
NORTHERN ROAD
FAIRBAIRN

CONSTRUCTION AND
OPERATIONS STRATEGY

MAY 2020



This Northern Road Construction and Operations Strategy (EPBC 2009/4748) was approved by a delegate of the Minister responsible for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 29 May 2020, as a condition to EPBC Act Referral 2009/4748 (Varied 29 May 2020).

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1. Introduction

Canberra Airport is a major public transport and global gateway to the Nation's Capital and Southern NSW. The Airport is located in the south-west of the Majura Valley which has Natural Temperate Grassland (NTG) and habitat for listed threatened species. Canberra Airport forms a small but important part of this grassland community.

In November 2009 referral EPBC 2009/4748 was approved, subject to conditions, by a delegate of the Minister of the then Department of Environment, Water, Heritage and the Arts responsible for the EPBC Act, for Infrastructure Upgrade and Construction at Canberra Airport. The approval included the construction of a Northern Road connecting Majura Road to the Fairbairn Precinct subject to Condition 5. Fairbairn was a RAAF Base between the 1930's until June 2004.

The Fairbairn precinct has developed as the home base for the Australian Government's executive aircraft fleet, the national gateway for visiting heads of state, headquarters for the ACT Emergency Services Agency, including a facility to service and supply fire-fighting aircraft in the bushfire season, and Defence industry offices.

Canberra Airport has master-planned the Northern Road link between Fairbairn and Majura Road since the first draft Master Plan in November 1998. The future Northern Road will provide Fairbairn with a second means of road access, vitally important for emergency and security capability.

Condition 5 of EPBC 2009/4748, as varied on 29 May 2020 and as set out below, requires the approval of this Strategy prior to the construction of the Northern Road.

Condition 5. The person taking the action must develop and submit a Northern Road Strategy to the Minister. The Northern Road Strategy must include a population viability analysis (or equivalent) that has been prepared by a suitably qualified expert, familiar with the Grassland Earless Dragon, and demonstrate that the Northern Road at **Annexure 1** will achieve:

- a) No net loss of habitat for the Grassland Earless Dragon as identified on the map at **Annexure 2**;
- b) No fragmentation of Grassland Earless Dragon habitat as identified on the map at **Annexure 2**;
- c) No net impacts on the Grassland Earless Dragon from construction activities; and
- d) No increase in the risk of extinction for the east Majura Valley Grassland Earless Dragon population.

The Northern Road Strategy must be approved by the **Minister** before construction of the Northern Road commences. The approved Strategy must be implemented.

In the ten years since approval of EPBC 2009/4748, the Department of Defence has reduced the land area surplus to their requirements to 11.8ha and renegotiated a new Northern Road alignment with Canberra Airport.

Further, the Department of Defence (Defence) confirmed on 2 April 2020 their requirement, as a condition of land transfer, for Canberra Airport to construct within the Majura Training Area two (2) gravel vehicle parking and turning precincts, each of 3,900sqm (65mx60m). These parking areas will remain within the Majura Training Area and be positioned:

1. inside the main gateway to the Grenade Range; and
2. inside the Malcolmvale gateway to the south.

Both subject to environmental impact, please refer to **Attachment 6** a location plan drafted by Calibre.

Each parking area will have a recessed gateway to ensure vehicles arriving or departing each gateway have a parking position off the Northern Road, a road safety imperative.

The Grenade Range gateway parking area will remove and at least impact Natural Temperate Grassland (NTG) flora. The second (south) Malcolmvale gateway does not impact NTG (Rowell May 2020, **Attachment 5**).

Figure 1, Page 4 (same plan as Annexure 1, EPBC 2009/4748, as amended May 2020) shows the new Northern Road alignment plus a separate Defence vehicle parking area located inside the Grenade Range road gateway within the Defence Majura Training Area, marked in Yellow.

A separate Environmental Investigation is underway for the Grenade Range gateway parking area by Alison Rowell, a Suitably Qualified Expert.

The new road alignment, excluding the Majura Training Area Grenade Range gateway Defence parking area, has minor environmental impact (please refer to Attachment 5), a result of:

- a) its westerly location within Malcolmvale West. There is no loss of Natural Temperate Grassland (NTG) flora or Grassland Earless Dragon habitat in this part of Malcolmvale West, however there is a loss of low to very low Golden Sun Moth habitat (Rowell, May 2020, Attachment 5); and
- b) the use of a greater length of the existing gravel Malcolm Vale Road, where there is a range in quality of remnant NTG located along the proposed roadway construction zone and adjacent to the side fence lines as reported in Attachment 5 and as set out in Section 2.1 of this Strategy.

In practical terms, subject to final design within the corridor, the new road alignment comprises three (3) separate sections of approximately:

1. 500m (25%) within the Airport mainly on existing roadways. There is no grassland flora or fauna;
2. 880m (44%) across the heavily disturbed and degraded farmland of Malcolmvale West, (Rowell, May 2011, **Attachment 4** and May 2020 Attachment 5); and
3. 611m (31%) on the existing Malcolm Vale gravel paved Road with some grassland impacted (Rowell, May 2020, Attachment 5).

Since 2007, Canberra Airport has invested heavily in the research of NTG flora and fauna on and off the Airport.

In the context of NTG flora, one of the investments was directly with Greening Australia to demonstrate broadacre methods of upgrading native pasture to NTG. In addition, a broadacre weeding trial is progressing on the Airport with the objective of upgrading Native Pasture to NTG.

In terms of the Grassland Earless Dragon (GED) research, this investment includes a significant project with the University of Canberra (UC) and the Australian Research Council as a corporate partner (**Attachment 3**).

The Canberra Airport Construction Environment Management Plan (CEMP) for Airside Works (**Attachment 1**) and Threatened Species Management Plan (TSMP) (**Attachment 2**) are documents approved by a delegate of the Minister responsible for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2010 as a condition of EPBC 2009/4748. These two Plans will be the base documents for the construction component of this Strategy. Additional construction management actions are included below in Section 3.

Management actions for the ongoing Operations Strategy are included below in Section 4.

The environmental aims and objectives of this Strategy are set out below consistent with Canberra Airport's Threatened Species Management Plan 2010 and have due regard to ongoing research and monitoring data set out in Sections 2 and 3 and Attachments 3-5 inclusive, undertaken or reported between March 2010 and May 2020.

1.1 Operations Strategy Review Timeframe

The proposal is to construct the Northern Road to be open for operation during the 2020/21 Bushfire Season.

The review timeframe of the Operations Strategy will align with Canberra Airport's 2020 Master Plan review which is due in 2027/28. The Airport proposes to review this Operations Strategy during 2027 and each eight years thereafter, consistent with the statutory review cycle of the Airport's Master Plan.

In between these review dates monitoring of performance will be ongoing consistent with current surveillance and monitoring practices on Airport. Any corrective actions taken during these times may result in minor variations to this Operations Strategy.

Variations to the Operations Strategy will be consulted with the Department of Agriculture, Water and the Environment or Department responsible for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) after advice from suitably qualified experts.

Figure 1 – Annexure 1 (2020) Variation to EPBC 2009/4748



1.2 Table 1 – EPBC 2009/4748 Approval Condition 5

Approval condition	Section(s) of Strategy where this is addressed
5. The person taking the action must develop and submit a Northern Road Strategy to the Minister.	This Strategy in-toto.
The Northern Road Strategy must include a population viability analysis (or equivalent) that has been prepared by a suitably qualified expert, familiar with the Grassland Earless Dragon, and demonstrate that the Northern Road at Annexure 1 will achieve:	The Grassland Earless Dragon University of Canberra, Australian Research Council and Canberra Airport collaborative research Final Report (April 2013) is provided at Attachment 3. This report provides extensive detail in relation to the population viability of the Grassland Earless Dragon within the ACT. A brief overview is provided in Section 3.1.2-3.1.4 together with updated monitoring data.
a) No net loss of habitat for the Grassland Earless Dragon as identified on the map at Annexure 2;	Sections 2.1 and 3.1
b) No fragmentation of Grassland Earless Dragon habitat as identified on the map at Annexure 2;	Sections 2.1 and 3.1 Tables 2 and 3
c) No net impacts on the Grassland Earless Dragon from construction activities; and	Sections 2.1 and 3.1
d) No increase in the risk of extinction for the east Majura Valley Grassland Earless Dragon population.	Section 3.1 Tables 2 and 3
The Northern Road Strategy must be approved by the Minister before construction of the Northern Road commences. The approved Strategy must be implemented.	Noted and this draft Strategy is submitted for approval.

2. Northern Road

The Northern Road is required to improve and provide secure alternate road access to Australian and global visiting VIP's, ACT Emergency Services and air traffic control operations in Fairbairn while maintaining access to the southern areas of the Defence Majura Training Area.

Fairbairn is the home base for the Australian Government's executive aircraft fleet, for use by the Prime Minister, Executive Ministers and the Governor-General. Other aircraft movements include visiting dignitaries such as Presidents, Royal Families and allied Air Forces.

The Northern Road will also be used as an alternate access for ACT Emergency Services Headquarters operations and available to all staff employed at Fairbairn.

The Northern Road will reduce congestion on Pialligo Avenue over time which, in turn, will reduce greenhouse gas emissions.

Several different options for the Northern Road linking Majura Road to Fairbairn have been investigated over the past twenty-two years.

The proposed road takes the most westerly alignment of all options considered. It also does not disturb as great an area of Natural Temperate Grassland (NTG) and associated fauna habitat as the road alignment is either along the existing gravel Malcolm Vale Road corridor (almost sixty years old) or through the heavily disturbed Malcolmvale West farmland.

The initial construction of the road is for two lanes (one in each direction) plus shoulder cycle lanes, service easement for conduits and cross flow drainage. The initial width of the road reserve, which includes the construction zone and adjacent undisturbed verges, is likely to be up to 35m (where available), subject to final design. Please refer to Figure 2, page 10.

The objective of this Strategy to constrain the construction zone to minimise soil and grass disturbance.

The installation of in-ground conduits is required to supply utilities and data cables to service the Airport, including Fairbairn. The installation of conduits will reduce ongoing disturbance to any threatened listed species as cables can be readily replaced in the future without disturbing the ground. Please refer to Figure 2, page 10.

2.1 Northern Road Ecological Surveys

Canberra Airport Commissioned an Ecological Study specifically for the Northern Road alignment and adjacent land to be transferred totalling 11.8ha. Alison Rowell, a suitably qualified expert, undertook surveys during January–April 2020. This report of 50 pages is Attachment 5. Key points are summarised below:

The threatened species and communities to be considered in this report were determined from an EPBC Act Protected Matters search, threatened species and community mapping from the ACT Government's interactive mapping service (www.actmapi.act.gov.au), threatened species

monitoring reports prepared for the Department of Defence, and mapping and monitoring carried out at Canberra Airport.

The threatened vegetation community likely to be present is Natural Temperate Grassland of the South Eastern Highlands (NTG), which is listed as a critically endangered ecological community under the EPBC Act and as an endangered ecological community under the ACT Nature Conservation Act 2014 (NC Act). The community and threatened species considered in this report are shown in Table 2.1.

The proposed road travels through an area that is within the original occupied by the NTG community, and the route now contains relatively well-drained grassland with few surface rocks. Threatened flora and fauna species which do not occur in this type of habitat were excluded from the survey.

Section 2 of the Rowell report sets out the methods adopted for the surveys and the species investigated at Table 2.1, page 8 as follows:

- *Flora: Natural Temperate Grassland, Hoary Sunray and Button Wrinklewort*
- *Fauna: Grassland Earless Dragon, Golden Sun Moth, Striped Legless Lizard, Perunga Grasshopper, Canberra Raspy Cricket*

Section 3 of the report records the results of the surveys and key outcomes are discussed in Section 4, including at 4.3 *Mitigation and Protection* and Table 4.1 *Summary of potential losses and mitigation*. Table 4.1 is replicated in the summary page 4 (Rowell, May 2020).

Canberra Airport supports the recommendations in the columns “*Potential area of enhanced habitat in construction zone or on enclosed land* and *Potential area of additional created habitat in construction zone or on enclosed land*”

Natural Temperate Grassland (NTG)

Table 4.1 notes there is approximately 6,300m² of NTG existing on the verges of the gravel Malcom Vale Road of which 970m² is likely to be located outside the construction zone.

The likely NTG to be destroyed in the construction zone is noted as 5,830m². EPBC 2009/4748 contemplates and approves the destruction of NTG associated with works on the Airport and the Northern Road.

The Canberra Airport Offsets Strategy (EPBC 2009/4748) was approved by a Delegate of the then Department of Environment, Water, Heritage and the Arts on 9 February 2010, as satisfying a condition to EPBC Act Referral 2009/4748 prior to commencing the *Infrastructure upgrade and Construction at Canberra Airport*. The Northern Road is included in the Offsets Strategy.

Parlour Grassland, located south of Braidwood, was purchased following approval by the Delegate as a compensatory action property for the Offsets Strategy. The offset property “Parlour Grasslands” contains an NTG Conservation Area of approximately 47ha and is subject to a conservation management agreement with the then Nature Conservation Trust of New

South Wales, in a form acceptable to the then Department of Environment, Water, Heritage and the Arts.

The destruction of NTG on the Malcolm Vale Road verge will be the first area of NTG destroyed by EPBC 2009/4748 construction activity and will activate the Canberra Airport Offsets Strategy (February 2010). The Rowell report confirms there is no loss of Hoary Sunray (Section 3.8) and Button Wrinklewort (Section 3.9).

Grassland Earless Dragon (GED)

The key outcomes of the Rowell report in regard to GED are mainly included in Section 3 of this Strategy.

Table 4.1 recommends “12,500m² (enclosed land on southern part of route, low quality habitat created within 5-6 years of completion)” be managed within the Malcolmvale west land, outside the construction zone and adjoining NTG within the Airport to replace the 5,320 m² of very low quality and/or transit GED habitat. Please refer to Rowell’s Figure 7.

Canberra Airport undertakes to manage this 12,500m² identified by Rowell to achieve this objective within 5-6 years.

Golden Sun Moth (GSM)

Rowell records at 4.1.3.1 *The area containing native grasses which is mapped as GSM habitat in the southern part of the Northern Road easement and enclosed land is patchy, and most is probably only intermittently occupied by GSM due to the extreme fluctuations in biomass that occur in this area between wet and dry years due to the presence of exotic pasture grasses and other environmental weeds (Photographs 15 and 16). The presence of GSM pupal cases in parts of this area in 2019-20 indicates that those areas have been suitable for occupation for at least 2-3 years (generation time of GSM), possibly due to reduced biomass during the current drought. In wetter years the dense structure of the grassland as seen in this area in 2012 (Photograph 16) is likely to reduce breeding success by interfering with emergence of adults, basking, mate searching and egg-laying (ACT Government 2017). This ongoing variability in GSM habitat quality under current management methods (selective weed control and kangaroo grazing only) puts the survival of the GSM population in this area at risk.*

Further, Rowell at 4.3.1 states:

The requirement for a 3 metre setback of the Northern Road from the Airport fence would allow protection of a 2.5 m strip of existing GSM habitat, an estimated area of 970 m². This strip would need ongoing mowing and weed control to retain it as GSM habitat. If the parts of this strip which are not currently GSM habitat could be successfully planted with appropriate native grasses it would represent an additional 530 m² of created habitat, a total of 1500 m² retained habitat (0.15 ha).

Much of the 5.7 ha of grassland enclosed between the eastern Airport boundary fence and the Northern Road route south of Malcolmvale Road (Figures 1 and 7) has potential for rehabilitation as GSM habitat as it contains mostly poor soils and parts have a moderate cover of Tall Speargrass and some bare ground in drought years (Photographs 11, 12 and 15). The 1.25 ha of this area shown as low quality GSM habitat in Figure 7 probably currently contains a sparse GSM population, based on habitat condition and the presence of GSM pupal cases in 2020, but is likely to become unsuitable for occupation by GSM in wetter years due to its high cover of tall exotic species (63% of vegetative cover on Transect 2 was exotic in 2020).

Rehabilitation of this grassland could begin with control of African Lovegrass and regular mowing to about 8 cm to weaken and suppress other tall weeds and exotic pasture grasses, with removal of slashed material if necessary to reduce thatch. Wallaby Grasses (preferred GSM larval food plants) are currently rare in this area, probably because these smaller native grasses are smothered by the high biomass that develops in wetter years while Tall Speargrass can persist under those conditions (Photograph 16). This change in management to regulate biomass within a suitable range would immediately protect the 1.25 ha of habitat that is currently thought to be occupied by GSM but at risk of degradation in non-drought years.

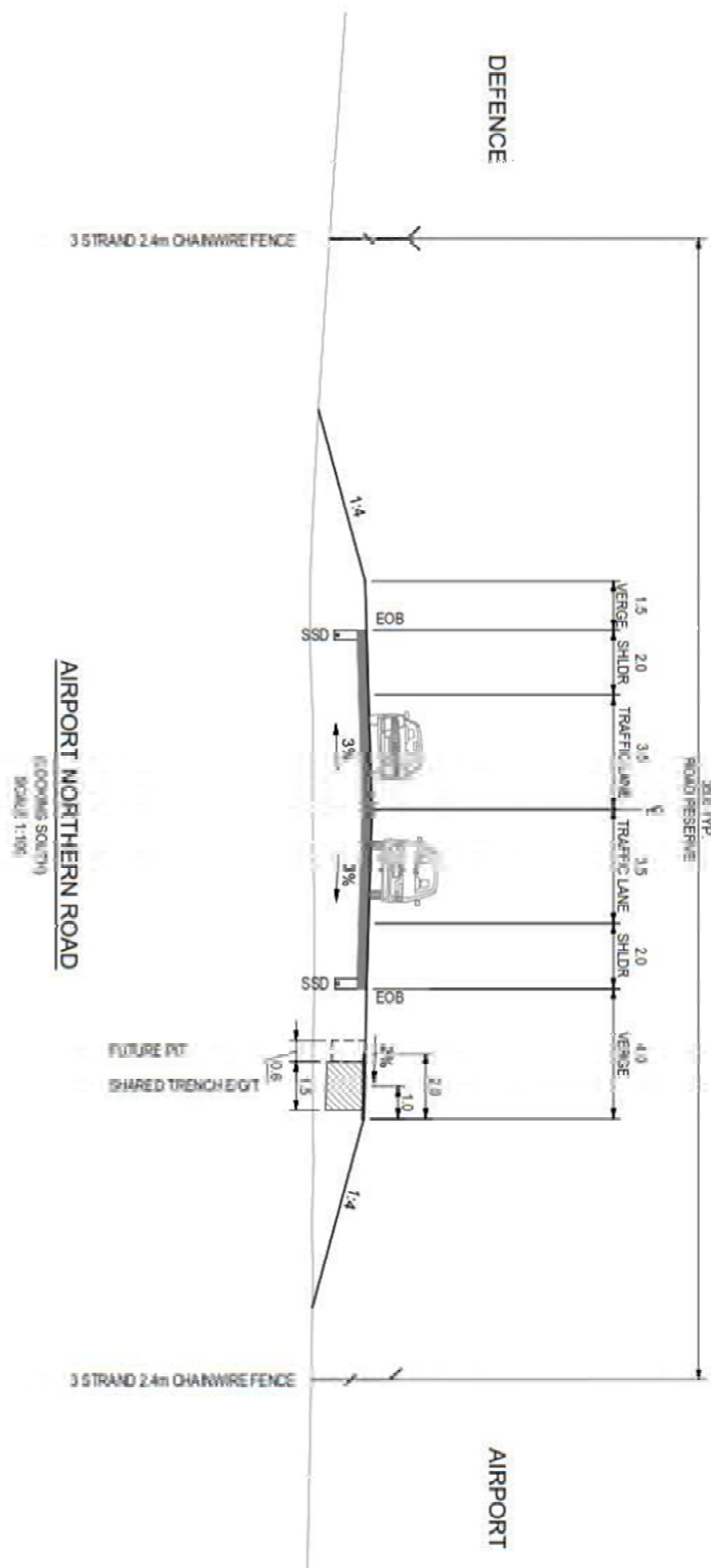
Canberra Airport has undertaken within Sections 3 and 4 of this Strategy to manage weeds and low mow the Northern Road corridor and the area between the airside fence and the Northern Road in the Malcolmvale West precinct consistent with mowing on Airport and the Airport's TSMP.

