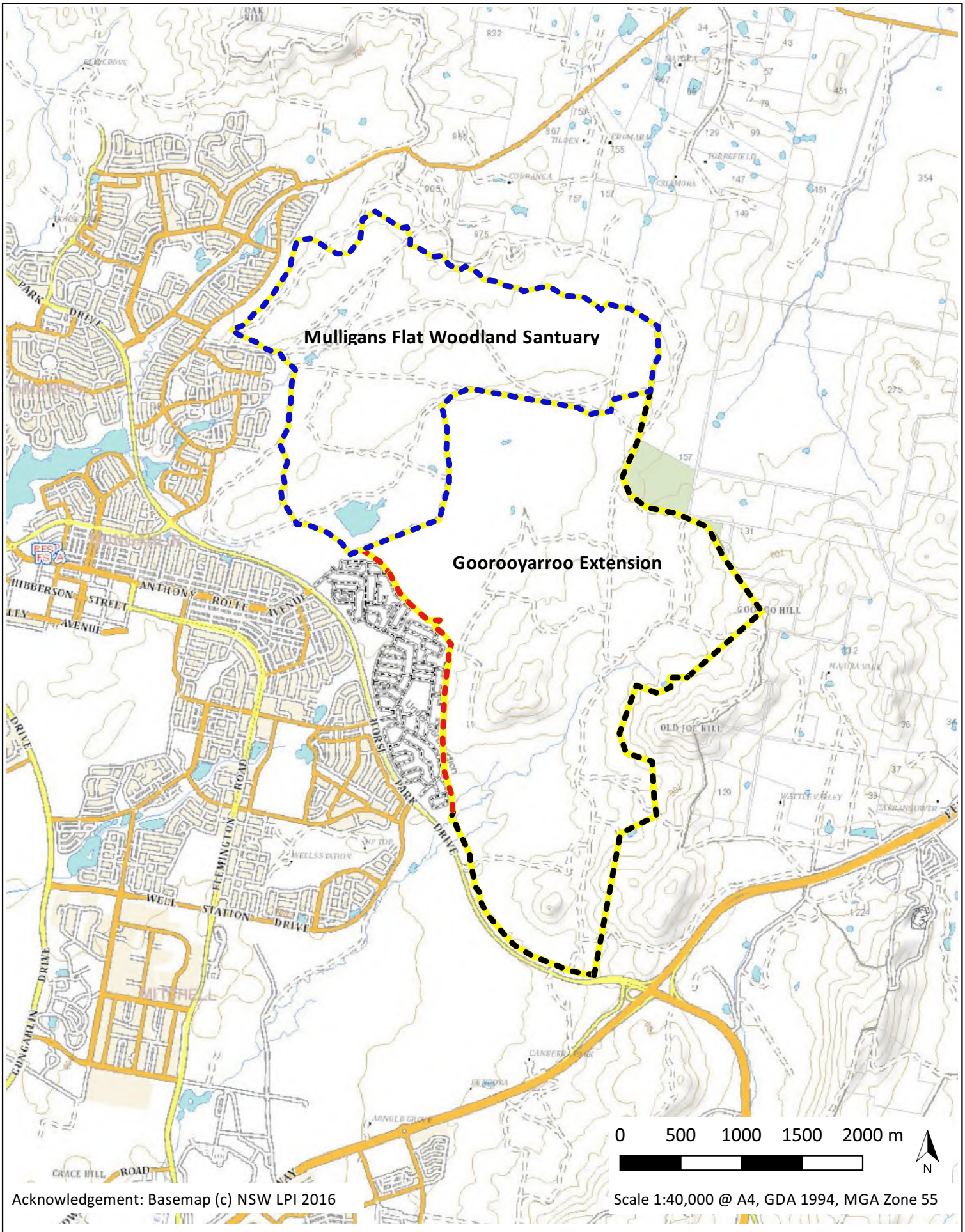

Acknowledgement: Basemap (c) NSW LPI 2016

Scale 1:40,000 @ A4, GDA 1994, MGA Zone 55

Figure 1. Locality Plan

Legend

- Mulligans Flat - Existing Predator-proof Fence
- Stage 1 - Throsby - Existing Predator-proof Boundary Fence
- Stage 2 - Goorooyarroo - Proposed Predator-proof Fence

Capital Ecology Project No: 2709
Drawn by: R. Speirs
Date: 11 October 2017

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Legend

- ACT Border
- Mulligans Flat Nature Reserve
- Mulligans Flat Woodland Sanctuary
- Goorooyarroo Nature Reserve
- Mulligans Flat Woodland Sanctuary - Goorooyarroo Extension
- Mulligans Flat - Existing Predator-proof Fence
- Stage 1 - Throsby - Existing Predator-proof Boundary Fence
- Stage 2 - Goorooyarroo - Proposed Predator-proof Fence

0 500 1000 1500 2000 m

Scale 1:20,000 @ A3, GDA 1994, MGA Zone 55

N

Figure 2. Mulligans Flat – Goorooyarroo Woodland Sanctuary

Capital Ecology Project No: 2709
Drawn by: R. Speirs
Date: 11 October 2017

capital ecology

Figure 3. Predator-proof Fence Alignment – Stage 2 – Direct Impacts

Capital Ecology Project No: 2709
Drawn by: R. Speirs
Date: 11 October 2017

Appendix A. Environmental Significance Opinion Supporting Document

Based upon our assessment of the likely impacts of the proposed development, we believe there are reasonable grounds to request an ESO for the proposal. This appendix addresses the ecological components of Section 9 of the ESO application. It has been prepared as per the ACT Planning and Land Authority guide '*Preparation of an application for scoping and Preparation of an application for an ESO*' guideline (the 'ESO Guideline').

Point 1. Statement of objectives and importance of proposed development

Established in 1994, Mulligans Flat Nature Reserve (the 'reserve') contains an important example of an endangered ecological community that is habitat for threatened species. The adjoining Goorooyarroo Nature Reserve was established in 2004. Together, Mulligans Flat and Goorooyarroo Nature Reserves form the largest, most intact and contiguous Yellow Box – Blakely's Red Gum Woodland in the ACT and region.

Many native fauna species have disappeared from bushland in the ACT, including Mulligans Flat and Goorooyarroo Nature Reserves, and it is thought that predation by cats and foxes is the primary cause. Past overgrazing inhibiting regeneration has also had an impact on native fauna habitat.

The environmental offset for Jacka (North), Taylor and Moncrieff residential developments as identified in the Gungahlin Strategic Assessment includes the creation of the Kinlyside Nature Reserve and the extension of the Mulligans Flat and the Goorooyarroo Nature Reserves.

The enlarged Mulligans Flat and Goorooyarroo Nature Reserve complex is the location for an extension of the existing predator-proof fence (PPF) that will encompass the Throsby offset areas and much of Goorooyarroo, creating a woodland sanctuary of national and international significance.

The objective of the project is to extend the secure and manageable wildlife sanctuary that allows regeneration of native vegetation and excludes feral predators such as cats and foxes, thereby further promoting the recovery of the woodland ecosystem and conservation of threatened species. The extended sanctuary will also provide further opportunities for research, education and nature-based recreation and tourism.

Point 2. Project description

The proposed extension of the Mulligans Flat Woodland Sanctuary will include the Throsby North and Throsby East offset areas and much of the existing Goorooyarroo Nature Reserve, increasing the sanctuary by 820 ha from the existing 484 ha to a total enclosed area of 1,304 ha (refer Figure 2). Extending the sanctuary will substantially increase the area of high quality Box-Gum Woodland which can be managed in a secure manner, allowing natural regeneration and excluding cats, foxes and other feral predators. The project will further promote the recovery of the Box-Gum Woodland ecological community itself, as well as provide the largest and most intact patch of lowland woodland habitat in the region for threatened species, notably woodland birds. Extending the sanctuary will increase the value of the Mulligans Flat Woodland Sanctuary as a conservation measure of national and international significance.

On 23 June 2016, the project team (including two Capital Ecology ecologists) completed a site visit to inspect the proposed Stage 2 alignment. It was determined during the site inspection that substantial alterations should be made to the then proposed alignment. As is now reflected in the currently proposed alignment (illustrated in Figure 3), it was identified that the alignment could be improved by:

- aligning the PPF to run along existing stock fence lines where practicable, thereby minimising new vegetation clearance and ground disturbance;
- straightening the PPF alignment where practicable to minimise the number of strainer points required: and
- aligning the PPF to minimise creek crossings, substantial rocky outcrops and other natural features through which it will be difficult and expensive to construct the PPF and maintain it once constructed.

Development of Stage 2 of the PPF will involve the following.

- Clearance of woody vegetation within a five (5) metre wide disturbance zone along the PPF alignment.
- Installation of galvanised steel posts (star pickets).
- Construction of the fence.

The base of the fence will be constructed as the first package of works scheduled to be completed by 30 June 2018. The 'floppy top' and electric wires will be added to the fence as the second package of works, the timing of which is to be determined. The existing Mulligans Flat Woodland Sanctuary fence is shown in Plates 1 and 2, it is envisaged that the completed Stage 2 fence will be of a similar type and form as this fence. However, the base of the mesh will not be buried in excavated trenches either side of the fence as it was for the existing Mulligans Flat Woodland Sanctuary, instead the mesh will lay across the ground and be pinned and covered with a light layer of gravel.

Point 3. Preliminary Risk Assessment (PRA) (not required for an ESO application)

N/A

Point 4: Description of natural conservation values

For a detailed description of the ecological values of the site, please refer to Section 3 of the EIA. The natural conservation values of the subject land are described and discussed below.