The Malcolmvale West precinct has been highlighted in the Rowell May 2020 report as an opportunity for also Striped Legless Lizard, Perunga Grasshopper and Canberra Raspy Cricket habitat following completion of the Northern Road and ongoing maintenance, management and monitoring commences.

Baseline Survey on completion of the roadway works

This Strategy commits in Sections 3 and 4 to a baseline ecological survey of the Northern Road and verge and the land between the Airport and the Northern Road once construction is completed. This baseline ecological survey will assist in measuring performance over future years and providing learnings from the operation and maintenance procedures to inform corrective actions.

Figure 2 – Proposed Northern Road – Typical Cross-Section



3. Mitigation Measures and Solutions

Canberra Airport has consulted over the past fifteen years with road engineers, ecologists, members of the Grassland Earless Dragon (GED) Recovery Team, ACT Environment, the University of Canberra Institute of Applied Ecology for the purpose of finding practical solutions in building the Northern Road to mitigate the impact on nearby Natural Temperate Grassland (NTG) and listed threatened species.

3.1 Addressing Condition 5 (EPBC 2009/4748 as amended May 2020)

Condition 5 - The Northern Road Strategy must include a population viability analysis (or equivalent) that has been prepared by a suitably qualified expert, familiar with the Grassland Earless Dragon (please refer to Attachment 3 and Sections 3.1.1 - 3.1.4 below) and demonstrate that the Northern Road at Annexure 1 will achieve:

Condition 5a) No net loss of habitat for the Grassland Earless Dragon as identified on the map at Annexure 2 of EPBC 2009/4748 (2020):

- As identified on the map at Annexure 2 (2020), there is no net loss of primary habitat for the Grassland Earless Dragon.
- Ecological Surveys (Rowell, May 2011 *Attachment 4* and May 2020 *Attachment 5*) indicate the Malcolmvale West area is not NTG and was considered very unlikely to be occupied by GED due to its history and recent fluctuations in condition. Further, the new alignment of the road no longer has a section of the road traversing through the Majura Training Area - an area of high quality NTG and GED habitat forming the south western edge of the Majura Training Area grassland.
- There is remnant NTG on the verge of the gravel Malcolm Vale Road. Potential GED habitat was identified in NTG on these verges near where GED are known to occur on adjacent parts of Canberra Airport and MTA. This was considered to be very low quality habitat due to repeated low mowing of the verges producing the condition shown in Photograph 17, with very short vegetation and higher ground scalped by the mower blades, (Rowell, at Section 3.3 May 2020 *Attachment 5*).

Condition 5b) No fragmentation of Grassland Earless Dragon habitat as identified on the map at Annexure 2 (2020):

- As noted in responses above for 5a, the Malcolmvale West property appears to be no longer a viable Grassland Earless Dragon habitat. Further, the new alignment of the Northern Road no longer has a section of the road traversing through the Majura Training Area; a high-quality grassland.
- Engineering initiatives incorporated into the road design to mitigate fauna fragmentation risk include the formation of a constant grade profile of the finished road surface integrated with the adjacent grass verges and stormwater swales and the potential use of fauna underpass/es associated with stormwater drainage corridors. Please refer to Figure 2, page 10.

- To confirm, there will be no concrete gutter or kerb on the roadway edge. The Northern Road will be in construction a rural roadway similar to most of Majura Road, a design to facilitate GED and other fauna movements across the roadway. The roadway will also not have verge street lights, other than at the intersection with Majura Road which are required for safety reasons.
- Consistent with the Airport's TSMP and research outcomes, the Northern Road verges and stormwater underpasses will initially be maintained to facilitate free movement of fauna with regular weeding and mowing to limit biomass accumulation barriers.
- In the context of the existing gravel section of the Malcolm Vale Road shown on Figure 1, page 4, the risk of fragmentation will unlikely be greater by upgrading this long term (sixty years old) gravel road alignment to a bitumen surface public road.
- Canberra Airport has experience of GED crossing bitumen runway and taxiway systems, including as evidenced by the discovery of eight Grassland Earless Dragons in 2001 between the northern end of the main runway 17/35 and Taxiways Alpha and Foxtrot. The runway and taxiway infrastructure was upgraded to a bitumen surface in 1949/50.
- Rowell, May 2020 (Attachment 5) notes at Section 4.2, *"a University of Canberra report (Attachment 3 of this Strategy) noted that migration between the Majura and Airport GED populations was likely to be infrequent because of the presence of the gravel road and that genetic studies suggest that more substantial paved roads are likely to represent a greater barrier. It was also considered that GED already faces extinction on the Airport, and that experimental facilitated transfer or colonisation using animals from the MTA population or captive bred animals could be considered as an approach to maintaining the Airport population."*

For this reason, the real risk of increased GED loss to vehicle strike should be considered against the potential benefits of genetic mixing between the Airport and MTA GED and the potential support given to the sparse Airport population from possible continued rare immigration across the Northern Road from MTA.

Options include:

- 1. *Design, construct and maintain the road, verges and fences with the aim of facilitating GED crossing on most parts of the roadway, e.g. as far as possible making the easement contour reasonably graded from fence to fence, and without dense grass at the fence bases or in swales and without gutters or grids to impede or trap GED, and making the road surface a similar colour to the surrounding soil and vegetation to minimise overheating and exposure to predation by birds.*

- *2. Making limited zones more suitable for GED crossing, with the above design features and then funnelling animals to the crossing zones by netting the lower parts of the MTA fence outside the zones. Crossing zones would ideally be where vehicles are travelling slowly and would have good GED habitat on both sides of the road.*
- *3. Preventing natural GED crossings by netting the lower part of both boundary fences, and relying on artificial introduction or transfer to maintain the Airport population."*

Canberra Airport has set out in this Strategy to design the Northern Road for construction as set out in Rowell's Option 1. However, as a learning from and monitoring of the operation of the roadway overtime, Canberra Airport is open to Options 2 and 3 in consultation with suitably qualified experts and with the support of the Commonwealth Minister for the Environment.

- The risk of fragmentation appears low to nominal and appears concentrated to the linkage between the Airport and Defence lands bordering the existing gravel Malcolm Vale Road. This length of existing gravel road is over sixty years old and forms approximately 611m in length of the proposed Northern Road.
- The final road design mitigation measures to limit the risk of fragmentation for the Grassland Earless Dragon (GED) have been developed in consultation with the Airport's consultants, including Peter Robertson, co-author of the Grassland Earless Dragon Recovery Plan and ongoing research. Please refer to Table 2 below.

Condition 5c) No net impacts on the Grassland Earless Dragon from construction activities:

- Canberra Airport, in response to the approved Threatened Species Management Plan, has a pre-construction protocol to investigate the construction site zone prior to commencement of construction. The pre-construction protocol was approved by a Delegate for the Minister for the Environment as a condition of EPBC 2009/4748 in November 2009. The Canberra Airport Construction Environmental Management Plan (CEMP) for Airside Works and Threatened Species Management Plan (TSMP) were approved by the Delegate on 3 February 2010 and 9 March respectively and both plans include the pre-construction protocol.
- In Summary, the pre-construction protocol requires low mowing of the proposed construction zone and any thatch on ground is picked up. Silt fencing is erected to the perimeter of the construction search zone to prevent ingress of NTG fauna including GED, and then the area is searched by a suitably qualified expert for GED and other endangered species, methodically inspecting each invertebrate hole in the construction zone.

- The positive performance of the pre-construction protocol was again demonstrated to be effective in 2019 with the pre-construction protocol being undertaken in the northern part of the Canberra Airport's Taxiway Bravo extension now advanced in construction. As a result of the pre-construction investigation in 2019 one Grassland Earless Dragon was discovered and relocated on-airport.

5d) No increase in the risk of extinction for the east Majura Valley Grassland Earless Dragon:

- The alignment of the proposed roadway does not traverse through either the Canberra Airport or the Majura Training Area high value NTG flora or fauna habitat thereby reducing the risk of extinction of GED.
- Based on the history of ongoing research set out below in 3.1.2 the roadway proposed will not increase the risk of extinction for the east Majura Valley Grassland Earless Dragon.
- Canberra Airport has invested in research designed to increase the body of knowledge in regard to the lifecycle of GED, what makes up an ideal GED rangeland habitat and what is the climate impact on GED in the wild, in the ACT. The building of the knowledge base is ongoing.

3.1.1 Condition 5 - viability analysis requirement

"The Northern Road Strategy must include a population viability analysis (or equivalent) that has been prepared by a suitably qualified expert, familiar with the Grassland Earless Dragon."

3.1.2 The University of Canberra Grassland Earless Dragon (GED) Australian Research Council (ARC) research study 2007-2011

Canberra Airport invested over \$174,501 as the corporate partner in this research study.

The final report dated April 2013 has a Project Title: "Metapopulation and habitat quality: towards an integrated approach to the conservation of an endangered grassland lizard" and can be found at Attachment 3.

This research, as required by and as defined within EPBC 2009/4748 (2020), was undertaken by a group of suitably qualified experts set out at page 2 of the report. Canberra Airport also retained (at additional cost to the Airport) Alison Rowell (also a suitably qualified expert) to assist the post graduate students in their studies in regard to the Majura Training Area and Canberra Airport and to consult with the UC experts.

The research commenced in 2007 and progressed over four years. The study provides an in-depth study of the populations of the Grassland Earless Dragon (*Tympanocryptis pinguicolla*) in the ACT and surrounds, including at the Canberra Airport. The main conclusion found that Population decline in *T. pinguicolla* which previously appeared widespread with 3 populations present in the mid-1990s, to now be below detectable levels (page 3).

Within the airport (pages 3 and 4) statements include; the low numbers observed at the Airport site since 2006 are typical of most *T.pinguicolla* populations in the ACT. Recovery could occur with the end of the drought, but it is likely that the airport population is now critically small. It is therefore likely that population recovery will be slow.

Further, populations at Jerrabomberra West Nature Reserve and Majura are each genetically isolated from all other populations while some low levels of interaction occur among populations at Bonshaw North, Bonshaw South, and Queanbeyan Nature Reserve. It is therefore likely that dispersal between populations is rare even if they are within only a few hundred metres of each other.

The fundamental outcome was this population viability analysis (or equivalent) indicated low viability across the ACT including the Majura Training Area and Canberra Airport and in the worst-case, extinction probability of 99% (page 3).

3.1.3 Proposed research and additional data

- In January 2019, Canberra Airport was approached again by Professor Stephen Sarre (UC) and officers of the ACT Environment, Planning and Sustainable Development Directorate to take part in a GED research proposal. This proposal in summary is focused on creating man-made burrows in known GED habitat. The purpose is to measure additional trapping of GED, based on the hypothesis there are more GED in the wild in the ACT habitats than traditional habitat trapping measures. This trial is likely to be ongoing over four years.
- A Canberra GED Recovery Meeting was held on Wednesday 18 March 2020. Canberra Airport was represented by Alison Rowell.

Monitoring data provided by an ACT representative included an overview of GED in the ACT, as follows:

- We have seen a 99% population decline at Jerrabomberra West since 2006, with no animals found this year. This reserve used to be the stronghold containing some 100ha of suitable habitat.
- We have seen a 99% population decline at Jerrabomberra East since 2016 with one animal found this year. This reserve recorded over 100 animals in 2016 and contains around 30-40ha of suitable habitat.
- We have seen a decline in Dragons at the Majura Training Area with a single animal recorded in 2020.
- The only site that has recorded consistent captures of GED is Cookanalla. This rural lease has less than 10ha of high-quality habitat and is not managed for conservation.
- This year not a single juvenile has been recorded. This points to a breeding failure and is a huge concern.

- No Dragons have been detected at AMTECH, Callum Brae, Campbell Park, Majura West for over ten years and they are likely extinct.
- In summary, monitoring data suggests this species is rapidly approaching extinction.
- Canberra Airport notes that a single young adult GED was discovered and relocated on Airport in the second quarter 2019 during the pre-construction protocol search of the Taxiway Bravo extension.

3.1.4 Due Regard to viability research and data

Canberra Airport is concerned not to adversely impact on the viability of the GED population and grassland habitat in the Airport or the Majura Training Area during construction, following the road opening or during the future operation of the road.

Canberra Airport will retain Alison Rowell (a suitably qualified expert) to undertake the pre-construction protocol search for GED in the Malcolmvale West road alignment and in the verges of the Malcolm Vale gravel road.

As previously set out in responses to condition 5 a-c), pages 8-9, engineering design and caution during construction will mitigate impacts on the GED population in the precinct of the roadway.

The long-term ongoing maintenance of mowing, weeding and the like of the Northern Road verge will be undertaken by Canberra Airport staff, already skilled in the maintenance of NTG flora and the need for awareness of fauna, consistent with the Airport's TSMP.

3.2 Construction Environmental Management Plan for Airside Works

Canberra Airport's Construction Environmental Management Plan for Airside Works (CEMP) fulfils the requirements of the *Airport (Environment Protection) Regulations 1997* and *Environmental Management Systems: Guidelines* (NSW Government, 1998), and is consistent with the aims and practices required under the Green Star Certification Scheme.

The CEMP has additional sections addressing works undertaken Airside and in environmental sensitive areas. The CEMP is provided at Attachment 1 of this Strategy and was approved by a Delegate for the Minister for the Environment, Water, Heritage and the Arts on 3 February 2010, as a condition to EPBC Act Referrals EPBC 2008/4170 and EPBC 2009/4748.

In addition to the CEMP, additional mitigation measures will be undertaken for the construction of the Northern Road. Tables 2 and 3 set out the actions for Construction of the Northern Road.

Table 2 responds to EPBC 2009/4748 condition 5 (2020) requirements for the Grassland Earless Dragon.

Table 2: EPBC approval – Responses to condition 5 for the Construction Phase

Management objective	Measure (task)	Target	Timing	Monitoring	Corrective actions
a) No net loss of habitat for the Grassland Earless Dragon as identified on the map at Annexure 2 ;	No net loss.	Maintain or increase habitat area in the precinct.	Commencing on opening of road operation.	Two yearly after road opening until 2027 review of Operations Strategy.	Additional weeding of NTG and native pasture consistent with Canberra Airport's TSMP.
b) No fragmentation of Grassland Earless Dragon habitat as identified on the map at Annexure 2 ;	Monitoring of GED movements overtime.	Free movement.	Commencing on opening of road operation.	Two yearly after road opening until 2027 review of Operations Strategy.	Additional maintenance and minor works to road verge as required.
c) No net impacts on the Grassland Earless Dragon from construction activities; and	No impact. Relocation nearby of any GED found in pre-construction protocol search.	Confining and searching the site.	Pre-construction and during construction program, expected July - December 2020.	Ongoing Toolbox talks with construction staff and random inspection by a suitably qualified expert.	Ongoing review of silt fencing barrier integrity and additional toolbox talks as required.
d) No increase the risk of extinction for the east Majura Valley Grassland Earless Dragon population.	Mitigate risk of extinction.	Ongoing presence of GED on MTA and Canberra Airport adjacent the roadway.	Commencing on opening of road operation.	Two yearly after road opening until 2027 review of Operations Strategy.	Guidance by a suitably qualified expert and implementing research findings.

Canberra Airport provides additional detail in Table 3 below in the context of GED habitat mitigation during construction.

Table 3: Supplementary detail for Mitigation of any Fragmentation - EPBC 2009/4748 condition 5b) arising during construction of the Northern Road

Key Issues	<p>The key issues relating to the construction of the Northern Road include:</p> <ul style="list-style-type: none"> • Risk of fragmentation of Grassland Earless Dragon habitat. • Keeping construction soil disturbance to a minimum, and • Mitigating weed dispersal from construction activities into NTG.
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TASKS AND TARGETS

Task	Description	Timing
Mitigate fragmentation of Natural Temperate Grassland and listed threatened species in road design.	Incorporate road crossings over water course depressions and swales with even graded contours.	Incorporated into final road design.
Achieve no net impact on the Grassland Earless Dragon or Striped Legless Lizard during construction.	Implementation of the Pre-construction Grassland Earless Dragon and Striped Legless Lizard Protocol (refer to CEMP and TSMP).	To be completed prior to construction commencing and monitored regularly during construction.
Implementation of Construction Environment Management Plan and Pre-construction Grassland Earless Dragon and Striped Legless Lizard Protocol (refer to CEMP and TSMP).	Management Actions to minimise soil disturbance, weed dispersal and habitat disturbance.	Implement during construction phase.
Restoration of Natural Temperate Grassland.	Restoration of any areas disturbed by construction by allowing for natural regeneration and reseeded (if required).	To be implemented during and immediately post construction.
Grassland Survey.	A suitably qualified Ecologist is to conduct grassland surveys to set a post construction baseline condition and quality of the grassland.	The suitably qualified Ecologist will decide the season/seasons the grassland survey will be conducted in the year after construction. Additional surveys will then be undertaken every two years until the Strategy is reviewed in 2027.