- *Is the location important in maintaining existing processes or natural systems of the ACT?*

The location is important in maintaining existing processes or natural systems of the ACT. The sanctuary supports one of the best remaining examples of the Yellow Box – Blakely's Red Gum Woodland endangered ecological community in the ACT and region. The sanctuary is therefore important for maintaining hydrological cycles, nutrient cycles, and habitat connectivity of this threatened community within the ACT.

- *Is the location important in exhibiting unusual richness of diversity of flora, fauna or landscapes?*

While the Mulligans Flat and Goorooyarroo Nature Reserves were historically managed under rural lease and grazed by stock, the condition of the Box-Gum Woodland and other dry forest communities within has improved substantially under the current conservation-focussed management. The sanctuary supports extensive Yellow Box – Blakely's Red Gum Woodland with high groundcover flora diversity. It also supports many threatened species and habitat for threatened species. The sanctuary's value is high in the context of the Box-Gum Woodland remaining in the ACT and region.

- *Is the location important in its possession of uncommon, rare or endangered flora, fauna, communities, natural landscapes or phenomena?*

Together, Mulligans Flat and Goorooyarroo Nature Reserves support the best remaining example of the threatened ecological community Yellow Box – Blakely's Red Gum Grassy Woodland (Box-Gum Woodland), listed as critically endangered pursuant to the EPBC Act and endangered pursuant to the NC Act. This location is known to support a large variety of flora and fauna, including numerous rare and threatened species (refer to section 3.4).

- *Is the location important in demonstrating the principal characteristics of the range of landscapes, environments or ecosystems, the attributes of which identify them as being characteristic of their class?*

Together, Mulligans Flat and Goorooyarroo Nature Reserves form the largest, most intact and contiguous patch of the Yellow Box – Blakely's Red Gum Grassy Woodland (Box-Gum Woodland) ecological community in the ACT and region. This location contains noteworthy landforms and natural features which are characteristic of their class, and are an outstanding example of an endangered ecological community.

- *Is the location important for information contributing to a wider understanding of the ACT's natural history, by virtue of its use as a research site, teaching site, type locality, reference or benchmark site?*

The Mulligans Flat and Goorooyarroo Nature Reserves are the site of a major research program of national and international importance. Commencing in 2004, the Mulligans Flat Goorooyarroo Woodland Experiment is a long-term research project established in partnership between the ACT Government, the Australian National University, CSIRO, and associated collaborators. The research aims to provide a whole-of-ecosystem understanding of Box-Gum Woodlands, particularly relating to restoring the structure and function of temperate woodlands and increasing biodiversity. Learnings from the research are applied in other reserves across the ACT and region and support evidence-based management by the ACT Parks and Conservation Service.

Mulligans Flat Nature Reserve is a popular venue for recreational walkers, bird watchers, wildlife enthusiasts and cyclists (using the Centenary Trail). In addition to direct conservation benefits, the extended sanctuary will provide further opportunities for scientific research, education and nature based recreation and tourism.

Point 5. Avoidance and minimisation measures

Refer to Section 6 of the EIA.

Point 6. EPBC Act decision

Refer Section 7.1 of the EIA - The proposed development is considered unlikely to significantly impact upon MNES. However, due to the proposed impact upon EPBC Act Box-Gum Woodland, EPBC Act referral was considered warranted. Accordingly, an EPBC Act referral was lodged with the Department of Environment and Energy on XX October 2017. The decision _____ was received on XX November 2017.

Point 7. (additional information required for s211 applications only)

N/A

Appendix B. Threatened Species Likelihood of Occurrence Assessment

Key for the below table:

1) Listed pursuant to the EPBC Act as Critically Endangered (CE), Endangered (E), or Vulnerable (V)

2) Listed pursuant to the NC Act as Endangered (E) or Vulnerable (V)

Note: The brief descriptions of species distribution and habitat are paraphrased from or based on information sourced from the threatened species profiles, recovery plans and listing determinations prepared for each species by the Commonwealth and ACT governments. These resources and their references can be found on the relevant government websites.

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Birds				
Anthochaera phrygia Regent Honeyeater	E	E	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises a number of other eucalypt species. Nectar and fruit from the mistletoes *Amyema miquelii*, *A. pendula*, and *A. cambagei* are also eaten during the breeding season. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks as well as within mistletoe haustoria (section of the root which connects with the host tree). An open cup-shaped nest is constructed by the female of bark, grass, twigs and wool.	Moderate The species may visit the study area and other areas of Mulligans Flat and Goorooyarroo to feed on flowering eucalypts during movements through the region.
Calidris ferruginea Curlew Sandpiper	CE	-	The Curlew Sandpiper occurs around the coast of Australia, and are also widespread inland, albeit in smaller numbers. In the south-east they are occasionally recorded in the Tablelands and often in the Riverina. When inland, they are found around ephemeral and permanent lakes, dams, waterholes and bore drains. Curlew Sandpipers prey mainly on invertebrates, foraging on mudflats and at the edge of shallow pools, wading up to depths of 60 mm deep. They generally roost on dry shingle or sandy beaches, sandspits, and islets. Curlew Sandpipers are migratory and adults are found in Australia from August to April, juveniles are found year-round. This species does not breed in Australia.	Negligible The study area does not support potential habitat for this species.