3.3 Canberra Airport Proposed Northern Road Draft Construction Methodology

In addition to the provisions of the Construction Environment Management Plan for Airside Works and detail set out in tables 2 and 3 above, additional mitigation measures will be activated for the construction of the Northern Road due to its location nearby the east Majura Valley grasslands. Canberra Airport is to apply the following measures:

3.3.1 Construction Vehicle Wash Down

Construction vehicles are to be cleaned and washed off site prior to working on the site to minimise any transfer of dirt, topsoil and seeds from other areas.

3.3.2 Fencing of Road Reserve

The road reserve eastern boundary with the Defence Majura Training Area to be security and silt fenced and the western boundary of the road corridor to be only silt fenced at the start of the project ready for the pre-construction GED search protocol. This would define the limit of works and general limit of travel of construction vehicles. In addition, the silt fencing around the perimeter of the construction zone will also act as a temporary Grassland Earless Dragon exclusion barrier during construction and as part of the pre-construction protocol to search for Natural Temperate Grassland fauna consistent with the Airport's CEMP and TSMP.

3.3.3 Erosion and Sediment Control

Sediment and erosion control measures are to be put in place prior to any earthworks commencing on site. Where appropriate, additional downstream silt fences are to be erected along the road reserve as discussed above. Where possible, hay bales should be avoided as part of the sediment and erosion control measures to avoid contamination with seed from other locations.

3.3.4 Construction Containment

The construction zone disturbed is to be kept to the minimum necessary to undertake the project. Any activities which could be undertaken away from the construction zone, where it is located through and/or adjacent to any habitat areas, are to be undertaken off site or at the site compound.

3.3.5 Construction Vehicle Routes

The routes to be used for construction vehicles are to be clearly defined and fenced. Vehicles are to be prohibited from operating outside the defined construction zone/s.

3.3.6 Reinstatement

Areas within the road reserve disturbed during construction are to be battered off and left to regenerate naturally. If seeds can be obtained from the nearby Airport Natural Temperate Grasslands, the seeds could be spread on disturbed areas or batters. It is not proposed to spread introduced topsoil as this would potentially assist with weed growth and/or invasive grass species.

4. Ongoing Management Strategy for Northern Road Operations

Canberra Airport has grassland management actions for each ongoing threat. These actions have been progressively implemented by the Airport since privatisation in 1998 and have been successful in managing the grassland flora and fauna on Airport. Airport staff are experienced in the ongoing management of endangered grassland flora and fauna.

The objective is to adopt Canberra Airport's Threatened Species Management Plan (TSMP) for the ongoing management of the Northern Road Reserve to maximise Natural Temperate Grassland viability and free movement of Grassland Earless Dragons. Canberra Airport staff are skilled in managing NTG flora and fauna in response to the TSMP.

Table 4 below includes ongoing management actions to be implemented in the Northern Road reserve Operations Strategy, in addition to the management actions discussed in the Threatened Species Management Plan.

Table 4: Strategy Plan for Ongoing Management of the Northern Road Reserve Operations in response to Conditions 5a) – d)

Key Issues	<p>Key to the ongoing management of the Northern Road reserve include:</p> <p>Management of Natural Temperate Grassland and listed threatened species post construction to ensure:</p> <ul style="list-style-type: none"> ➤ Grassland ongoing diversity; ➤ Weed minimisation; ➤ Habitat viability; and ➤ Connectivity for the Grassland Earless Dragon.
Objective	To optimise Natural Temperate Grassland habitat viability and free movement of the Grassland Earless Dragon, leveraging off existing Canberra Airport staff NTG flora and fauna management and maintenance skills.
Management Actions	Implement actions consistent with the Threatened Species Management Plan, ongoing learnings from the roadway's operation leading to the proposed Strategy review in 2027.
Methods of Implementation	<p>Mow graded batters, water course swales and road underpass depressions to facilitate free movement of Grassland Earless Dragons.</p> <p>Implement weed control program to protect NTG diversity and habitat values.</p> <p>Provide anti-perching devices on fences and navigation aids, as required, to reduce the impact of birds of prey on threatened fauna species.</p>

Timing	Implementation of this Strategy to commence during and post construction of the Northern Road.
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ADDITIONAL MANAGEMENT TASKS AND TARGETS TO MITIGATE IMPACTS ON GED

Task	Description	Timing
Ongoing Management Strategy Actions	Review implementation of Threatened Species Management Plan and learnings from the roadway's operations.	After construction works are completed.
Anti-perching devices to mitigate birds of prey impact on GED population	Anti-perching devices on fences and navigation aids as required.	To be installed as finishing detail during the last phase of construction.
Mowing to mitigate bio-mass growth.	Mowing of swales and water course underpass depressions to allow for free movement of Grassland Earless Dragons.	During and post-construction (as required).
Weed Control to enhance Habitat quality	Implement a regular weed control program.	Year 1 – seasonal and ongoing.

4.1 Malcolmvale West Property

The Malcolmvale West property forms the central part of the Northern Road reserve. The property is owned by the Department of Defence and was previously leased as rural land.

The property has been ploughed, exotic pasture improved fertilised with superphosphate and other soil fertility applications in the past. During the millennium drought there was evidence of overgrazing by horses, cattle and kangaroos with resultant degrading of property.

It appears from 2011 and 2020 surveys that habitat for listed threatened species such as Natural Temperate Grassland, the Grassland Earless Dragon and the Striped Legless Lizard, is not present or viable on this site.

Canberra Airport proposes the rehabilitation measures as set out in Table 5.

Table 5: Rehabilitation Action for the Malcolmvale West Property

Key Issues	The Malcolmvale West property was assessed in May 2011 to have mostly exotic and native pasture with high weed infestation and to be unlikely Grassland Earless Dragon habitat.
Objectives	<p>Detract feral animals from entering the Northern Road corridor and remnant Malcolmvale West property.</p> <p>Reduce broadacre weeds to rehabilitate the remnant Malcolmvale West property grassland quality.</p>
Required Actions	<p>Manage ongoing surveys of the Malcolmvale West property by conducting:</p> <ul style="list-style-type: none"> • A grassland baseline assessment on completion of the roadway and then bi-annual monitoring until the Strategy review in 2027; • Ongoing Grassland Earless Dragon bi-annual monitoring until the Strategy review in 2027; <p>Consistent with the Canberra Airport Threatened Species Management Plan and subject to the results of the 2020 survey compared to the 2021 survey on completion of the roadway.</p>
Methods of Implementation	<p>The road alignment will be fenced along the Defence Majura Training Area with an airport security fence (Defence requirement) and this will detract grazing by feral animals such as rabbits, kangaroos and foxes.</p> <p>Canberra Airport has commissioned a suitably qualified expert to conduct grassland fauna and flora surveys to ascertain the condition and quality of grassland. The qualified ecologist commenced these surveys in January 2020 as a status check comparison to a previous survey in May 2011.</p> <p>This survey will investigate the site and determine if the site is suitable for Grassland Earless Dragon, Striped Legless Lizard and Golden Sun Moth and if further surveys are required post road construction.</p> <p>Soil testing have been conducted to ascertain trace elements and nutrients on the property. The results once to hand will be compared to previous catchment testing and be used as baseline data for any future rehabilitation works.</p> <p>The property will initially be managed for biomass and weed control by mowing.</p>

	A weed control program will be developed and implemented in coordination with a qualified Ecologist.
Timing	Implementation of this Strategy will commence post construction of the Northern Road.

TASKS AND TARGETS

Task	Description	Timing
Feral animal deterrent measures	Install fence to detract feral animals and Kangaroos.	Pre and post construction.
Surveys	Commission grassland and listed threatened species surveys.	Pre and post construction.
Weed control	A weed control program will be developed and implemented in co-ordination with the recommendations of a suitably qualified expert.	Post construction.

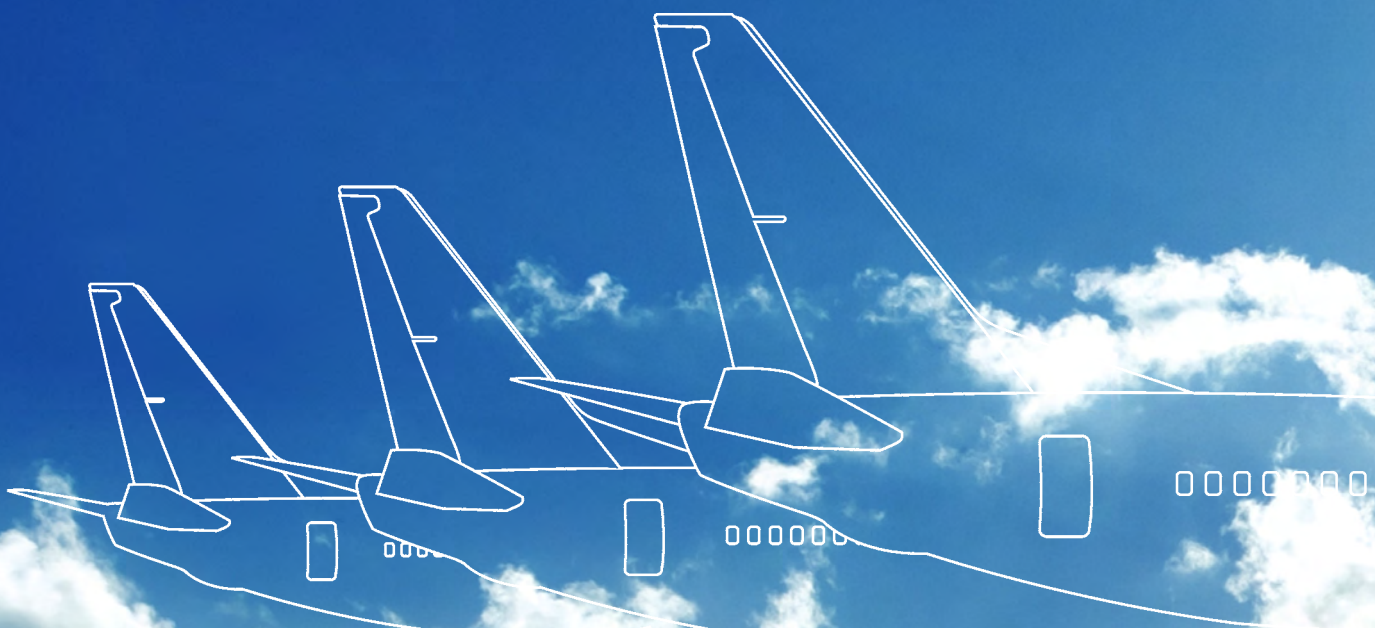
4.2 Monitoring and Reporting

Monitoring and reporting of Natural Temperate Grassland and listed threatened species is undertaken in accordance with the Airport's Environment Strategy and Threatened Species Management Plan. Table 6 below summarises the monitoring and reporting regime.

Table 6: Monitoring and Reporting Regime

Monitoring and Reporting	Frequency
Grassland Earless Dragon	Biannually or as recommended
Golden Sun Moth	Biannually or as recommended
Perunga Grasshopper	Biannually or as recommended As part of Natural Temperate Grassland monitoring

Natural Temperate Grassland	Biannually Mapping to be updated at least every six years
Reporting of retrieval details of Grassland Earless Dragon and/or Striped Legless Lizard individuals found prior to construction to the Department of the Environment.	As required
Details of monitoring will be updated consistent with the Threatened Species Management Plan.	As required



Canberra Airport Construction Environmental Management Plan for Airside works (EPBC 2008/4170 and EPBC 2009/4748)

3 February 2010



The Standard Construction Environmental Management Plan (CEMP) satisfactorily fulfils the requirements of the *Airport (Environment Protection) Regulations 1997* and *Environmental Management Systems: Guidelines* (NSW Government, 1998), and is consistent with the aims and practices required under the Green Star Certification scheme.

Additional components were added to the CEMP to address conditions of approval for EPBC Act Referrals EPBC 2008/4170 and EPBC 2009/4748.

This CEMP for Airside works was approved by the Department of the Environment, Water, Heritage and the Arts on 3 February 2010, as a condition to EPBC Act Referrals EPBC 2008/4170 and EPBC 2009/4748.

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1. Introduction

1.1 Background

This Environmental Management Plan (CEMP) has been prepared for the design and construction phase of projects on Airport and addresses the environmental impacts for the proposed developments in terms of the *Airports (Environment Protection) Regulations 1997*, and the 2005 Canberra Airport Environment Strategy, approved 1 June 2005. This plan also satisfactorily fulfil the requirements of Environmental Management Systems: Guidelines (NSW Government, 1998), and is consistent with the aims and practices required under the Green Star Certification scheme.

This CEMP was approved by the Department of the Environment, Water, Heritage and the Arts on 3 February 2010, to meet the conditions to EPBC Act Referrals EPBC 2008/4170 and EPBC 2009/4748 for Airside works.

1.2 Purpose of the CEMP

The *Airports (Environment Protection) Regulations 1997* requires that all operators (including contractors) at the Airport take all reasonable and practicable measures to prevent pollution or if not reasonable or practicable, to minimise the generation of pollution.

The 2005 Canberra Airport Environmental Strategy, required under the *Airports Act 1996*, sets out the environmental management objectives of the airport. It identifies areas, which are environmentally significant, as well as measures to prevent, control or reduce environmental impact.

The Strategy was developed in the context of an Environmental Management System (EMS) consistent with the International Standard ISO 14001. This CEMP is consistent with the Environment Strategy.

The CEMP describes the proposed measures to be implemented to help achieve and maintain acceptable levels of environmental impact. When coupled with the individual site Erosion and Sediment Control Plan this CEMP becomes a site-specific plan developed to ensure that all contractors, sub-contractors, employees and site visitors comply with environmental requirements and that environmental risks are properly managed for the life of the project.

1.3 Structure of the CEMP

This CEMP comprises the following:

- Measures to incorporate environmental considerations into the construction of the proposed developments;
- Environmental management measures which will be implemented during construction; and
- Environmental management checklists to assist with monitoring the implementation of environmental management obligations during construction works.

This document, in conjunction with the project specific Erosion and Sediment Control Plan provided by the Airport and developed in consultation with the contractor, forms the basis of environmental management during the planning and construction of the project.

2. Project Description

2.1 Location and site layout

The location and site of the development are shown in the Erosion and Sediment Control Plan.

2.2 Summary of Environmental Issues

The following environmental issues are addressed in the Airport Environment Strategy and are discussed in terms of the proposed construction.

2.2.1 Air Quality

The two primary causes of air quality issues are emissions from construction machinery and airborne dust.

Airborne dust results from the excavation and stockpiling of soil as well as vehicle movement around the site. The earthworks contractor must undertake ground watering for dust suppression and place gravel on areas where large numbers of vehicle movements occur.

The Contractor must take appropriate precautions to minimise dust.

The Contractor will install filter fabric on any adjacent plant air intakes to minimise dust particles entering air conditioning systems if deemed necessary by the Airport.

2.2.2 Flora and fauna

Natural Temperate Grassland and Grassland Earless Dragon and Golden Sun Moth habitat are located Airside. Contractors are not to enter in these areas or commence work without the express approval of the Airport.

The Contractor will take appropriate precautions to minimise disturbance to surrounding grasslands.

Prior to works commencing, the Contractor will assist Canberra Airport in conducting the Preconstruction Protocol as set out in Appendix B.

The Contractor is to display pictures of the Grassland Earless Dragon, Golden Sun Moth or Striped Legless Lizard in the Contractors site shed and should cover the protection of listed threatened species during induction and regular toolbox meetings.

The Contractor is to provide a plan, for approval by Canberra Airport and the Airport Environment Officer, detailing fencing and signage of “no go areas” in areas of Natural Temperate Grassland and listed threatened species habitat.

Contractors have an obligation to report any listed threatened species, such as the Grassland Earless Dragon, Golden Sun Moth or Striped Legless Lizard, sighted to Canberra Airport immediately.

Natural temperate grassland has been assessed and mapped prior to construction and will be assessed after construction. Natural temperate grassland disturbed by construction, in the approved buffer areas, will be managed during construction and rehabilitated after construction to improve grassland quality.

Rehabilitation methods may include:

- Light spray of bitumen for dust mitigation (facilitates water penetration) and allowing the area to naturally regenerate using existing seed bank;

- Sowing natural temperate grassland and forb seed; and
- Translocation of grassland and forbs (otherwise destroyed by development).

All trees not to be removed from the site or adjacent verges are to be protected. Trees are to be fenced to protect them from damage from plant and equipment during the construction process.

2.2.3 Hazardous Goods

There is potential for relatively small quantities of hazardous goods to be used on site during construction. These goods will be managed as required by legislation.

2.2.4 Indigenous and Historic Heritage

The Airport lease was surveyed by Australian Archaeological Survey Consultants in 2001 in consultation with the three Ngunnawal groups. Artefacts were found on the Airport during this study, but none were found on the site of construction.

Contractors are to report any artefacts unearthed during construction works to Canberra Airport and the Airport Environment Officer.

2.2.5 Land Management

To assist in mitigating Bird Hazards, Canberra Airport has produced a re-seeding and soil stabilisation protocol as outlined below. Note that any reseeded airside of Natural Temperate Grasslands areas will be undertaken following appropriate consultations. Prior written permission is required from the Environment Manager and Operations Manager for any variations to the below protocol.

Airside

(Note: this also includes areas of Brindabella Park, Majura Park and Fairbairn adjacent to the airside fence.)

- Bitumen is to be used for all soil stabilisation.
- Reseeding to exclusively use Couch, Redleg and Fescue grass (or any combination thereof).

Landside

(Note: this excludes areas of Brindabella Park, Majura Park and Fairbairn adjacent to the airside fence)

- ACT Dryland Grass Mix to be used for reseeded of non-irrigated areas with bitumen stabilisation.

2.2.6 Natural Resources

Sustainable use of resources is a central theme of the Canberra Airport's development of the Airport. Energy saving measures will be utilised as far as economically and commercially possible through design and construction of the proposed development.

Water use is to be minimised as far as practicable and recycled or renewable materials is to be used where practical and economically viable.

Only Non-potable water is to be used for dust suppression and irrigation contractors are to comply with ACTEW Water Restrictions and to minimise water use where possible.

2.2.7 Noise

The likely noise producing activities arising from the development will include:

- Building and site construction activities; and
- Traffic noise generated by vehicles transporting materials and construction workforce to and from the site.

Noise generated from construction, maintenance and demolition of a building or other structure at the airport should not exceed 75dB (A), calculated at the site of a sensitive receptor, as defined in the *Airports (Environment Protection) Regulations 1997*.

Noise from operation of plant and machinery should not exceed background noise level at a sensitive receptor site:

- between the hours of 07:00 and 22:00 – by more than 5dB(A); and
- Between 22:00 hours of a day and 7:00 of the next day – by more than 3dB (A) (Schedule 4, Airports (Environment Protection) Regulations 1997.)

2.2.8 Hydrology and water quality

The Erosion and Sediment Control Plan will detail the use of silt fences, hay or straw bales and sediment retention ponds to prevent the flow of sediment into stormwater drains and where possible the removal of spoil to a dedicated stockpile within the Airport grounds.

The Contractor will provide a vehicle shake down area at the construction zone perimeter to minimise the accumulation of dirt and mud on the roads. Detergents will not be permitted in these areas.

If deemed necessary by the Airport, the Contractor will maintain the shakedown area to ensure that excessive build up of

sediment does not impede the area's effectiveness.

During the construction phase, fuel and chemicals are not to be stored on site unless in an approved bunded area. If a spillage does occur during operations, cleanup methods will be employed which are appropriate for that instance as detailed in the Airports Standard Operating Procedures. The Canberra Airport Environment representative must be notified.

If stormwater accumulates on site, the Airport is to be contacted before the water is pumped to the stormwater system. An Airport representative will test the turbidity of the collected water and provide approval to pump the accumulated water if appropriate. No accumulated water is to be pumped to the stormwater system without the express approval of the Airport.

If ground water is encountered during construction, the Airport is to be contacted for testing before the water is pumped out and before any chemical treatment to settle turbidity. If possible, groundwater is to be collected and used for dust suppression and/or irrigation.

2.2.9 Soils quality

The potential impacts associated with soils on site during the construction phase relate to onsite earthworks and, as a result, possible erosion and movement of sediment offsite by either wind or water. Measures to control this will be outlined in the Erosion and Sediment Control Plan.

Soil testing is to occur as per 6.07 (c) and (d) of the Airports (Environmental Protection) Regulations 1997.

6.07 Duty to assess soil conditions
(c) The soil is an area of land that:

- i. *Is likely to have previously experienced some pollution; and*
 - ii. *Is subject to a sublease or licence that is about to expire or is proposed to be terminated or transferred; or*
- (d) *The soil is in area of land that is affected by a proposed change of use, under a final master plan of the airport, of a kind described in subregulation (2).*

2.2.10 Waste management

The Environment Strategy commits to the ACT policy of 'No Waste by 2010'. This is achieved at the Airport by the application of the 'reduce, reuse and recycle' principle. Industrial waste generated during construction on the site may, where economically feasible, be sorted off-site for recycling. The *ACT Waste Minimisation Act 2001* and *Waste Minimisation Regulations 2001* will be applicable to the transport of all waste off Airport.

Soil and Water Legislation

The disposal of any contaminated soil or water from the site to lands outside the Canberra Airport is to be approved by the ACT EPA and be carried out in a manner consistent with the outlined under the *ACT Environment Protection Act 1997* and the *ACT Environmental Protection Regulation 2005*.

2.2.11 Heritage - for works in the Fairbairn Precinct

The Ex-RAAF Base Fairbairn is listed on the Register of National Estate (RNE) and a Heritage Management Plan (HMP) is being finalised for the Fairbairn Precinct. Prior to any works or development undertaken within the Fairbairn Precinct, an assessment will be completed by Canberra Airport.

If no heritage significance is affected then works can continue along the usual process, however if any detrimental effect to the heritage significance is identified, a referral under the EPBC Act is required.

The Contractor will take all reasonable measures to ensure that heritage listed items are not damaged.

The Contractor will erect tree protection measures around any Heritage listed trees adjacent to the construction site.

3. Legislation and Statutory Obligations

The following legislation applies:

3.1 *Airports Act 1996*

Canberra Airport is principally subject to Commonwealth law. The key pieces of legislation controlling the operation of the airport are the *Airports Act 1996*, and the *Airports (Environment Protection) Regulations 1997* and the *Environment Protection and Biodiversity Act 1999*.

3.2 *Airports (Environment Protection) Regulations 1997*

The *Airports (Environment Protection) Regulations 1997* establish in conjunction with National Environment Protection Measures made under Section 14 of the *National Environment Protection Council Act 1994*, a Commonwealth system of regulation of and accountability for activities at airports that generate or have the potential to generate pollution or excessive noise. The Regulations also promote the improvement of environmental management practices for activities carried out at airport sites.

The Regulations set out provisions for potentially major sources of environmental impact including air, water and soil pollution and excessive noise. The Regulations deal with:

- Duties of operators of undertakings at airports;
- Local standards and individual authorisations;
- Monitoring, reporting and remedial action; and
- Enforcement.

The Regulations provide guidance for the formulation of this CEMP. Importantly, the Regulations require all operators (including contractors) at the airport to take all reasonable and practicable measures to prevent pollution or if not reasonable and practicable to minimise the generation of pollution from an undertaking. Compliance can be enforced under the Regulations.

3.3 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection to matters of national environmental significance which includes nationally threatened species and communities. In this regard, natural temperate grassland and associated endangered fauna species (including the Grassland Earless Dragon and the Golden Sun Moth) occurs airside.

Prior to any works commencing airside Canberra Airport will obtain, if required, the necessary environmental approvals under the EPBC Act.

3.4 **Canberra Airport Master Plan**

The approved 2009 Canberra Airport Master Plan addresses the issues set out in s71 (2) of the *Airports Act 1996*. This CEMP is consistent with the Master Plan.

3.5 **Canberra Airport Environment Strategy**

The Canberra Airport Environment Strategy (approved 1 June 2005) provides a framework for the environmental management of the Airport. This CEMP is consistent with the Environment Strategy.

4. Environmental management process and responsibilities

4.1 Construction

The Contractor will be responsible for the construction of the proposed development and associated infrastructure identified in Section 2 of this CEMP.

The Contractor is responsible for:

- Complying with this CEMP;
- Obtaining all licences and approvals under relevant legislation (with the exception of approvals under the EPBC Act) in consultation with Canberra Airport;
- Having regard to local procedures and best practices regardless of whether they directly apply at the Airport; and
- Where required a Temporary Traffic Management Plan (TTM) must be submitted to the appropriate authorities

Compliance Bonds

The individual contractual agreements made with all contractors and sub-contractors may contain specific compliance bond requirements (if necessary and relevant) and set forth the consequences for responsible parties in the case of non-compliance.

4.2 Approvals and Conditions

The Construction Contractor will submit the Erosion and Sediment Control Plan to the Airport for Review. If the Airport is satisfied with the Erosion and Sediment Control Plan for the Site it will be submitted to the Airport Environment Officer for endorsement. The endorsed Erosion and Sediment Control Plan, consent conditions and the CEMP must be adhered to during the construction of the development.

4.3 Review and update

A copy of the CEMP will be kept on site and should be easily obtainable at all times. If the CEMP needs to be updated the Contractor will submit a new Erosion and Sediment Control Plan to the Airport. If the Airport is satisfied with the updated Erosion and Sediment Control Plan it will submit the updated plan to the Airport Environment Officer for endorsement. In this instance, the old Erosion and Sediment Control Plan remains in force until the Airport Environment Officer endorses the updated version.

4.4 Reporting requirements

A dedicated file will be established by the Contractor for the development to contain all documentation pertaining to environmental management of the works.

During construction, the Contractor will undertake ongoing inspections of the works to identify non-compliance with the provisions of the CEMP.

The Contractor will complete the environmental checklists provided in Appendix A at a frequency agreed with the Airport, but no less than once per month.

The Contractor will provide monthly written reports to the Airport detailing the Contractor's compliance with the CEMP.

The Contractor will immediately inform the Airport of any non-compliances and it is the Contractor's responsibility to remedy all non-compliances. The Airport may impose restriction of construction activities until remedial action has been taken with regards to any environmental deficiencies.

4.5 Reporting requirements under the *Environment Protection and Biodiversity Act 1999*

In response to Referral EPBC 2009/4748, Canberra Airport is required to submit a report of performance against the requirements of the CEMP by 30 June each year for a period of 5 years. During construction the annual performance report will comprise of:

- Preconstruction checklist for the individual site (to be supplied electronically);
- Regular checklists for the individual site (to be supplied electronically);
- Photo diary, using point of references for the site adjacent to natural temperate grassland, prior to construction and during construction;
- A summary report of any non-conformances or complaints.

On the completion of the project annual photos using standard point of references will be taken to monitor weed dispersal, erosion and species diversification.

4.6 Complaints procedure

On-Airport noise complaint and environmental incident registers are in place at the Airport. The Contractor must immediately report to the Airport any complaints they receive, and the actions they take in response to these complaints.

4.7 Environmental emergency response procedures

An environmental incident is an unplanned event, such as an oil or chemical spill that occurs on site and causes significant adverse environmental impacts. The general response to an environmental incident shall be as follows:

1. Site Foreman – Institute a ‘stop-work’, ensure site safety, move people from the immediate area.
2. Site Foreman – Warn traffic of any hazard that may affect traffic using temporary lights, warning signs, etc.
3. Site Foreman – Take practical steps to contain the hazard and prevent it from spreading. Ensure that the Contractor’s Works Site Manager is notified.
4. Contractor’s Works Site Manager – Notify Canberra Airport’s Representative and relevant authority. Liaise with relevant authority and clean up and remediate site.
5. Canberra Airport’s Representative – Notify Canberra Airport’s project manager. Ensure Contractor undertakes clean up in accordance with all statutory requirements.

Some potential environmental incidents and containment guidelines are discussed below. The Contractor shall arrange for appropriate containment equipment to be held at the site and the Site Foreman shall instruct staff in how to carry out emergency procedures.

Emergency Contacts

Accidents and Emergencies	Contact Telephone Number
ACT Fire Brigade	000
Aviation Rescue & Fire Fighting ARFF	02 6243 2199
Police	000
Ambulance	000
Canberra Hospital	02 6244 2222
ACT Work Cover	02 6205 0200

Pollution of a Waterway

This section discusses measures to be taken in the event of a spill of fuel, oil or any chemical into a waterway, or the uncontrolled release of dirty water from a water quality control structure or bunded area.

If possible, intercept the discharge before it enters the waterway with an earth bund or sock from a spill kit. Spread absorbent material from spill kit to soak up the spill. If discharge enters the waterway and mixes with water, isolate it with booms.

Cut Overhead or Underground Services

Secure and isolate problem area and notify the relevant utility authority.

Uncontrolled Fire

Follow the guidelines for using fire extinguishers (if very small fire).

In the event of a larger fire, contact the Fire Brigade. Take precautions to protect adjacent houses from fire (fill gutters with water, close windows and doors, etc.).

If vapour from the burning of toxic material is released into the air move people away from the area.

Utilities Contacts

Utilities	Contact Telephone Numbers
ActewAGL – Water	13 11 93
ActewAGL – Electricity	13 10 93
ActewAGL – Gas	13 19 09
Telstra	13 22 03

5. Environmental Issues

The following sections outline the key issues to be addressed during the construction phase.

5.1 Noise Management

Table 5.1 Noise Management Plan	
Element	Noise Management
Policy	To mitigate noise levels generated as a result of works activities in accordance with specified requirements.
Performance Criteria	The Contractor is to control noise levels such that minimal complaints are received from surrounding areas.
Implementation Strategy	<ul style="list-style-type: none"> Noise generated from construction, maintenance or demolition of a building or other structure is not to exceed 75dB(A) for more than 10% of a period of at least 15 minutes at the site of a sensitive receptor, as defined in the <i>Airport's (Environment Protection) Regulations 1997</i>. Operation of the site will be undertaken to meet the requirements of the regulations (particularly in relation to sensitive and commercial receptors) and the Environment Strategy. Equipment and vehicles used during works are to be adequately maintained and serviced to ensure that noise levels associated with operation are as low as can be reasonably achieved.
Monitoring	Monitoring by the Contractor will include inspection of vehicle service records, monitoring of equipment operating noise levels and programming for appropriate time of day, and consideration of any complaints.
Reporting to CA	The Contractor will provide weekly comment on noise management issues, including details of any complaints from the public or regulatory authorities.
Corrective Action	If monitoring identifies practices which are inconsistent with best environmental practice, the Contractor will immediately take action to remedy the situation. Non-conformance notices and corrective action notices will be prepared and actioned. Monitoring of noise levels will be considered in consultation with the AEO.
Responsibility	Work Site Manager.
Timing	Throughout works implementation.

5.2 Air Quality and Dust Management

Table 5.2 Air Quality and Dust Management	
Element	Air Quality Management
Policy	Airborne dust and air pollution from excessive exhaust emissions from construction machinery and vehicles to be controlled within acceptable limits as defined in the Airport's (Environment Protection) Regulations 1997.
Performance Criteria	<p>Air pollution, particularly dust, is to be controlled such that there is:</p> <ul style="list-style-type: none"> • No interference with the safety of aircraft movements. • Minimal interference with the safe passage of adjacent vehicular traffic. • Minimal impact of airborne sediment on the community in general.
Implementation Strategy	<ul style="list-style-type: none"> • Air borne dust results from excavation, stockpiling of soil, high wind and vehicle movements around site – earthworks contractor is required to undertake ground watering using non-potable water for dust suppression and gravel to be placed on areas where large numbers of vehicle movements occur. • Construction traffic will be restricted to designated areas and tracks. • Dust control measures to be in place and enforced 24 hours per day throughout construction and landscaping periods. • Shakedown areas to be provided prior to entering major roads and loads to be covered where practicable. • If excessive exhaust fumes observed to be emitted for a period of ten seconds or more, vehicles will be requested to shutdown and undergo a maintenance check. • Contractors to submit evidence of vehicle servicing to ensure equipment is running efficiently and fumes are minimised.
Monitoring	Attention will be given to dust during works. If complaints are received, works will cease and additional dust suppression will be undertaken.
Reporting to CA	Weekly site report to include incidents of highly visible emissions of dust or smoke and complaints and remedial actions undertaken.
Corrective Action	If complaints are received, Contractor must immediately alleviate problem.
Responsibility	Works Site Manager.
Timing	Throughout works implementation.

5.3 Water Quality

Table 5.3 Water Quality Management	
Element	Water Quality Management
Policy	To minimise impacts on water quality resulting from construction works
Performance Criteria	<ul style="list-style-type: none"> • Development and adherence to Erosion and Sediment Control Plan and measures outlined in CEMP. • Absence of visible signs of water quality deterioration in water bodies affected by works and any chemical spills or waste that would be swept from the site via drainage lines. • Absence of sediment on road and in drains • Absence of third party complaints including Commonwealth and Territory Regulatory authorities.
Implementation Strategy	<ul style="list-style-type: none"> • Stockpiles of potential water pollutants i.e. oils, fuels, works materials, rubbish, suitably stored/bunded to minimise potential for contaminants to enter drainage lines. • No petroleum products to be stored on site, except for limited amounts of fuel for small plant usage if necessary. • Cleaning of equipment/vehicles to be undertaken in designated wash down area where untreated wash water is contained and does not enter stormwater drainage system • Stabilised access and shakedown grids to be established as detailed in Erosion and Sediment Control Plan. • A street sweeper or equivalent to be used when appropriate to remove accumulated dirt/mud from all roads. Do not wash into stormwater system. The Airport's Street sweeper is not to be used to remove the accumulation of dust/mud caused by Construction works. • At completion of works, area to be cleared of all potentially polluting materials • Employ best practice management to minimise potential for oil/diesel spills e.g. Bunding of temporary storage areas, no open top containers containing chemicals to be left in open, use of drip trays when decanting from large to small containers etc. • If maintenance of plant and machinery occurs on site, it is to be carried out in an approved area. • Any spills to be cleaned up and disposed of immediately. Canberra Airport Project Manager to be advised. • Any disposal of contaminated soil or water to be carried out in accordance with ACT Government requirements. • Works to be carried out in stages to restrict exposed areas susceptible to erosion. Initiate stabilisation of finished areas

	<p>and formations as soon as possible to restrict further exposed areas.</p> <ul style="list-style-type: none"> • Excess materials such as fill and topsoil to be stockpiled on site for future use and provided with erosion protection, after approval of location. Stockpiles to be stabilised if not used for four weeks or more. • Water sources for all construction activities to be approved by Superintendent's representative. • Canberra Airport Project Manager to be contacted if groundwater located during construction. • If possible groundwater is to be collected and used for dust suppressant and/or irrigation. • Express approval of Canberra Airport representative required before ponded water is released to the stormwater system. • Parking of machinery between work periods to be in designated areas only. Stabilised access to be established as detailed in the Erosion and Sediment Control Plan. • Adequate use of sediment pit-socks on street drainage when required. • Encourage workers to park on paved/hardstand areas. • Where possible retain grassed/vegetation strip to filter sediment. • Maintain all sediment control measures during construction and until full stabilisation. • Shake down grids should be checked and cleared out regularly. • Check stabilised entrances daily and prior to rain events.
Monitoring	Daily visual checks and weekly compliance checks (using Erosion and Sediment Control Checklist) to be conducted.
Reporting to CA	Incidents of chemical spills, visible pollution of watercourses and groundwater visibility. Checklist of erosion and sediment control measures to be reported monthly
Corrective Action	Rectification of non-conformance and non-conformance and corrective action notices to be prepared and actioned as soon as possible.
Responsibility	Works Site Manager
Timing	Throughout works implementation.

5.4 Erosion and Sediment Control

Table 5.4 Erosion and Sediment Control	
Element	Soil Erosion and Sediment Control
Policy	To minimise erosion and sedimentation during the works
Performance Criteria	<ul style="list-style-type: none"> • No signs of unacceptable erosion or sediment transport • Absence of water quality deterioration in water bodies affected by works and any chemical spills or waste that would be swept from the site via open swales and drainage lines. • Absence of third party complaints including Commonwealth and Territory Regulatory authorities.
Implementation Strategy	<p>Before commencement of construction activities, the following measures will be incorporated where appropriate, to ensure minimal disturbance and adverse water quality impacts.</p> <ul style="list-style-type: none"> • Sediment fences to be constructed along the downstream edges of the exposed construction area and at the base of any fill embankments. • Areas to be designated for plant and construction material storage. Runoff from these areas to be contained in case of spillage. • Catch drains to be used where possible at the downstream boundary of construction activities to ensure any sediment laden runoff is contained and not permitted to flow onto downstream undisturbed areas. Diversion banks and catch drains to be constructed along contours to minimise scour along the invert. • Sediment fences and sandbags to be placed along catch drains to slow flow, reduce scour and capture some coarse sediment from runoff. • Sufficient materials to protect against erosion to be available on site prior to construction commencing. • Education of site personnel in the location, inspection and maintenance of erosion and sediment control structures. <p>During construction, sediment-laden runoff will be directed through erosion and sediment control structures prior to discharging into the stormwater system. Measures to mitigate water quality impacts during construction will include:</p> <ul style="list-style-type: none"> • Progressive stabilisation of filled areas and filled batters • Construction activities to be confined to the necessary construction area • All construction traffic to use the specified access and exit points from the construction site. <p>Regular inspection and maintenance to be undertaken for all sediment control works. Replacement of damaged equipment</p>

	should occur immediately
Monitoring	Daily visual checks and weekly compliance checks to be conducted. Additional compliance checks to be conducted following rain events greater than 15 mm. The Airport will monitor water quality impacts through its Airport wide regular stormwater monitoring program.
Reporting to CA	Observations made during inspection of sediment and erosion control measures to be incorporated in Contractor's site report.
Corrective Action	Remedy practices that have allowed sediment generation and movement. If non-conformance is result of poor work practices, personnel to be advised of problem and informed of acceptable work practices.
Responsibility	Works Site Manager
Timing	Throughout works implementation.