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Calyptorhynchus lathami Glossy Black-cockatoo	-	V	The Glossy Black-cockatoo has a patchy distribution, having once been widespread across most of the south-east of Australia. The species is now distributed throughout an area which extends from the coast near Eungella in eastern Queensland to Mallacoota in Victoria. Glossy black-cockatoos feed on casuarina seeds, however they occasionally consume seeds from eucalypts, angophoras, acacias and hakeas, as well as insect larvae. In the ACT region the species feeds almost exclusively on Drooping Sheoak *Allocasuarina verticillata*. Pairs mate for life and nest in the hollows of large, old living or dead eucalypt trees. Breeding takes place between March and August.	Moderate The species is rarely recorded in the northern parts of the ACT, however Drooping Sheoak trees occur nearby and the species may visit these to feed during broader movements throughout the locality.
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	-	V	In the ACT region, Brown Treecreepers occur in dry woodlands and open forest below 1,000 metres. The species is relatively common along the Clear Range and along the Lower Naas River. Other populations occur at Mulligans Flat Reserve, Campbell Park, Burbong and former quarries south of the airport in the northern part of the ACT, and at Castle Hill, north of Tharwa. Brown Treecreepers also frequent paddocks and grasslands where there are sufficient logs, stumps and dead trees nearby. The species prefers relatively undisturbed woodland and dry open forest where the native understorey, especially grasses, has been preserved. The species usually prefers predominantly rough-barked trees such as Stringybarks and rough barked Boxes.	High The species is known to occur in the locality and is likely to forage and potential breed in the study area or nearby.
Daphoenositta chrysoptera Varied Sittella	-	V	In the ACT region, the Varied Sittella occurs in a wide variety of woodland and forest habitats, particularly in lowland areas. The species prefers areas with a dominance of rough barked trees, notably Red Stringybark at relatively high density. The species is rarely recorded in sparsely treed areas.	High The species is known to occur in the locality and is likely to forage and potentially breed in the study area or nearby.
Grantiella picta Painted Honeyeater	V	V	The Painted Honeyeater is found in Queensland and New South Wales west of the Great Dividing Range, through to northern Victoria. The species displays some migratory movement and is occasionally found in the Northern Territory and is a vagrant to South Australia and the ACT. The species frequents eucalypt forests and woodlands, particularly those that are infested heavily with mistletoes. In the ACT, the species' primary habitat is River Oak (*Casuarina cunninghamiana*) along river systems, especially the Murrumbidgee River.	Moderate The species may visit the study area and other areas of Mulligans Flat and Goorooyarroo to feed on mistletoe and other flowering trees.

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Hieraaetus morphnoides Little Eagle	-	V	The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment, and occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. The species is sensitive to human disturbance.	High The species has been recorded nearby and the study area is likely to comprise part of the large home range of a pair.
Lathamus discolor Swift Parrot	E	V	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	Moderate The species may visit the study area and other areas of Mulligans Flat and Goorooyarroo to feed on flowering eucalypts during movements through the region.
Melanodryas cucullata cucullata Hooded Robin (southeastern form)	-	V	The Hooded Robin occupies drier eucalypt forest, woodland and scrub, grasses and low shrubs, as well as cleared paddocks with regrowth or stumps. The species uses stumps, posts or fallen timber from which to locate prey on the ground. In the ACT region, the species is found in woodland, often with scattered Yellow Box and/or Blakely's Red Gum, with long grass and low shrubs, or fallen logs.	High The species is known to occur in the locality and is likely to forage and potentially breed in the study area or nearby.
Petroica boodang Scarlet Robin	-	V	The Scarlet Robin is found in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes, breeding in drier eucalypt forests and temperate woodlands.	High The species is known to occur in the locality and is likely to forage and potentially breed in the study area or nearby.
Polytelis swainsonii Superb Parrot	V	V	Found mainly in open, tall riparian River Red Gum forest or woodland. Often found in farmland including grazing land with patches of remnant vegetation. Breeds in hollow branches of tall eucalypt trees within nine kilometres of feeding areas.	High The species forages throughout Mulligans Flat and Goorooyarroo and areas of Goorooyaroo and the Throsby East offset area are key breeding habitat for the species.
Rostratula australis Australian Painted Snipe	V	-	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. The species prefers freshwater wetlands, ephemeral or permanent, although it has been recorded in brackish waters.	Negligible The study area does not support potential habitat for this species.