5.5 Waste Management

Generally waste management relates to minimisation of waste generated, the utilisation of recycled materials, the

recycling of waste materials and appropriate disposal of waste.

Table 5.5 Waste Management	
Element	Waste Management
Policy	To minimise waste generation at source
Performance Criteria	Waste generated as a result of works activities is located in designated areas of site awaiting appropriate disposal or, where economically feasible, recycling.
Implementation Strategy	<ul style="list-style-type: none"> • Designate specific areas on site for temporary management of various waste streams i.e. general domestic waste, works waste and contaminated waste. • Excess works material and solid material is to be separated where economically and commercially practicable and collected into wastes that can be recycled and the remaining waste disposed of at a legally operating landfill. • All domestic and industrial waste to be secured in proper industrial bins and covered to ensure rubbish is secure from wind and rain, and to ensure birds and vermin are not attracted to putrescible waste in uncovered containers. • Recycle waste oils. • Where practicable, use suppliers who have a working waste minimisation policy in place and assess quantities of materials required carefully to minimise surpluses and scrap. • Any disposal of contaminated soil or water to be carried off Airport in accordance with ACT Government requirements. • Trucks to be adequately covered when leaving site
Monitoring	Areas designated for waste storage to be inspected by Contractor as part of weekly works site inspection. Waste amounts to be recorded as they leave the site.
Reporting to CA	Observations and amounts when available to be incorporated in site report.
Corrective Action	If practices are inconsistent with environmental best practice, action must be undertaken to remedy the situation immediately. Non-conformance and corrective action notices to be prepared and actioned.
Responsibility	Works Site Manager
Timing	Throughout works implementation

5.6 Handling and Storage of Hazardous Materials

Given the nature of the works it is not anticipated that large quantities of chemicals will be used or stored on site.

The most likely source of any chemical spill would be oil or diesel from plant and machinery. Provided that good handling and storage practices are employed on site the risk of contaminating the environment due to chemical spills is considered very low.

Table 5.6 Handling and Storage of Hazardous Materials	
Element	Handling and Storage of Hazardous Materials
Policy	To minimise, as far as reasonably practicable, the potential for adverse environmental impact due to handling or storage of hazardous goods.
Performance Criteria	Handling and storage of hazardous materials in accordance with ACT legislation and best management practice.
Implementation Strategy	<ul style="list-style-type: none"> • Establish a suitable dangerous goods storage area (in compliance with statutory regulations), including stores and waste chemical compounds. Prohibit open containers being left out in the open and use drip trays when decanting materials. • Establish temporary bunding for hazardous material storage during construction • All dangerous goods are to be stored in accordance with Dangerous Goods legislation. • Any waste oils to be collected and transported to recyclers or a designated disposal site as soon as possible. • Development of a spill control plan and education of workers in its provisions. This plan is to be readily available on site. • Any leakage or spills to be immediately contained and cleaned up to the satisfaction of the Project Manager • Contact Canberra Airport if spills are greater than 50L. • Written emergency and incident procedures to be communicated to all site personnel. • Current Material Safety Data Sheets (MSDS) for all chemicals on site to be readily available to site personnel with copy given to Superintendent's Representative upon request.
Monitoring	Ongoing visual inspection of handling and storage practices
Reporting to CA	Non-conformances with best practice handling and storage procedures will be noted in weekly site report along with actions to remedy situation.
Corrective Action	If practices are inconsistent with environmental best practice, action must be undertaken to remedy the situation immediately. Non-conformance and corrective action notices to be prepared and actioned.
Responsibility	Works Site Manager
Timing	Throughout works implementation

5.7 Staff and Subcontractor Training

Table 5.7 Staff and Subcontractor Training	
Element	Staff Training
Policy	All personnel involved in or visiting the works are aware of the CEMP and its objectives. Particularly those aspects relevant to the individual.
Performance Criteria	All personnel involved in or visiting the works to be aware of the CEMP and their responsibilities pursuant to the objectives.
Implementation Strategy	<ul style="list-style-type: none"> • Project/site induction is to include instruction on the CEMP and its requirements. Particular attention should be given to the specific actions required, responsibility and timings for each action. • Undertake all activities in accordance with the agreed plans of management, procedures and work methods. • Ensure that they are aware of the contact person regarding environmental matters. • Report any activity that has resulted, or has the potential to result, in an environmental incident. • Ensure that they attend the environmental training provided.
Monitoring	Regular inspection of activities carried out on site to identify compliance with the CEMP
Reporting to CA	The induction of personnel working on the works site to the CEMP will be noted in the Contractor's site report.
Corrective Action	Where individuals are identified as carrying out work in a manner contrary to the objectives of the CEMP, they will be apprised of the problems and given appropriate training in best practices to remedy the deficiency.
Responsibility	Works Site Manager
Timing	Prior to commencement of works and as required for new personnel

5.8 Threatened Species Management

Table 5.8 Threatened Species Management	
Element	Natural Temperate Grassland and threatened species management
Policy	To mitigate the loss and fragmentation of natural temperate grassland and potential habitat during construction.
Performance Criteria	<p>Threatened species are to be managed such that:</p> <ul style="list-style-type: none"> • The conditions of EPBC Act referrals are met. • Minimise disturbance to surrounding grassland. • Minimise weed dispersal • No loss in Grassland Earless Dragon individuals.
Implementation Strategy	<ul style="list-style-type: none"> • No works to commence without the express approval by the Airport • Preconstruction protocol to be followed prior to works commencing as set out in Appendix B • All work personnel will be briefed regarding the location of grassland and threatened listed species prior to works commencing • Regular toolbox meeting regarding threatened species to be undertaken as required • Photographs of Grassland Earless Dragon and Golden Sun Moth will be placed in the contractor work room • The designated area for work will (where applicable) have barriers around the extent of the site. • The designated work area will be clearly marked with no-go zones in areas adjacent to natural temperate grassland and associated habitat not affected by construction works • Areas of relevant grassland adjoining the works area, which will not be impacted by the works, are to be clearly marked to avoid vehicle damage and spillage of spoil. • Vehicle access lanes will be clearly defined by markers and access to the construction zone will be on existing gravelled paved surfaces or existing and former airside roads whenever possible. • All vehicles, plant and equipment must be contained within the work site at all times when parked. • All vehicles used by the contractor must have clean tyres to prevent weed seeds, spoil and other debris. • Vehicles must be washed where necessary before entering the site. • Minimise runoff from the construction site. • No fluffing or unnecessary disturbance of soil

	<ul style="list-style-type: none"> • No topsoil to be added on disturbed areas. • Maintenance of plant and machinery must occur outside the designated construction area. • No fill, topsoil or spoil to be stockpiled on or near grassland. • All wiring to be placed in conduits to minimise disturbance to grassland.
Monitoring	Daily visual checks and weekly compliance checks to be conducted. Additional compliance checks to be conducted when workings in areas adjacent to edge of construction site.
Reporting to CA	Observations made during inspections to be incorporated in Contractor's site report.
Corrective Action	If complaints are received, Contractor must immediately alleviate problem.
Responsibility	Works Site Manager.
Timing	Throughout works implementation.

5.9 Additional Requirements for fuel or other risk sites

Table 5.9 Fuel or other risk site management	
Element	Additional requirements for fuel or other sensitive sites
Policy	To minimise the risk of contamination and to monitor the site for fuel or other hazardous substances.
Performance Criteria	<ul style="list-style-type: none"> • Absence of contamination on site • The protection of groundwater monitoring well.
Implementation Strategy	<p>Before commencement of construction activities, the following measures will be incorporated where appropriate, to ensure mitigation measures are in place to minimise contamination of the site.</p> <ul style="list-style-type: none"> • Base line testing is also required to ascertain the condition of the site prior to construction • Minimum of three groundwater monitoring wells (including one well up gradient) to be installed prior to any works. • Baseline monitoring of the core and water samples to be undertaken in accordance with the <i>Airport (Environment Protection) Regulations 1997</i>. • All excavations for the tank, fuel lines etc to be tested to confirm status of condition. • Baseline monitoring of water samples after the installation of tanks and product and prior to operation of the facility • All groundwater monitoring wells to be protected during construction
Monitoring	<ul style="list-style-type: none"> • Canberra Airport will conduct regular monitoring of groundwater monitoring wells for contaminants of concern in accordance with Airport Environment Strategy (cost of monitoring to be forwarded to tenant) • Monitoring results to be compared to <i>Airport (Environment Protection) Regulations 1997</i>
Reporting to CA	Any incidents to be reported to Canberra Airport immediately
Corrective Action	If practices are inconsistent with best practice, action must be undertaken to remedy the situation immediately. Non-conformance and corrective action notices to be prepared and actioned.
Responsibility	Works Site Manager and tenant
Timing	Prior to works commencing and ongoing management of the site.

Appendix A Checklists

Control Measures	Applicable		Done/ Comment
<i>Pre-Construction</i>			
Staff Awareness			
Ensure that all employees are aware of their environmental responsibilities	Y	N	
Ensure that all subcontractors are aware of their environmental responsibilities	Y	N	
Site Planning			
Mark limits of work site, storage and accesses to minimise the ground area affected by road maintenance activity	Y	N	
Plan order of work to minimise period of exposure of disturbed ground to weather	Y	N	
Locate services (including water, sewerage, electricity etc)	Y	N	
Identify site placement for work materials and fuel storage	Y	N	
Set up secure storage for fuel, oil or other chemicals on site, and bunded around	Y	N	
Identify site placement for spoil, topsoil and waste (not under tree canopies)	Y	N	
Heritage/Archaeology/Flora and Fauna			
Locate sensitive areas and/or areas containing flora and fauna (e.g. particular trees) to be protected	Y	N	
Locate and remove noxious weeds	Y	N	
Install exclusion fences around trees and saplings to prevent damage from machinery or vehicles	Y	N	
Access and Traffic Management			
Prepare traffic control plan	Y	N	
Set up traffic controls	Y	N	
Arrange parking for construction plant and employee vehicles so that through traffic is not impeded.	Y	N	
Erosion and Sediment Controls			
Erosion/Sedimentation Plan approved by Airport Environment Officer	Y	N	
Identify drainage and slope to and from site	Y	N	
Correctly locate erosion control devices and structures, e.g., diversion drains, silt fences, hay bales, sandbags, detention basins	Y	N	
Deployment of sandbags, silt fencing etc to use if work is interrupted by rain	Y	N	
Is a concrete washout needed/installed?	Y	N	
Water Quality			
Provide spill kit, in case of fuel or chemical spills	Y	N	
Noise Control			
Check that mufflers on plant meet EPA requirements	Y	N	

Control Measures	Applicable		Done/ Comment
Install silencing devices or noise reducing barriers if necessary	Y	N	
Hazardous Substances			
Are hazardous substances (e.g. chemicals) being used?	Y	N	
Are appropriate environmental safeguards in place?	Y	N	
Waste Management and Disposal			
Identify wastes generated and method of disposal, including recycling where possible	Y	N	
Prepare Waste Management Plan as part of CEMP	Y	N	
During Construction – Weekly Checklist			
Heritage/Archaeology/Flora and Fauna			
Control or prevent spread of weeds	Y	N	
Monitor vehicles to ensure vehicles keep to designated tracks and roads	Y	N	
Check vehicle and plant tyres to minimise weed dispersal			
Works will cease in the event any heritage or archaeological items are discovered	Y	N	
Community Liaison			
Maintain a register of any complaints and detail the methods by which they were addressed	Y	N	
Access and Traffic Management			
Monitor traffic response to traffic controls and rectify any problems.	Y	N	
Erosion and Sediment Controls			
Correctly maintain erosion control devices for job duration	Y	N	
Soil Impacts			
Cover stockpiled soil and separate topsoil	Y	N	
Minimise compaction of topsoil due to use of heavy machinery	Y	N	
Air Quality			
Do not use plant which exceeds 10 sec continuous visible smoke from exhaust	Y	N	
Keep loose surfaces on site damp in windy weather	Y	N	
Dispose of excess spoil promptly or cover stockpiles	Y	N	
Cover truck trays when transporting dry material	Y	N	
Do not burn off waste materials	Y	N	
Noise Control			
Restrict construction noise levels by using plant responsibly	Y	N	
Notify neighbours if work outside normal hours of work is planned	Y	N	
Fire Control			
Ensure no cutting, welding or grinding on ‘fire ban’ days	Y	N	

Control Measures	Applicable		Done/ Comment
Keep flammable materials in clearly signed secure area	Y	N	
No open fires allowed	Y	N	
Hazardous Substances			
Maintain a register of all hazardous substances kept on site			
Waste Management and Disposal			
Maintain a Waste Management Register recording the type, quantity and location of waste reused, recycled, stockpiled and disposed of	Y	N	
Maintain worksite in clean, rubbish-free state	Y	N	
Inspect plant for fuel, oil or hydraulic fluid leaks. Repair leaks before using plant	Y	N	
Carry out any on-site refuelling and servicing within bunded area at least 20m from natural or built drainage lines.	Y	N	
Appropriately contain wastes stored on site	Y	N	
Dispose of waste in accordance with legal requirements, including treatment, if required	Y	N	
Ensure waste is transported securely	Y	N	
Post-Construction			
Rehabilitation of Site			
Ensure soil is made stable (especially when soil slopes)	Y	N	
Revegetate site in accordance with Landscape Plan	Y	N	
Remove soil and erosion controls after soil is made stable	Y	N	
Remove all waste materials or liquids from site	Y	N	
Remove site sheds and amenities	Y	N	
..... Site Foreman..... (date)			

Appendix B Preconstruction Protocol

Protocol for the investigation and retrieval of Grassland Earless Dragon

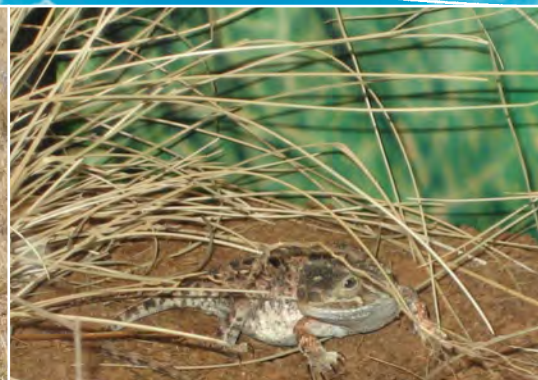
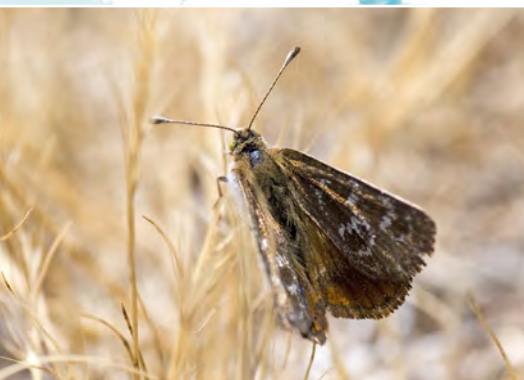
The following protocol was developed in consultation with Peter Robertson, Wildlife Profiles Pty Ltd and co-author of the Grassland Earless Dragon Recovery Plan and Alison Rowell, Qualified Ecologist on 9 November 2009 and will be followed, prior to any works, for the investigation and retrieval of potential Grassland Earless Dragon.

1. Fence off construction area and install sediment fencing to deter the movement of Grassland Earless Dragons into the construction area;
2. Closely mow the construction area and remove the thatch;
3. Investigate the area north of Taxiway Foxtrot for invertebrate holes;
4. Check any holes in the works area with a fibrescope for the Grassland Earless Dragon;
5. Once the holes are checked the holes are destroyed to deter Grassland Earless Dragons from re-entering the hole;
6. If found, the Grassland Earless Dragon is identified by photography, measure, sex and DNA if possible (DNA sampling to be undertaken by the University of Canberra who will obtain necessary permit to take and ethics approvals);
7. It is proposed to move the animals away from the works area and placed in an area of potential or actual habitat, preferably adjacent to the works area. The area will be decided upon by Alison Rowell and Peter Robertson;
8. The Grassland Earless Dragon individuals will be monitored by using a tracking device (to be undertaken by the University of Canberra);
9. Alternative burrows will be made by hammering a round stake or by drilling in the ground to a depth of 20cm– such a hole then has the characteristics of an invertebrate hole where the lizards are found at the Airport; and
10. Build upon the database recording each of the captured animal's characteristics including exact site location and relocation. This will allow for possible comparison of future monitoring and recaptures. Data will be shared with the University of Canberra, Grassland Earless Dragon Recovery Team, Department of the Environment Water, Resources, Heritage and the Arts and ACT Parks, Conservation and Lands (PCL).

Sediment and erosion control fencing will be installed to prevent Grassland Earless Dragons re-entering the work corridor during works.

Appendix C Existing Airside Roads





Threatened Species Management Plan

March 2010



Canberra Airport takes its environmental responsibilities seriously. Given this it will do all that it is reasonable and practicable in the circumstances to ensure it and its employees, officers, agents, and contractors comply with this strategy.

Canberra Airport has taken expert advice from Peter Robertson, Wildlife Profiles Pty Ltd and co-author of the Grassland Earless Dragon Recovery Plan, Alison Rowell, Qualified Ecologist and University of Canberra, Institute of Applied Ecology.

Canberra Airport has also consulted with the Department of Defence, ACT Commissioner for Sustainability and the Environment, Friends of Grasslands, Conservation Council - ACT Region, ACT Department of Environment, Climate Change, Energy & Water, Limestone Plains Group and peak community groups (ACT and NSW) regarding the EPBC Act referrals and listed threatened species on Airport.

Issues relating to the northern road, the Northern Road Strategy (Construction and Operation) and Conservation Agreement will be formally submitted to the Department of the Environment, Water, Heritage and the Arts for approval in the event that the land is transferred to Canberra Airport for the purpose of constructing the northern road.

This Threatened Species Management Plan was approved by the Minister for Environmental Protection, Heritage and the Arts on 9 March 2010, as a condition to EPBC Act Referral 2009/4748 for the Infrastructure upgrade and Construction at Canberra Airport.

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Chapter one | Introduction



Canberra Airport is a major public transport gateway to the Nation's Capital. The Airport is located in the south west corner of the Majura Valley, and makes up a small but important part of the Majura Valley Grassland community.

Prior to Airport operations commencing at Majura in 1927, the land formed part of the Limestone (treeless) Plains which was comprised mainly of Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory (NTG), which is listed as endangered under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act), and supports listed threatened species.

The Commonwealth progressively developed the site as a commercial airfield and RAAF Base. The initial construction in the 1930s and subsequent maintenance and expansion of the Airport's runways and taxiway systems has involved significant landplaning, re-grading of contours and alterations to hydrology.

Disturbed areas have naturally regenerated over time to its present condition which has been assessed as Botanical Significance Rating 3 or patches of moderately-modified NTG and exotic and native pasture (ACT Government, 2005).

The ACT Commissioner for Sustainability and the Environment acknowledged the overall effective management of NTG by Canberra Airport in the 2009 Report on the Lowland Native Grassland Investigation (ACT Commissioner for Sustainability and the Environment, 2009).

This Threatened Species Management Plan updates the 2004 Grassland Management Plan to reflect the proposed construction of new and the ongoing maintenance of Airport infrastructure, as identified in the Canberra Airport 2009 Master Plan and referral approvals with conditions.

This Threatened Species Management Plan has also been developed to provide employees of Canberra Airport and the wider community with a better understanding of NTG and listed threatened species on Airport and how they are managed in response to contemporary research and practices.

The plan may be amended, from time to time, in consultation with the Department of the Environment, Water, Heritage and the Arts to evolve in response to new experience and knowledge.

Chapter two | Master Plan Project



Canberra Airport has a responsibility to the Airlines, aviation business and the community to ensure that infrastructure including the construction and widening of runways, taxiways and aprons is in place to meet aviation demand and ensure the safety, efficiency and regularity of aviation and other traffic on and around the Airport.

In 2003/04 the Airport undertook extensive consultation and obtained approval on a Major Development Plan (MDP) for Runway and Taxiway upgrades, including a 600m extension to the main runway 17/35 and a full runway strengthening program.

EPBC approval 2008/4170 (with conditions) was granted in December 2008 for the construction of the northern section of Taxiway Bravo as shown in Figure 1, which complements the MDP approval.

In February 2009, the *Infrastructure upgrade and construction at Canberra Airport EPBC 2009/4748* referral was submitted in response to the EPBC 2007/3756 referral approval conditions and the Canberra Airport 2009 Master Plan as shown in Figure 1.

The proposals covered in the referral include:

- Extension of the Fairbairn apron;
- Construction of Taxiway Alpha aviation facilities;
- Realignment and widening of Taxiway Alpha to meet relevant standards;
- Widening and strengthening of Taxiways Charlie and Juliet;
- Construction of a new Air Traffic Control Tower;
- Upgrades to tarmacs in all precincts;
- Relocation of Runway 35 threshold;
- Turning node on Runway 17/35;
- New link taxiways to Runway 17/35;
- Relocation of General Aviation area;
- Expansion of freight facilities;
- Upgrading of lighting, including new High Intensity Approach Lighting (HIAL) to Runway 17;
- GPS Ground Station;

- Provision for Runway Visual Range (RVR) instruments and other infrastructure required for improved precision navigation;
- Upgrading of the aerodrome to Category II and III ILS/GPS on Runways 17/35;
- Upgraded airfield lighting;
- Relocation of Instrument Landing System (ILS);
- Construction of a northern road (currently on Defence land yet to be transferred to Canberra Airport ownership);
- Upgrading of the airside roads; and
- Provision of buffers to ensure ongoing maintenance of airfield and aviation.

The ongoing maintenance of infrastructure and buildings, the sealing and otherwise upgrading of airside roads and

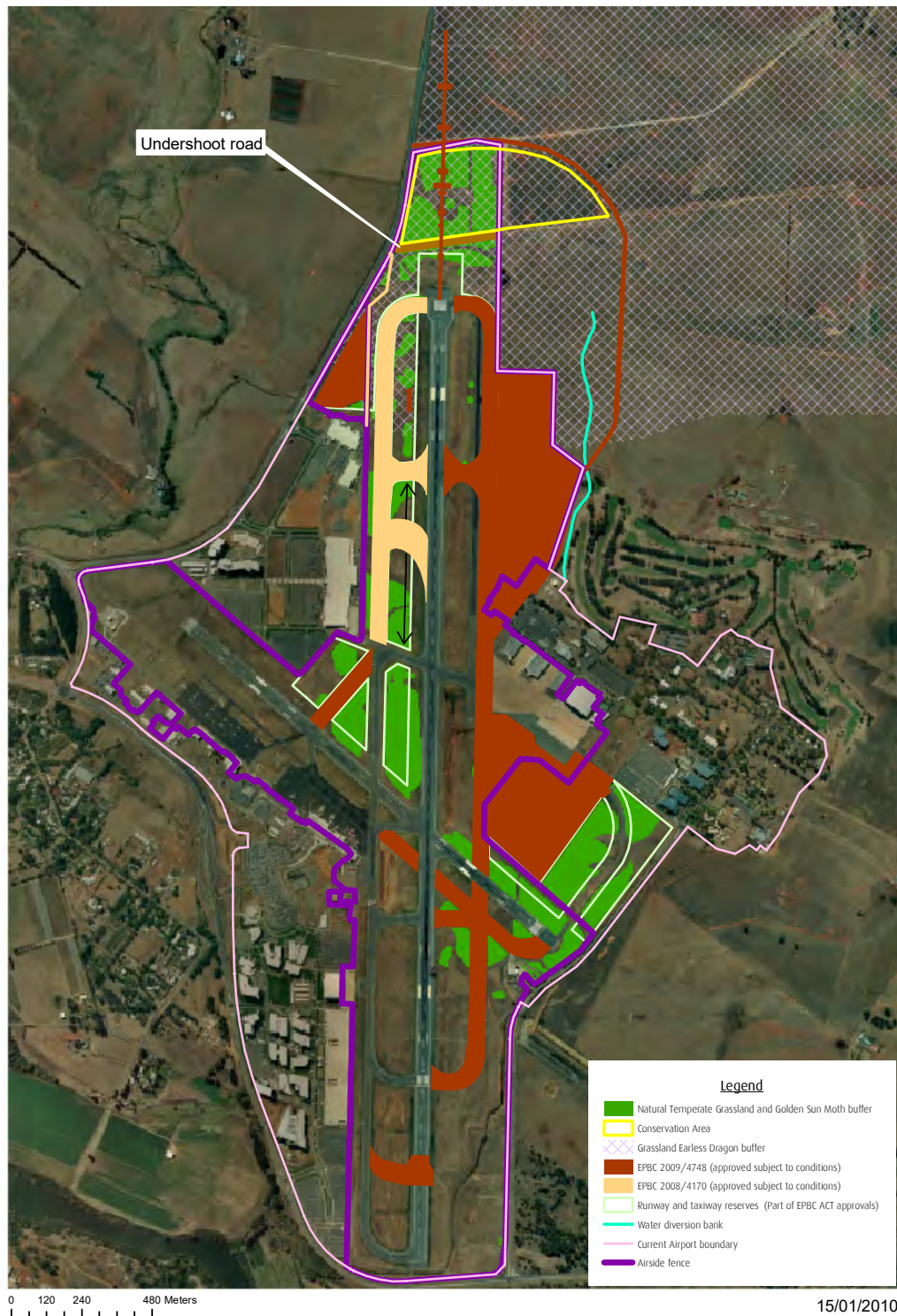
the provision of new roads associated with the extension of taxiways and runways is required to ensure compliance with security and emergency requirements.

The following road and corridor reserves are consistent with the 2004 Grassland Management Plan:

- 10m road corridor
- 4m from the building
- 60m taxiway corridor
- 90m cross runway 12/30 corridor
- 150m main runway 17/35 corridor

Conduits and pipes are laid in the road and corridor reserves wherever possible to minimise disturbance to grassland and listed threatened species.

Figure 1:
Environment Protection and Biodiversity Conservation Act Referrals



Chapter three | Legislative Requirements



The key pieces of legislation controlling the environmental operations of the Airport are the *Airports Act 1996*, *Airports (Environment Protection) Regulations 1997* and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

3.1. Airports Act 1996

The *Airports Act 1996* requires the operator of an airport to prepare an Airport Master Plan and Environment Strategy every five years.

This Threatened Species Management Plan complements the 2009 approved Master Plan, 2010 Environment Strategy and 2004 Grassland Management Plan and provides further information on the management of listed threatened species on Airport.

The 2004 Grassland Management Plan was a condition of approval for the Major Development Plan for Runway and Taxiway Expansion Program by the then Minister for Transport and Regional Services.

3.2. Airport (Environment Protection) Regulations 1997

The *Airport (Environment Protection) Regulations 1997* requires the development and adoption of a comprehensive environmental management system.

Environmental management at the Airport is the responsibility of Canberra Airport. The delegation of responsibility is shown in Figure 2 on the following page.

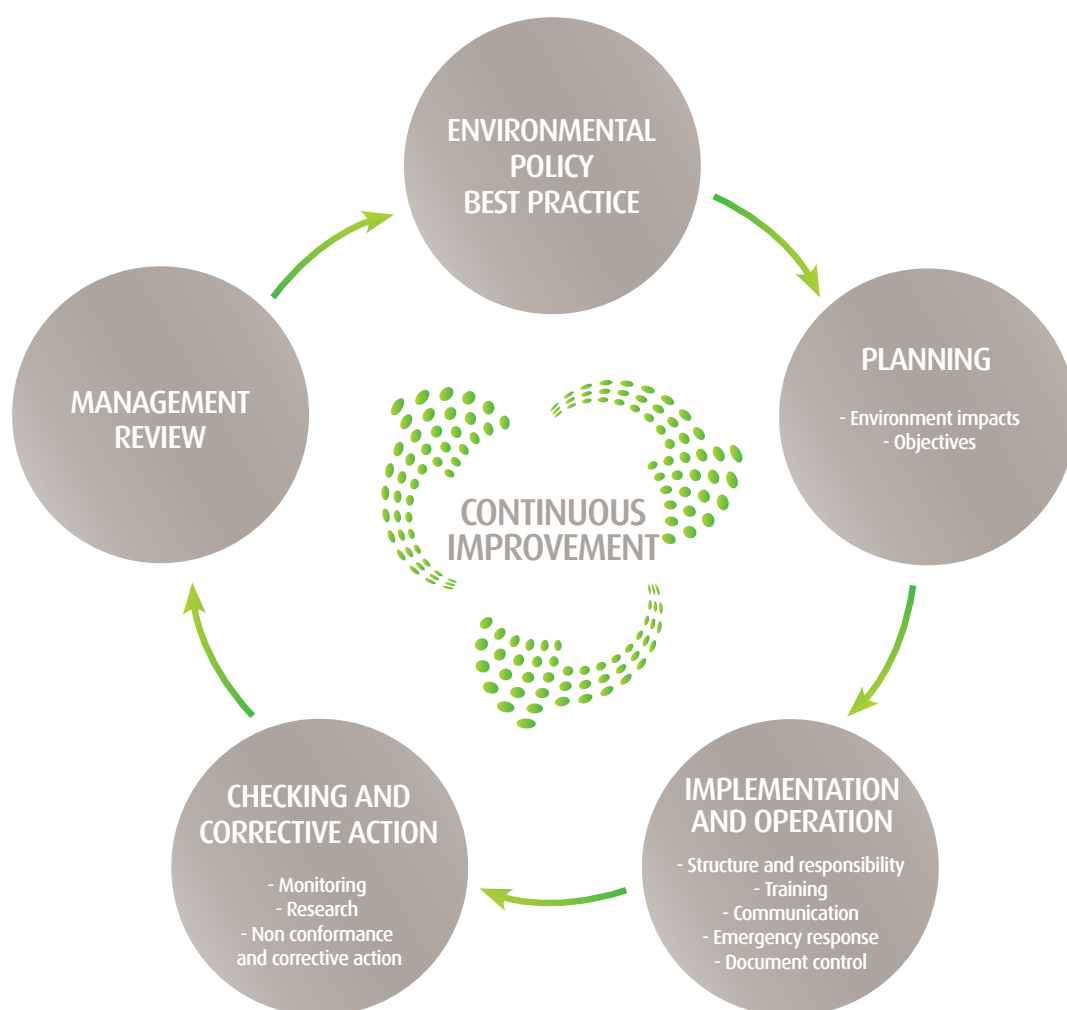
The environmental management framework at Canberra Airport is based on a system of continuous learning and improvement as shown in Figure 3.

Individual components of the environmental management framework are updated as required to ensure consistency with regulations and evolving best practice standards.

Figure 2:
Structure and responsibility at Canberra Airport



Figure 3
Environment Management System – Continuous Improvement



3.3. Environmental Protection Biodiversity Act

Two referral approvals under the EPBC Act have been obtained. These approvals with conditions include the:

- *Taxiway Bravo and associated works EPBC 2007/4170* referral (approved with conditions on 10 December 2008); and
- *Infrastructure upgrade and construction at Canberra Airport EPBC 2009/4748* referral, in response to the *Transfer of Defence Land at Majura, ACT EPBC 2007/3756* referral and the Canberra Airport 2009 approved Master Plan, (approved with conditions on 11 November 2009)

The Airport has prepared a number of documents, including this Threatened Species Management Plan, in response to these referral conditions of approval under the EPBC Act. These documents have been reviewed and have been approved by the Department of the Environment, Water, Heritage and the Arts.

The Northern Road Strategy (Construction and Operation) and Conservation Agreement which are conditions of approval for the EPBC 2009/4748 referral will be formally submitted to the Department of the Environment, Water, Heritage and the Arts for approval in the event that the land is transferred to Canberra Airport for the purpose of constructing the northern road.

Table 1: Condition of referral approvals

CONDITION OF REFERRAL APPROVAL EPBC	DOCUMENTS	APPROVAL DATE
2009/4748	Threatened Species Management Plan	9/3/2010
2009/4748	Master Plan Offset Strategy	9/2/2010
2009/4170	Taxiway Bravo Biodiversity Offset Strategy	2/2/2010
2009/4170 & 2009/4748	Standard Construction Environment Management Plan	3/2/2010

3.3.1. Threatened Species Management Plan

This Threatened Species Management Plan includes measures to manage NTG and listed threatened species on Airport including:

- Monitoring and mapping;
- Weed control;
- Mowing heights and regimes;
- Rehabilitation and revegetation;
- Drainage;
- Monitoring regimes and surveys;
- Thresholds for triggering further management interventions;
- Environmentally significant areas and their protection; and
- Results of research and details of any current and future research proposals.

Conditions are referenced throughout this plan as “In response to referral EPBC 2009/4748, approval condition 2.”

3.3.2. Biodiversity Offset Strategy

Offset Strategies are required as conditions of the referral approvals for the *Taxiway Bravo and associated works EPBC 2007/4170* and *Infrastructure upgrade and construction at Canberra Airport EPBC 2009/4748* referrals.

The Taxiway Bravo Biodiversity Offset Strategy includes:

- Methods for rehabilitation;
- Timeframes for the implementation of the Strategy;
- Ongoing monitoring and evaluation; and
- Details and outcomes of research funding.

The Master Plan Offset Strategy includes:

- Details of the acquisition and protection in perpetuity of land containing NTG; and
- Details of future ownership and management of the land to be used as the offset.

The main objective of the Offset Strategies is to fulfill the conditions of the referral approval conditions and to compensate for areas of NTG removed as a result of the proposed actions and the benefits of the offsets to the affected listed threatened species and ecological community.

The implementation of the Offset Strategy will also provide valuable information for the rehabilitation and conservation of NTG and listed threatened species.

3.3.3. Conservation Agreement

A Conservation Agreement between the Department of Environment, Water, Heritage and the Arts and Canberra Airport is to be formally submitted and finalised, in the event that the land is incorporated into the Canberra Airport lease, in response to the referral approval conditions for the *Transfer of Defence Land at Majura, ACT EPBC 2007/3756* referral.

In addition, NTG and listed threatened species to the north of the undershoot road is to be placed in the Conservation Agreement as part of the offset for the *Infrastructure upgrade and construction at Canberra Airport EPBC 2009/4748* referral. Refer to Figure 1.

This Conservation Area was identified by Canberra Airport in the referral and Preliminary Documentation for EPBC 2009/4748 as being beneficial for the long term viability of natural temperate grassland and listed threatened species on Airport.

3.3.4. Construction Environment Management Plan

The Standard Construction Environment Management Plan (CEMP) for Airside works comprises the following:

- Measures to reduce indirect construction impacts on NTG;
- Measures to reduce impacts on listed threatened species;
- Management of NTG adjacent to the construction area to improve the quality of the grassland;
- Measures to incorporate environmental considerations into the construction of proposed developments; and
- Indicative environmental management checklists to assist with monitoring the implementation of

environmental management obligations during construction works.

The CEMP fulfils the requirements of the *Airport (Environment Protection) Regulations 1997* and *Environmental Management Systems: Guidelines (NSW Government, 1998)*, and is consistent with the aims and practices required under the Green Building Council of Australia, Green Star Certification scheme.

The CEMP, in conjunction with the project specific Erosion and Sediment Control Plan provided by the contractor, forms the basis of environmental management during the planning and construction of the project.

3.3.5. Northern Road Strategy (Construction and Operation)

The Northern Road Strategy (Construction and Operation) is required as a condition of approval for the *Infrastructure upgrade and construction at Canberra Airport EPBC 2009/4748* referral.

The purpose of the Northern Road Strategy (Construction and Operation) is to demonstrate:

- No net loss of habitat for the Grassland Earless Dragon;
- No fragmentation of Grassland Earless Dragon habitat;
- No net impact on Grassland Earless Dragons from construction activities; and
- No increase to the risk of extinction for the east Majura Valley Grassland Earless Dragon population.

The Strategy will include a population viability analysis (PVA) that will be peer reviewed by a suitably qualified expert, familiar with the Grassland Earless Dragon, and agreed to by the Minister.

The Northern Road Strategy (Construction and Operation) will be formally submitted and finalised, in the event that the land is incorporated into the Canberra Airport lease, in response to the referral approval conditions for the *Infrastructure upgrade and construction at Canberra Airport EPBC 2009/4748* referral.