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Lalage sueurii White-winged Triller	-	V	The White-winged Triller is most common in the south-east of Australia, the far north of Northern Territory and in the Kimberleys and the west of Western Australia. The White-winged Triller is generally found in lightly timbered country with an open shrub layer and grassy ground-cover, usually open woodlands and forest, tree-lined waterways in semi-arid regions and the nearby scrub. The White-winged Triller is a breeding migrant to southern Australia in summer (August to March). It overwinters in the inland and northern Australia.	High The species is known to occur in the locality and is likely to forage and potentially breed in the study area or nearby.
Fish and Crustacea				
Maccullochella peelii Murray Cod	V	-	The Murray Cod's natural distribution extends throughout the Murray-Darling basin ranging west of the divide from south east Queensland, through NSW into Victoria and South Australia. The species is found in the waterways of the Murray– Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers, billabongs and large deep holes. Murray Cod is entirely a freshwater species and will not tolerate high salinity levels.	Negligible The study area does not support potential habitat for this species.
Macquaria australasica Macquarie Perch	E	E	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their substantial tributaries.	Negligible The study area does not support potential habitat for this species.
Frogs				
Litoria aurea Green and Golden Bell Frog	V	-	The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land.	Negligible The study area does not support potential habitat for this species.
Litoria castanea	E	-	The Yellow-spotted Tree Frog previously had a disjunct distribution, being recorded on the New England Tablelands and on the Southern Tablelands	Negligible

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Yellow-spotted Tree Frog			from Lake George to Bombala. The species has only recently (2010) been rediscovered on the Southern Tablelands. Prior to this the species had not been recorded on the Southern Tablelands since the 1970s. Found in large permanent ponds, lakes and dams with an abundance of bulrushes and other emergent vegetation, it shelters during autumn and winter under fallen timber, rocks, other debris or thick vegetation.	The study area does not support potential habitat for this species.
Litoria raniformis Growling Grass Frog	V	-	Previously found across much of the south-east of Australia, the Growling Grass Frog's range has declined. In NSW and the ACT, it is present in the Murray River valley and has been recorded from six Catchment Management Areas in NSW. It is mainly found in emergent vegetation in or at the edges of still of slow flowing water bodies. It can be found in open grassland and open forest, and in montane eucalypt forest and dry sclerophyll forest. Submerged vegetation is important for breeding success. Grassland provides habitat for foraging, dispersal and shelter. Common refuges include soil cracks, fallen timber, debris and dense vegetation.	Negligible The study area does not support potential habitat for this species.
Mammals				
Dasyurus maculatus maculatus Spot-tailed Quoll (SE mainland population)	E	V	The Spot-tailed Quoll occurs along the east coast of Australia and the Great Dividing Range. The species uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000ha, while males have larger home ranges of between 2000 and 5000ha. Breeding occurs from May to August.	Low Although the Mulligans Flat – Goorooyarroo complex provides suitable habitat for the species, the species is rarely recorded in the lowland areas of the ACT. The species has been reintroduced to Mulligans Flat Woodland Sanctuary.
Phascolarctos cinereus Koala (combined populations of Qld, NSW and the ACT)	V	-	In NSW, the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 hectare and	Negligible The species has not been recorded in the locality and is generally not known to occur in the lowland areas of the ACT.

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
			overlap, while in semi-arid country they are usually discrete and around 100 ha.	
Pteropus poliocephalus Grey-headed Flying Fox	V	-	The Grey-headed Flying Fox occurs in the coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. Whilst Brisbane, Newcastle, Sydney and Melbourne are occupied continuously, the species is widespread throughout their range during summer. In autumn the species occupies coastal lowlands and is uncommon inland. In winter the species congregates in coastal lowlands north of the Hunter Valley and is occasionally found on the south coast of NSW and on the northwest slopes (associated with flowering eucalypts of these areas). The Grey-headed Flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, Melaleuca swamps and Banksia woodlands. The Grey-headed Flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. The roost at Commonwealth Park in Canberra is the only known roost in the ACT region.	Moderate The species may visit the site to feed on the flowering eucalypts, however there are no known camps (roost sites) in the locality.
Reptiles				
Aprasia parapulchella Pink-tailed Worm-lizard	V	V	The Pink-tailed Worm-lizard is a fossorial species which lives beneath surface rocks and occupies ant burrows. It feed on ants, particularly their eggs and larvae. Thought to lay eggs within the ant nests under rocks that it uses as a source of food and shelter and for thermoregulation. Key habitat features are a cover of native grasses, particularly Kangaroo Grass, sparse or no tree cover, little or no leaf litter, and scattered small rock with shallow embedment in the soil surface.	Moderate The species has not been recorded in the locality, however no extensive surveys have been undertaken to determine presence/absence of the species in the expanses of suitable habitat rocky habitat present.
Delma impar Striped Legless Lizard	V	V	The Striped Legless Lizard is patchily distributed in grasslands of south-eastern NSW, the ACT, north-eastern, central and south-western Victoria, and south-eastern South Australia. In the ACT, the species is known to occur at four separate locations - in grassland areas of Gungahlin, Majura and Jerrabomberra Valleys, and Yarramundi. Unsuitable habitat, roads and urban development separate these sites. Most areas where the species persists are	Confirmed The study area contains a small patch of confirmed habitat in the southern extent of Block 742, Gungahlin (the offset area known as 'Kenny Broadacre'). Extensive targeted surveys