Chapter four | Environmentally Significant Areas



The Airport's Preliminary Draft 2010 Environment Strategy identifies the proposed Conservation Area as an Environmentally Significant Area and the balance of NTG and potential habitat for listed threatened species on Airport (excluding approved development under the EPBC Act) as Environmentally Sensitive Areas, refer to Figure 1.

The following sections are in response to referral EPBC 2009/4748, approval condition 2:

- f) Monitoring regimes and survey methods; and
- h) Environmentally Significant areas and their protection.

4.1. Natural Temperate Grassland

NTG is listed as an endangered ecological community under the EPBC Act and has a current National Recovery Plan and ACT Action Plan in force. The grasslands are habitat for vulnerable and endangered fauna such as the Grassland Earless Dragon and Golden Sun Moth.

The Department of the Environment, Water, Heritage and the Arts (DEWHA) broadly defines the NTG community as generally treeless or containing up to 10% cover of trees, shrubs or sedges.

The community is dominated by moderately tall (25-50cm) to tall (50-100cm) open tussock grasses with up to 70% of all plant species comprised of forbs.

The composition of NTG includes native grasses such as Wallaby Grass (*Austrodanthonia*), Speargrasses (*Austrostipa*), Redleg Grass (*Bothriochloa*), Tussock Grasses (*Poa*) and Kangaroo Grass (*Themeda*) and over 700 native herbs including sedges, rushes, orchids, lilies and forbs (*Environment ACT, 2005*).

The cryptogamic crust formed by layers of lichens and mosses is also present and plays an important role in seed germination and stabilizing inter-tussock spaces.

The Airport was re-mapped in 2008/2009 bringing the Airport mapping into line with standards used in the ACT and NSW. This mapping is shown in Figure 1 and excludes the approved referral areas (EPBC 2007/4170 and EPBC 2009/4748).



4.2. Grassland Earless Dragon

The Grassland Earless Dragon (*Tympanocryptis pinguicolla*) is listed as endangered under the EPBC Act.

Grassland Earless Dragon is a small cryptic lizard measuring approximately 150mm, from the snout to the tip of the tail and lacks an external ear opening and functional ear drum. Grassland Earless Dragons have individually distinct brown patterns on their backs that can be used to identify individuals, with some individuals also having yellow throats and pink pelvic regions.

Grassland Earless Dragons prefer NTG that have inter-tussock spaces and burrows constructed by Wolf Spiders (*Lycosa spp.*) and the Canberra Raspy Cricket (*Cooraboorama canberrae*).

Grassland Earless Dragon lifespan is assumed to be between 1 and 3 years in the wild and its diet includes a variety of insects including ants, beetles and moths.

Grassland Earless Dragons were first recorded at the Airport in 1996 and subsequent monitoring and capture has confirmed their presence east of the main runway and north of Taxiway Foxtrot.

On Airport, Grassland Earless Dragons have been recorded in well-drained, minimally disturbed NTG, dominated by Wallaby Grasses, Speargrasses and Kangaroo Grass.

Grassland Earless Dragons surveys are undertaken biennially and currently more frequently to coincide with the University of Canberra Grassland Earless Dragon Post Doctorate Research Project.

Canberra Airport has erected a ceramic mural of the Grassland Earless Dragon in Brindabella Business Park. The mural located in the foyer increases the awareness of the Grassland Earless Dragon to Airport staff, tenants and visitors.

4.3. Golden Sun Moth

The Golden Sun Moth (*Synemon plana*) is listed as critically endangered under the EPBC Act.

The male Golden Sun Moth has an average wingspan of 3.4cm and is dull in colour. Their forewings are dark brown with pale grey patterns and hind wings are brown with darker brown patches.

The female Golden Sun Moth is smaller and has an average wingspan of 3cm and is much brighter in colour. Their forewings have grey and brown patterns and hind wings are golden brown colour with dark patches of brown. The female sits in the tussock grasses as she is generally flightless, due to her smaller wings, and attracts the flying males with her golden hind wings.

The Golden Sun Moth gets its name from golden hind wings of the female and the fact that they are diurnal, meaning they fly during the day.

Golden Sun Moths prefer calm clear conditions and avoid flying in high winds.

The Golden Sun Moth larva is presumed to feed on the roots of native grasses. The length of the larval stage is unknown, but may be one to three years.

As adults, they cannot feed as they do not have functional mouthparts and can only live for two to five days. The Golden Sun Moth is sometimes referred to as the "Mouthless Mouth".

Golden Sun Moth surveys at the Airport are carried out biennially between mid October and early January when the male Golden Sun Moth is actively searching for females.

They usually fly between 10:00am and 2:00pm and prefer full sun, no rain or cloud and low winds. The female Golden Sun Moth rarely flies, it prefers to walk between the tussocks.

4.4. Perunga Grasshopper

The Perunga Grasshopper (*Perunga ochracea*) is listed as vulnerable under the ACT Nature Conservation Act 1980.

The Perunga Grasshopper is short winged and flightless. They are distinguished from other grasshoppers by the "X" on their pronotum. Adult females are between 26-35mm in length and adult males are 15-20mm in length. Adults may be brown buff or green.

Perunga Grasshoppers are found in NTG and feed on forbs. The Perunga Grasshopper has an unusual lifecycle with nymphs hatching in late summer and autumn and maturing over the winter and early spring.

The species has rarely been recorded at the Airport, despite many grassland surveys carried out during their activity period.

Perunga Grasshoppers are difficult to find unless they are startled, when they jump once or twice before hiding in the grass tussocks which they also use for shelter. The Perunga Grasshoppers are difficult to catch as they are able to jump distances of over a metre.

The Perunga Grasshopper is monitored on Airport by indirect searching as part of other grassland surveys. This includes regular Golden Sun Moth surveys and vegetation monitoring, during which consultants spend many hours annually in the habitat.

4.5. Striped Legless Lizard

Striped Legless Lizard (*Delmar impar*) is listed as vulnerable under the EPBC Act.

Striped Legless Lizard grows to about 300mm in length and weighs about 8g. Usually they have a series of dark lateral stripes along the length of the body. However, some individuals, particularly juveniles, stripes may be absent or faint.

Striped Legless Lizard is a grassland specialist and feeds on a variety of arthropods including spiders, crickets, cockroaches and caterpillars.

The Striped Legless Lizard has not been recorded on Airport, although it is known to occur on Defence land to the north.

Extensive pitfall trapping at the Airport in 1996 by ACT government did not find the species, and it was concluded that the Airport does not provide suitable habitat for the species, probably due to the effect of long-term frequent low mowing on the tussock structure (*Environment ACT 1997*).

An initial assessment for Striped Legless Lizard in West Malcomvale will be undertaken as part of the assessment for the site.

Chapter five | Potential Impacts

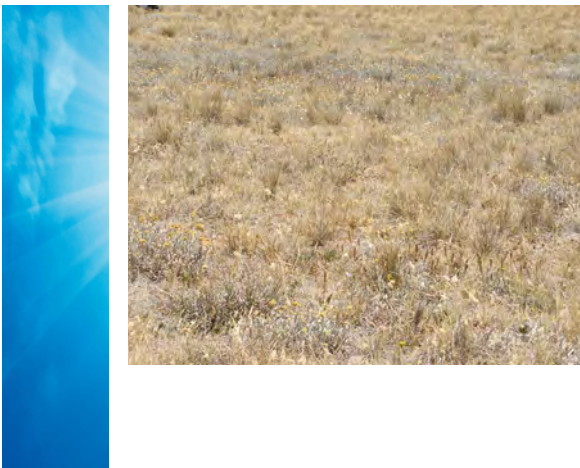


The implementation of the *Taxiway Bravo and associated works EPBC 2007/4170* and *Infrastructure and construction at Canberra Airport EPBC 2009/4748* referrals will result in the removal of NTG and potential habitat for listed threatened species.

Other potential impacts, on NTG and potential listed threatened habitat, from construction include:

- Soil disturbance;
- Soil compaction;
- Weed dispersal;
- Changes in hydrology;
- Runoff from construction site;
- Spoil and debris dispersal; and
- Disturbance to listed threatened species habitat.

The potential impacts from construction have been addressed in the Standard Construction Environment Management Plan and in Section 7.0 Management Actions.



Chapter six | Management Plan Strategies

This Threatened Species Management Plan updates and expands upon the 2004 Grassland Management Plan objectives of managing, improving and expanding NTG and listed threatened species on Airport (that are not affected

by development as approved with conditions under the EPBC Act).

The strategy and actions of this Threatened Species Management Plan are set out in Table 2 below.

Table 2: Threatened Species Management Plan Objectives and Strategies

OBJECTIVE	STRATEGIES
Ongoing management of NTG and listed threatened species on Airport.	Continue to implement management actions as stated in Table 3.
	Implementation and ongoing review of the Standard Construction Environment Management Plan.
Ongoing development and implementation of mitigation protocols.	Ongoing development of the retrieval and short distance movement protocols for the Grassland Earless Dragon and Striped Legless Lizard.
	Ongoing staff training and awareness including tool box meetings prior and during construction.
	Investigate and implement methods to propagate forbs in areas of native pasture.
	Demonstrate seeding of native grasses in a commercial broad acre method.
Demonstrate improvement and expansion of existing NTG and listed threatened species habitat (excluding approved referral areas)	Investigate opportunities to rehabilitate the western portion of Malcomvale property.
	Installing artificial holes to encourage the repopulation of Grassland Earless Dragons on Airport.
	Conduct trials to increase grassland quality on Airport.
Implementation and compliance with EPBC Act referral approval conditions.	Implementation and reporting of referral approval conditions: <ul style="list-style-type: none">• Threatened Species Management Plan;• Standard Construction Environment Management Plan;• Taxiway Bravo Biodiversity Offset Strategy;• Conservation Agreement;• Master Plan Offset Strategy; and• Northern Road Strategy (Construction and Operation).

Monitoring	Biennial Grassland Earless Dragon surveys
	Biennial Golden Sun Moth Surveys
	Re-mapping of grassland on Airport in 2013
Increase the body of knowledge for NTG and listed threatened species.	Continue to provide funding to the University of Canberra Grassland Earless Dragon Post Doctorate Research Project
	Continue to provide support to the University of Canberra Golden Sun Moth Counter Program
	Share monitoring data and trial outcomes

Chapter seven | Management Actions

7.1. Ongoing Management Actions

Canberra Airport has specific management actions which have been progressively implemented by the Airport since privatisation in 1998 and have been successful in managing the grassland on Airport.

The following section is in response to referral EPBC 2009/4748, approval condition 2:

a) Monitoring and mapping;

b) Weed control;

c) Mowing heights and regimes;

e) Drainage; and

g) Thresholds for triggering further management intervention (see Performance Indicators)

Ongoing management actions undertaken at the Airport are outlined in Table 3.

Table 3: Ongoing Management Actions

OBJECTIVE	STRATEGIES	RESPONSIBILITY	TIMING
Management Measures	Targeted weed spraying in areas of high quality grassland and broader in other areas	Environment Officer	Annually
	Spot spraying not to be undertaken on windy days	Ground Staff	Annually
	Mowing machinery cleaned to minimise weed transfer	Mowing contractor	Annually
	Mowing from higher quality grassland to lower quality grasslands (where operationally practical)	Mowing contractor	Annually
	No change to mowing regime on Airport – current mowing height 10-12cm	Mowing contractor	Annually
	Mowing frequency dependent on seasonal conditions, i.e. drought, and bird mitigation procedures	Canberra Airport	Annually
	No application of superphosphate or use of subterranean clover Airside	Ground Staff	Annually
	Fertilisers and other soil ameliorants are not used Airside	Ground Staff	Annually
	Conduits to be/have been laid to minimise future soil disturbance	Canberra Airport	Ongoing
	Ensure integrity of fences and feral animal control i.e. deterring rabbit burrowing under airside fence.	Project Managers	Annually

Management Measures cont...	Fire not used to manage NTG on Airport	Ground Staff	Annually
	No trees to be planted Airside	Environment Officer	Annually
	Local provenance to be considered when purchasing and collecting grass seed for cultivation on Airport	Environment Officer	Annually
	Maintain existing stormwater detention basins and swale systems	Canberra Airport	Ongoing
	NTG and listed threatened species habitat to be considered when designing additional drainage management works	Canberra Airport	As required
Monitoring Regime	Grassland Earless Dragon surveys	Environment Officer	Biennial
	Golden Sun Moth Surveys	Environment Officer	Biennial
	Re-mapping of grassland on Airport	Environment Officer	2013
Performance Indicators	Improvement or no change in grassland and habitat quality	Canberra Airport	Annually
Corrective Actions	Additional weed control	Canberra Airport	When required
	Review of mowing regime	Canberra Airport	When required

7.2. Rehabilitation Management Actions

Demonstrate improvement and expansion of existing NTG on Airport by rehabilitating vegetation quality 4 and 5 (native pasture and exotic grasses) to meet the definition of NTG, in accordance with Condition 2a (ii) of EPBC 2008/4170 referral.

Rehabilitation works are to be undertaken inside the Airside fence (refer to Figure 1) in areas not likely to be affected by future development or airport operations.

The following section is in response to referral EPBC 2009/4748, approval condition 2:

d) Rehabilitation and revegetation.

The key issues relating to the rehabilitation include:

- Establishment of NTG at a ratio of 3ha for every 1ha to be removed;
- Developing weed control, optimum seed and watering application rates;
- Developing broad acre method for seeding; and
- Managing seasonal impacts.

Table 4: Rehabilitation Management Actions

[illegible]

Monitoring Regime	Monitor success of rehabilitation program	Environment Officer	Year 1 - 5
	Annual report to the Department of the Environment, Water, Heritage and the Arts	Environment Officer	Year 1 -5
	Grassland survey and mapping	Qualified Ecologist	Year 5
Performance Indicators	Establishment of 9.6 hectares of NTG in vegetation quality 4 and 5 in response to referral EPBC 2008/4170, approval condition 2	Environment Officer	Year 5
Corrective Actions	Additional weed control and watering	Environment Officer	Year 2 - 5
	Additional seeding and transplantation	Environment Officer	Year 2 - 5
	Purchase of additional offset land in response to referral EPBC 2008/4170, approval condition 2	Environment Officer	Year 2 - 5

Chapter eight | Training

Training is an important component in ensuring the implementation of this Threatened Species Management Plan and ensuring compliance with EPBC Act referral conditions. Table 5 below summarises the training schedule.

Personnel trained will include:

- Airport Management;
- Environment Officer;
- Airport Operation Officers;
- Ground Staff;
- Contractors; and
- Consultants.

Table 5: Training Schedule

OBJECTIVE	STRATEGIES	RESPONSIBILITY	TIMING
Management Measures	Implementation of ongoing management strategy including weed control and moving regime	Director of Planning and Environment Officer	Year 1-5
	Implementation of construction management strategy including identification of listed threatened species	Director of Planning and Environment Officer	Year 1-5
	Implementation of rehabilitation management strategy, including: <ul style="list-style-type: none">- Collection, drying and storage of grass and forb seeds;- Rehabilitation methods; and- Post rehabilitation maintenance	Director of Planning and Environment Officer	Year 1-5
Monitoring Regime	Comprehension and implementation of methods	Director of Planning	Year 1-5
Performance Indicators	Implementation of management strategies	Canberra Airport	Annually
	Improvement or no change in grassland and habitat	Director of Planning	Year 1-5
Corrective Actions	Additional training	Director of Planning	Year 1-5

Chapter nine | Adaptive Management

Adaptive management may be required for further mitigation measures to maintain NTG and listed threatened species habitat on Airport. Table 6 below provides criteria for action on Airport.

It should be noted that NTG and Grassland Earless Dragon and Golden Sun Moth habitat may be affected by future drought conditions or other variables outside the control of Canberra Airport.

Table 6: Adaptive Management Actions

VALUES	TRIGGERS	ACTIONS	RESPONSIBILITY	TIMING
NTG	An apparent decline in NTG quality and quantity (excluding development areas in Figure 1). Condition to be assessed by Botanical Significance Rating	<ul style="list-style-type: none"> Consult with qualified Ecologist and Recovery team Review management actions Implement recommendations 	Director of Planning	Five yearly (in accordance with Canberra Airport 2010 Environment Strategy)
Grassland Earless Dragon	An apparent decline in Grassland Earless Dragon abundance, distribution or habitat quality (excluding development areas in Figure 1) to be assessed as part of biennial Grassland Earless Dragon monitoring report	<ul style="list-style-type: none"> Consult with qualified Ecologist and Recovery team Review management actions Implement recommendations 	Director of Planning	Biennially (in accordance with Canberra Airport 2010 Environment Strategy)
Golden Sun Moth	An apparent decline in Golden Sun Moth abundance, distribution or habitat quality (excluding development areas in Figure 1) to be assessed as part of biennial Golden Sun Moth monitoring report	<ul style="list-style-type: none"> Consult with qualified Ecologist and Recovery team Review management actions Implement recommendations 	Director of Planning	Biennially (in accordance with Canberra Airport 2010 Environment Strategy)

Chapter ten | Reporting

Reporting is required to demonstrate compliance with referral conditions of approval and to inform government departments, University of Canberra and

Canberra Airport’s Board of Directors of progress in threatened species management and research. Table 7 below summarises the reporting requirements.

Table 7: Reporting Schedule

REPORTING	DEPARTMENT/ORGANISATION
Translocation Report (Final report September 2010)	
Construction Environment Management Plan Annual Report (Condition 4 of EPBC 2009/4748)	<ul style="list-style-type: none">• Department of the Environment, Water, Heritage and the Arts
Rehabilitation Report (in response to EPBC 2008/4170) within 5 years of implementation of Taxiway Bravo Biodiversity Offset Strategy	<ul style="list-style-type: none">• Department of Infrastructure, Transport, Regional Development and Local Government• Canberra Airport - Board of Directors
A report verifying compliance of EPBC 2008/4170 conditions (within 3 months of completion of construction)	
Grassland Mapping (2013)	<ul style="list-style-type: none">• Department of the Environment, Water, Heritage and the Arts
Biennial Grassland Earless Dragon Surveys	<ul style="list-style-type: none">• Department of Infrastructure, Transport, Regional Development and Local Government• University of Canberra
Biennial Golden Sun Moth Surveys	<ul style="list-style-type: none">• Canberra Airport - Board of Directors• ACT Parks, Conservation and Lands
Annual Environment Report	<ul style="list-style-type: none">• Department of Infrastructure, Transport, Regional Development and Local Government• Canberra Airport - Board of Directors

In addition to reporting, Canberra Airport conducts regular consultation meetings with government departments and

major stakeholders. These meeting are summarised in Table 8 below.