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
			thought to have had low to moderate levels of agricultural disturbance in the past and it has been suggested that ploughing in particular may be incompatible with the survival of the species. Until recently, the species was thought to inhabit only native grasslands dominated by species such as Tall Speargrass and Kangaroo Grass. In recent years, surveys have revealed the Striped Legless Lizard in many sites dominated by exotic grasses such as Phalaris, Serrated Tussock and Flatweed (Biosis Research 2012). They have also been found in several derived grassland sites, generally within two kilometres of primary grassland.	completed during 2011 failed to detect the species elsewhere north of Horsepark Drive.
Arthropods				
Synemon plana Golden Sun Moth	CE	E	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut and the species has been recorded at many sites in the lowland areas of the ACT. The species occurs in Natural Temperate Grasslands and Box-Gum Grassy Woodland in which the groundcover is dominated by Wallaby Grasses (*Rytidosperma* spp.). It is believed that the females lay up to 200 eggs at the base of the Wallaby Grass tussocks. After hatching, the larvae tunnel underground where they remain feeding on the roots of Wallaby Grass tussocks. The species is also known to feed on the introduced species (and Weeds of National Significance), Chilean Needle Grass *Nassella neesiana* and Serrated Tussock.	Low Two short segments of the Stage 2 alignment traverse part of one of the Golden Sun Moth habitat polygons on ACTMAPi, however these areas are dominated by Kangaroo Grass (not a Golden Sun Moth food species) under a moderately intact eucalypt canopy and midstorey, such areas do not support potential habitat for the species. In this regard, it is considered unlikely that the study area supports the Golden Sun Moth.
Perunga ochracea Perunga Grasshopper	-	V	The Perunga Grasshopper is usually recorded opportunistically by ecologists undertaking vegetation surveys or targeted surveys for other species. The species is generally a natural grassland specialist, and although some records occur in Box-Gum Woodland, such sites are usually nearby the historical ecotone between the two ecological communities.	Moderate The Perunga Grasshopper has not been recorded in Goorooyarroo Nature Reserve, however it has been recorded in similar habitat at Kenny approximately 1 km to the south.
Plants				
Caladenia actensis Canberra Spider Orchid	CE	E	This orchid is endemic to the ACT and is only known from two populations on the western lower slopes of Mount Ainslie and Mount Majura. It was previously recorded at Aranda and Campbell, but no longer exists at those locations. The Canberra Spider Orchid grows on shallow, gravelly, brown clay	Low The study area is only 1.3 km from the closest known population of the species, located on Mount Majura. The habitat within parts of the

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
			loam soils. The species occurs amongst a groundcover of grasses, forbs and low shrubs, often among rocks. It grows on the transition zone (ecotone) between grassy woodland and dry sclerophyll forest.	study area is also similar to that where the species occurs. Notwithstanding these factors, Goorooyarroo Nature Reserve is regularly searched for orchids by the many orchid enthusiasts of Canberra and this species has not been found. It is unlikely that a population occurs in Goorooyarroo and has not been found.
Eucalyptus aggregata Black Gum	V	-	Black Gum occurs on the central and southern tablelands of NSW, and in a small disjunct population in Victoria. In NSW, it occurs predominantly in the South Eastern Highlands Bioregion. The species is a small to medium-sized woodland tree which grows in grassy woodlands on alluvial soils in moist sites along creeks on broad, cold and poorly-drained flats and hollows. It commonly occurs with Candlebark *Eucalyptus rubida*, Ribbon Gum *E. viminalis*, and Snow Gum *E. pauciflora*, with a grassy understorey of River Tussock *Poa labillardieri*. Most populations are located on private land or road verges and travelling stock routes.	Negligible This species is not present within the study area.
Lepidium ginninderrense Ginninderra Peppercress	V	E	The species is known from two natural sites in northern ACT, both within Natural Temperate Grassland.	Negligible The study area does not support potential habitat for this species.
Lepidium hyssopifolium Basalt Peppercress	E	-	This species is known from a few populations in NSW, Victoria and Tasmania. The Basalt Pepper-cress is known to establish on open, bare ground with limited competition from other plants. It was previously recorded from eucalypt woodland with a grassy ground cover, low open Casuarina woodland with a grassy ground cover and tussock grassland, however recently recorded localities have predominantly been in weed-infested areas of heavy modification, high degradation and high soil disturbance such as road and rail verges, on the fringes of developed agricultural land or within small reserves in agricultural land. Many populations are now generally found amongst exotic pasture grasses and beneath exotic trees.	Low The species is not known to occur in the locality.
Leucochrysum albicans var. *tricolor*	E	-	The Hoary Sunray occurs from Queensland to Victoria and in Tasmania. In the ACT the species can be seen in spring in abundance on the roadside along	High

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Hoary Sunray			Fairbairn Avenue and into Mt Ainslie Nature Reserve, on the western slopes of Mt Majura and adjacent to the Federal Highway road easement. In NSW it is distributed on the inland slopes and plains including grasslands and woodlands on the Monaro and is quite a common species along Old Cooma Road and other less modified areas south of Queanbeyan. The species is usually found in ungrazed and lightly grazed areas, along roadsides in particular. It appears to be very sensitive to grazing, but responds to disturbance as a coloniser and appears to tolerate mowing. Flowers spring to summer.	Although listed as 'endangered' under the EPBC Act, the Hoary Sunray is a relatively common daisy in the ACT and region, particularly across the Mt Ainslie, Mt Majura, Goorooyarroo reserve network. It is likely that Hoary Sunray plants occur within the study area.
Pelargonium sp. Striatellum Omeo Stork's-bill	E	-	An undescribed species of Pelargonium, Omeo Stork's Bill is a tufted perennial herb threatened by grazing, recreational activities, and exotic species. It is known to occur just above the high-water level of ephemeral lakes in NSW and Victoria.	Negligible There is no potential habitat for this species in the study area.
Pomaderris pallida Pale Pomaderris	V	-	A compact perennial shrub, growing to 1.5 m high. It is found in the ACT, southern NSW and eastern Victoria. In the ACT it is scattered along the Cotter, Paddy's and Murrumbidgee Rivers and through the Molonglo Gorge. It is found along the plateau edge and very steep upper slopes and cliffs of river valleys, in shallow, pale brown sandy loam soil over granite rock. It grows in shrubland, surrounded by *Eucalyptus* or *Callitris* woodland. In the ACT, it is only found on the eastern banks of the rivers.	Negligible The species is not known to occur in the northern areas of the ACT. Furthermore, the species is reasonably conspicuous during any season to those familiar with the species. It is unlikely that the species is present and has not been previously identified.
Prasophyllum petilum Tarengo Leek Orchid	E	E	When first described in 1991, the Tarengo Leek Orchid was known only from the Hall Cemetery in the ACT. It has since been found at four sites in New South Wales: Captains Flat Cemetery, Ilford Cemetery, Steves Travelling Stock Route (TSR) at Delegate and the Tarengo TSR near Boorowa. The Tarengo Leek Orchid occurs on relatively fertile soils in grassy woodland or natural grassland. The three cemetery sites originally contained grassy woodland, dominated by Snow Gum *Eucalyptus pauciflora* and Black Gum *E. aggregata* at Captains Flat, and Blakely's Red Gum *E. blakelyi* and Yellow Box *E. melliodora* at Hall and Ilford. Both Tarengo TSR and Steves TSR are natural grasslands.	Low The species has not been recorded in the locality.

Species Name	EPBC Act Status	NC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
			The species is intolerant of grazing and this is considered to be the key reason it has been found only within cemeteries and TSRs, land from which grazing has been restricted.	
Rutidosis Leptorrhynchoides Button Wrinklewort	E	E	In the ACT and NSW, Button Wrinklewort occurs in box-gum woodland, secondary grassland derived from box-gum woodland or in natural temperate grassland. It prefers open spaces where it does not have to compete for light. It is known from several sites in the ACT, NSW and Victoria, where it is threatened by habitat loss, grazing and weed encroachment.	Low Button Wrinklewort is reasonably conspicuous during any season to those familiar with the species. It is unlikely that the species is present and has not been previously identified.
Swainsona recta Small Purple-pea	E	E	The Small Purple-pea occurs in the grassy understorey of woodlands and open forests dominated by Blakely's Red Gum, Yellow Box, Candlebark and Bundy. The species grows in association with understorey dominants that include Kangaroo Grass, Poa tussocks and spear-grasses. Plants die back in summer, surviving as rootstocks until they shoot again in autumn. The species is intolerant of grazing but generally tolerant of fire, which also enhances germination by breaking the seed coat and reducing competition from other species.	Low The species has not been recorded in the locality and it is unlikely that a population is present in this location and has never been identified.
Thesium australe Austral Toadflax	V	-	Found in very small to large populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Austral Toadflax is a root parasite that takes water and some nutrients from other plants, especially Kangaroo Grass. It is often found in damp sites in association with Kangaroo Grass but it is also found on other grass species at inland sites. Occurs on clay soils in grassy woodlands or coastal headlands.	Moderate The species has not been recorded in the vicinity of the study area, however it is an inconspicuous species. The species may occur along the drainage lines and other damp portions along the study area.

Appendix C. EPBC Act Significant Impact Criteria Assessment

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

The *EPBC Act Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (Commonwealth of Australia 2013) provide a number of criteria for use in determining whether an 'action' will have, or is likely to have, a significant impact upon an EPBC Act listed 'critically endangered or endangered ecological community'. An assessment of the proposed development against each of these criteria is provided below.

- *Is there a real chance or possibility that the action will reduce the extent of the ecological community?*

6,275 m of the PPF alignment will traverse EPBC Act Box-Gum Woodland. Assuming that the ACTMAPi EPBC Act Box-Gum Woodland layer is accurate and that the entire 5 m wide works corridor will be impacted, the proposal will result in the disturbance of up to 3.14 ha of the community.

The following are important points regarding the likely significance of the proposed impact.

1. The impact is a small loss (3.14 ha) from the large (approx. 1,330 ha) patch of Box-Gum Woodland extending across the Mulligans Flat – Goorooyarroo reserve network.

2. Construction impact will be temporary in nature given and it is anticipated that groundcover will regenerate and re-establish naturally.

The impact is proposed for the purposes of conserving and improving the Box-Gum Woodland within the sanctuary, therefore the conservation gains will substantially outweigh the short-term impacts associated with construction of the PPF. Whilst the project will initially result in a relatively small reduction in the extent of the ecological community, this reduction is small in the context of the anticipated conservation gain for the ecological community and its constituent biota. It is anticipated that the Box-Gum Woodland regeneration and improvement in condition facilitated by the PPF will increase the area of the community which meets the EPBC Act listing criteria in future. The PPF will also allow effective control of feral predators (i.e. foxes and cats) which will improve the ecological function of the Box-Gum Woodland within the sanctuary.

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

The project will require the disturbance/clearance of a maximum 5 m wide corridor for 6.275 km through EPBC Act Box Gum Woodland. However, it is noted that:

- construction impacts will be temporary and it is anticipated that much of the disturbed groundcover vegetation will regenerate and re-establish naturally;

- the alignment has been designed in a manner that will avoid the need to remove large trees;

- the shrub and midstorey strata of Box-Gum Woodland is naturally sparse, the clearance of a few shrubs and midstorey trees along the narrow PPF corridor is therefore unlikely to fragment the ecological community; and

- the construction of the fence and establishment of the extended sanctuary will encourage regeneration of the Box-Gum Woodland within, thereby improving the connectivity of the large expanse of the ecological community across Mulligans Flat – Goorooyarroo.

Given the above, it is unlikely that the proposed action will fragment or increase fragmentation of the ecological community.

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

The proposed action will extend the sanctuary which will substantially increase the area of high quality Box-Gum Woodland which can be managed in a secure manner, allowing natural regeneration of the vegetation and excluding cats, foxes and other feral predators. The project will further promote the recovery of the Box-Gum Woodland ecological community itself, as well as provide the largest and most intact patch of lowland woodland habitat in the region for threatened species, notably woodland birds. Extending the sanctuary will increase the value of the Mulligans Flat Woodland Sanctuary as a conservation measure of national and international significance. The proposed action is unlikely to adversely affect habitat critical to the survival of the ecological community.

- *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 the ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?*

The proposed action involves the construction of a PPF, much of which has been aligned to replace existing stock fences. It is unlikely that the proposed action will modify or destroy abiotic factors or alter surface or subsurface water drainage patterns.

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

The proposed action is anticipated to improve the condition and function of the EPBC Act Box-Gum Woodland within the extended sanctuary. It is unlikely that the proposed action will result in a decline or loss of functionally important species.

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

  - *assisting invasive species, that are harmful to the listed ecological community, to become established, or*

  - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?*

The proposed action will facilitate the exclusion of the exotic predators and herbivores which currently impact upon the ecological community. It is anticipated that excluding these invasive species will lead to a long-term improvement in the quality and integrity of the EPBC Act Box-Gum Woodland within the extended sanctuary.

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

The key purpose of the proposed action is to establish a sanctuary free of invasive predators and herbivores, thereby promoting the recovery of the EPBC Act Box-Gum Woodland ecological community. Accordingly, the proposed action is a key action proposed to facilitate the recovery of the ecological community.

Conclusion

The results of this assessment suggest that the proposed development is unlikely to have a significant impact upon the EPBC Act listed Box-Gum Woodland critically endangered ecological community.