Table 8: Consultation Meetings

CONSULTATION MEETINGS	TIMING
Department of the Environment, Water, Heritage and the Arts	Quarterly
Airport Environment Officer - Department of Infrastructure, Transport, Regional Development and Local Government	Monthly
Development planning liaison meeting, Department of Infrastructure, Transport, Regional Development and Local Government, Airservices Australia, Airlines	Quarterly
University of Canberra	Biannually
Canberra Airport - Board of Directors	Quarterly
ACT Parks, Conservation and Lands	As required
Friends of Grasslands	Biannually

Chapter eleven | Contingency Arrangements

Contingency arrangements are required in the event that management measures fail to mitigate or minimise impact on the NTG and listed threatened species habitat. This may result from human induced (e.g. fire, oil spill) or natural extreme events (e.g. prolonged drought). Table 9 below identifies possible impacts and mitigation measures.

Table 9: Contingency Arrangements

TRIGGERS	ACTIONS	RESPONSIBILITY
Environmental Incident eg: fuel, oil spill	<ul style="list-style-type: none">Implementation of Canberra Airport Standard Operating Procedures (SOP4); andSpill cleaned up and incident reported to Airport Environment Officer.	Canberra Airport
Aircraft Accident e.g. fire, fire fighting foam	<ul style="list-style-type: none">Implementation of Canberra Airport Standard Operating Procedures (SOP4); andSpill cleaned up and incident reported to Airport Environment Officer.	Canberra Airport
Prolonged Drought	<ul style="list-style-type: none">Review of ongoing management procedures i.e. reduction in mowing regime.	Director of Planning

Chapter twelve | Management Plan Review



This Threatened Species Management Plan will be updated as required to include details of research and rehabilitation outcomes in consultation with the Department of the Environment, Water, Heritage and the Arts.

A formal review of this document will be undertaken in preparation of the 2014 Master Plan, which will incorporate the 2014 Environment Strategy.



Chapter thirteen | Research



Canberra Airport is committed to contributing and understanding research to increase the body of knowledge for the ongoing management and rehabilitation of NTG and listed threatened species on Airport.

Canberra Airport has a number of trials underway, including a weed and grassland trial.

The aim of these trials is to improve the quality of NTG on Airport and rehabilitate disturbed areas to meet the definition of NTG.

Canberra Airport is also working with the University of Canberra to increase the body of knowledge for the Grassland Earless Dragon and Golden Sun Moth.

The following section is in response to referral EPBC 2009/4748, approval condition 2:

i) Results of research and details of any current and future research proposals.

13.1. Weed Trials

General observations at the Airport noted that the most significant weed was Chilean Needle Grass (*Nassella neesiana*) and that it tended to occur along the edges of hard surfaces such as runways, taxiways and roads. Canberra Airport identified that a broad acre method was needed to minimise the risk of weeds at the edges dispersing in areas of high quality NTG.

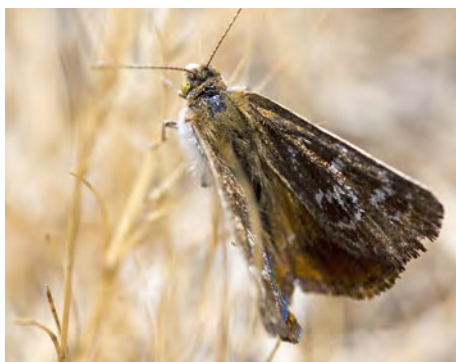
A weed trial was established in the “triangle” located north of the cross runway and adjacent to Taxiway Bravo. The edges of the weed triangle were boom sprayed.

The results show a reduction in Serrated Tussock and Chilean Needle grass around the edges of the weed triangle.

Further boom spraying and monitoring of the site is required, as the edges of the site were disturbed during the installation of vital airfield lighting.

13.2. Grassland Trials

In 2006 and 2007 high quality thatch harvested from the east of the Airport and the remaining high quality thatch harvested from Majura Park was spread onto poor quality grassland south of Taxiway Foxtrot to assist in increasing the diversity and quality of grassland. The 2008/2009 grassland monitoring shows no change in vegetation quality and the experiment in this area will not be repeated in this form.



In summer 2009, high quality thatch harvested from the east of the Airport was spread on an area in the north east corner of the Airport, with the aim of suppressing weeds and increasing grassland quality. The outcomes of this trial will be repeated in areas of high quality grassland if successful.

13.3. Translocation Site

The Department of the Environment, Water, Heritage and the Arts approved the Airport's application for a Permit to Take (Permit No.E2005-58339) for the removal and translocation of 0.86ha of NTG at Majura affected by development. The recipient site before translocation was classed as category 5 or exotic grass. After translocation disturbance tolerant native grasses and a soil crust containing mosses and algae had begun to develop in the recipient site. Vegetation density at the reception site is similar to that seen elsewhere at the Airport.

The site has been monitored every spring and autumn since the translocation in September 2005. The full results of the five year trial are not yet realized as there has been minimal rainfall and the absence of significant spring or autumn breaks. The translocation site has provided valuable information for future grassland trials such as:

- The sward needs to be translocated in intact sections;
- The reception site must not be over compacted as this restricts water penetration required to promote the natural germination of seed;
- Watering the reception site pre and post translocation will be investigated in future grassland trials; and
- The reception site will be sprayed twice for weeds prior to translocation in future trials.

13.4. Future Grassland Trials and Research

A translocation and/or reestablishment experiment is likely to be repeated using NTG that would otherwise be destroyed by development to reinstate areas of native or exotic grasses. A few of the options that will be considered are as follows:

- Collection of seed from an offset site to then be used to seed areas on Airport;
- Collection of forb seed on Airport to be used on Airport; and

- Replanting of forbs (otherwise affected by development) in areas of native grassland to encourage increased species diversity and NTG.

The timing for the implementation of any trials or rehabilitation works is dependent on weather conditions and seed, consultant and scientific information availability.

13.5. Grassland Earless Dragon Research

Canberra Airport is funding a joint Post Doctorate Fellowship for Grassland Earless Dragon research with the Australian Research Council and the University of Canberra. Canberra Airport also contributes the Airport's consultants' knowledge and advice, ongoing Grassland Earless Dragon monitoring and previous monitoring reports with the aim of collating population data for the University of Canberra's Grassland Earless Dragon research project. Any information obtained from Grassland Earless Dragon specimens' located on-Airport will be included in the research project to further increase the body of knowledge of this species.

In summary the primary components of the University of Canberra Post Doctorate Research Fellowship are:

1. Understanding the genetic relatedness of the remaining Grassland Earless Dragon population in the ACT and nearby NSW;
2. Understanding the relationship between grassland height and composition and Grassland Earless Dragon populations;
3. Identifying key habitat characteristics and features for ongoing management and the re-establishment of Grassland Earless Dragon habitat; and
4. Inform the Grassland Earless Dragon National Recovery Plan to enable the ongoing management and restoration of Grassland Earless Dragon habitat.

The outcomes of the research will include guidelines for the ongoing management of Grassland Earless Dragon habitat so as to maximise the rate of population increase and to restore habitat. The research is also expected to provide key insights into the habitat management mechanism for the Grassland Earless Dragon. This work will provide essential management information that will maximise the long term conservation of the Grassland Earless Dragon.

Details of the research outcomes from the Grassland Earless Dragon Post Graduate study will be published on the Canberra Airport's website in the form of hyper links to the University of Canberra website and to published articles.

13.6. Golden Sun Moth Research

Canberra Airport has contributed its consultant knowledge and time to assist in collecting data for the Golden Sun Moth count program. The program is financially supported by the World Wide Fund for Nature (WWF) in collaboration with the Friends of Grassland and the Institute for Applied Ecology at the University of Canberra. The research includes the following components:

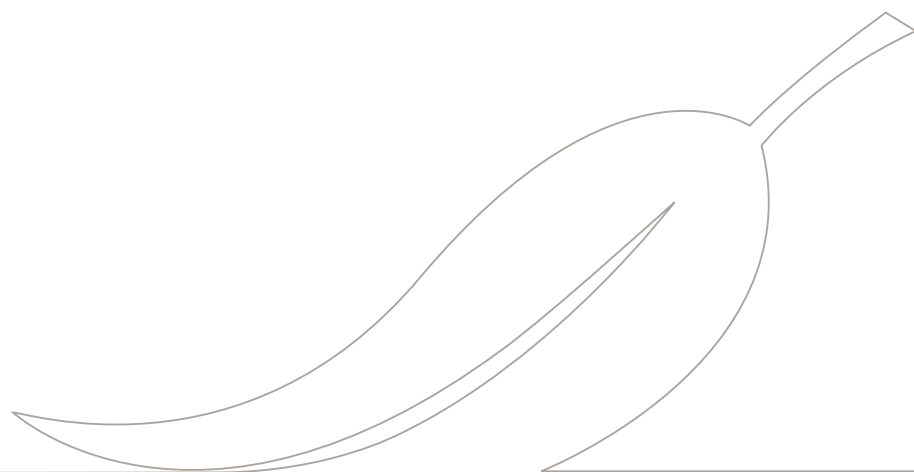
1. An examination of the influences of habitat and landscape characteristics on the distribution of the species; and
2. The development and evaluation of reliable monitoring techniques.

Results of this research will provide conservation managers with a rational approach to the seasonal detection and monitoring of the Golden Sun Moth.

This information will provide valuable information regarding changes in Golden Sun Moth numbers and also assist in defining a Golden Sun Moth habitat.

Chapter fourteen | References

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- ACT Government, 1999. *Perunga Grasshopper (Perunga ochracea)*: A vulnerable species. Action Plan 21. Environment ACT, Canberra.
- Canberra Airport 2009 Master Plan, <http://www.canberraairport.com.au>
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- Environment ACT 2005 National Recovery Plan for NTG of the Southern Tablelands (NSW and ACT): and endangered ecological community* (Environment ACT, Canberra).
- Environment ACT 1997. Canberra Airport. Ecological values and management actions*. Report to the Federal Airports Commission. Wildlife Research and Monitoring Unit, Canberra.
- Grassland Management Plan*, NTG at Canberra Airport. Canberra Airport, 2004.
- Infrastructure upgrade and Construction at Canberra Airport*, EPBC 2009/4748, 19 February 2009. <http://www.environment.gov.au>
- Langford C.M, Simpson P.C, Garden D.L., Eddy D.A, Keys M.J, Rehwinkel R. and Johnston W.H. 2004. *Managing Native Pastures for Agriculture and Conservation*. NSW Department of Primary Industries.
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- Report on ACT Lowland Native Grassland Investigation, Commissioner for Sustainability and the Environment, 19 March 2009 <http://www.environmentcommissioner.act.gov.au/>
- Robertson, P. & Cooper, P. (2000). *Recovery Plan for the Grassland Earless Dragon Tympanocryptis pinguicolla*. Unpublished report to Environment Australia, Canberra.
- Robertson, P & Evans M. (2006). *Draft National Action Plan for the Grassland Earless Dragon (Tympanocryptis pinguicolla)*. Unpublished report to the Department of the Environment, Water, Heritage and the Arts, Canberra.
- Sharp S, Dorrough J, Rehwinkel R and Eddy D. 2002 *The Grassy ecosystem management kit: a guide to developing conservation management plans*. Environment ACT, Canberra.
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- Taxiway Bravo Extension, Canberra Airport*, EPBC 2008/4170, 10 December 2008. <http://www.environment.gov.au>.





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ARC Final Report must be completed and submitted via GAMS

ARC Final Report - Linkage-Project - (LP)

In the interests of promoting awareness of the benefits of publicly-funded research, the ARC may draw on the material you provide about your research for reporting and promotional purposes.

Part A. PROJECT IDENTIFICATION

A1 Program

A2 Project ID

A3 Administering organisation

A4 First year funded

A5 Title of funded project

A6 1st named Participant (note: if these details are incorrect amend your GAMS record)

<i>Title</i>	<i>A/Prof</i>
<i>First Name</i>	<i>Stephen</i>
<i>Family Name</i>	<i>Sarre</i>
<i>Gams ID</i>	<i>B24542</i>
<i>Organisation</i>	<i>University of Canberra</i>
<i>Participant role</i>	<i>CI</i>
<i>Email address</i>	<i>Stephen.Sarre@canberra.edu.au</i>
<i>Work phone number</i>	<i>02 6201 5657</i>
<i>Mobile phone number</i>	
<i>Fax number</i>	<i>02 6201 5305</i>

A7 Other Participants

Title	FirstName	Family Name	GAMS ID	Organisation	Participant role
Dr	William	Osborne	U43699	University of Canberra	CI

A8 For this Project, total ARC Funding requested

A9 For this Project, total ARC Funding received

A10 Number of years for which Funding was received

Part B PROJECT DESCRIPTION AND OBJECTIVES

B1 100 word Project summary (from the original project application)

Australia has one of the worst records of any country for extinction in the last 200 years and altered approaches are required if we are to avoid further extinctions in the very near future. The Grassland Earless dragon is one taxon that sits on the brink of extinction through habitat loss and fragmentation. We will apply genetic and field experimental approaches to develop a scientific basis to underpin the sound conservation management of this species. In so doing, we will develop a management framework that will have the potential to be applied to other endangered species.

B2 Summary of original objectives of project

We will build upon our substantial previous research into the Grassland Earless Dragon *Tympanocryptis pinguicolla* through the incorporation of genetic and experimental analyses to develop a scientific basis for the conservation of this endangered species across its range. Specifically, we will:

AIM 1 Define the Evolutionary Significant and Management Units that exist within *T. pinguicolla* using molecular genetics analyses;

AIM 2 Test experimentally the impact of grazing and translocation on those features of habitat quality identified as likely to have important management implications;

AIM 3 Develop general strategic principles for the future management of *T. pinguicolla* to ensure its' continued persistence.

Part C PROJECT OVER DURATION OF FUNDING

- C1 Were there significant changes to the Project or the objectives? ☒ Yes
If yes, please briefly describe the changes and explain why they were made.

For example, changes may have been made because the ARC funding was less than the requested funding.

We maintained the essential structure of our habitat manipulations experiments but the reduced funding provided by the ARC meant that we could not establish field sites in two regions (ACT/NSW and Monaro) as planned. Instead, we focussed our field manipulations on the ACT region to minimise travel and to maximise the probability of strong results from our manipulations through maximum sampling intensity.

- C2 Did anything affect the satisfactory and timely progress or completion of the Project?

☒ Yes

If yes, please briefly describe what happened.

Extreme weather conditions in the final summer of sampling meant that habitat manipulations (mowing of native grassland areas) was not possible. A catastrophic decline in numbers of the study populations meant that habitat manipulation effects could not be detected.

- C3 Fellows on Team Projects - Briefly describe the Fellow's contribution to the Project
(ARC Fellows, who are Participants in a team of investigators but not the first-named Participant (Chief Investigator of Fellow), should contribute to this question)

--

Part D PROJECT OUTCOMES AND IMPACTS

D1 Did the project meet its initial objectives or approved revised objectives? ☒ Yes

D2 Describe briefly the significance, results and outcomes of the project.

The key findings are as follows:

1. There have been population declines of *T.pinguicolla* across all known sites from 1995 followed by a dramatic reduction (88%) from 2006 at the most densely populated site;
2. The largest remaining population of this species has a very high probability of extinction within the next 20 years;
3. *T.pinguicolla* populations are highly genetically structured with little admixture between adjacent populations and that significant barriers to dispersal exist among the remaining populations; and,
4. The effective population size of the largest *T.pinguicolla* population in the ACT was much larger (over 2000 individuals) than it is currently (8-106 individuals) indicating unnaturally low population sizes.

Overall, our data suggest a precipitous regional decline among *T. pinguicolla* populations that places the species in grave jeopardy of becoming the first confirmed reptile extinction in Australia since European settlement.

D3 Did the project lead to exciting new research directions, innovations and/or collaborations, and/or lay the foundations for new research and/or new partnerships? ☒ Yes

If yes, please describe briefly how.

Yes, this project generated a new research direction in which we seek to understand the mechanisms of extinction for reptiles within the framework of climatic extremes and climate change more generally. This new work has been built directly on a partnership with the ACT Government that emerged through the work reported here and is funded as part of an ARC Linkage grant (LP110200029).

D4 Are there identifiable national benefits—including economic, social, cultural and/or environmental contributions—resulting from this project? ☒ Yes

If yes, please describe briefly the national benefits.

This work delivered on the national research priority, An Environmentally Sustainable Australia by addressing directly the sustainable use of Australia's biodiversity through identifying and modelling a key extinction process as it happens and by identifying key hypotheses around the causal agents of that extinction.

This work has also consolidated and built upon an existing team of leading researchers and ECRs with a focus on ecological and genetic application to endangered species analysis. The work has contributed much to the training of a post doc and four postgrads (two PhD, one MSc, one Hons) and built up sufficient infrastructure to undertake captive breeding of this endangered species.

Part E RESEARCH COLLABORATION

E1 List the Industry Partners named in the application.

Note that each Industry Partner will be required to respond to questions on the collaborations in the following section.

<i>Name of institution/organisation</i>	<i>Type of Inst/Org</i>	<i>Country</i>
Canberra International Airport	Company	Australia

E2 Summarise briefly the nature and extent of the collaborative arrangements.

Include comments on the extent of the involvement of the collaborating partner(s) and how beneficial the involvement was to the outcomes of the project.

The collaborating party (Canberra International Airport) was involved closely with this project. They provided assistance with surveys and monitoring of airport controlled lands, and provided data from their own monitoring programs. In particular, they provided the assistance of an Environment Officer (Alison Rowell) for the conduct of *T.pinguicolla* surveys and monitoring and the sharing of long-term data collected by the Canberra International Airport. Some of those long-term data are now published in the peer reviewed literature (Dimond et al. 2012). Canberra Airport also provided a remote-sensed aerial image (a GIS layer) that enabled fine scale mapping and modelling of the distribution of Grassland Earless Dragons in the ACT region. The MAXENT modelling arising from those data has been completed at UC in preparation for publication. Finally, our industry partners provided regular updates on likely developments that might provide research opportunities on *T.pinguicolla* habitat and hosted joint workshops twice a year to ensure a clear flow of information between collaborators around the research.

E3 Summarise briefly the ways the project fostered a greater understanding and appreciation of industry needs and expectations, including research training needs.

The project fostered a better understanding of the pressures associated with development around infrastructure of national importance and of the possible ways in which the requirements of biodiversity conservation can be incorporated. We believe that this was very much a two-way process of education between the researchers and industry partner.

E4 Outline any cooperative links between the higher education sector/industry/public sector users of research that resulted from the project.

The research conducted in this project fostered very strong relationships between the ACT Government and the research team with the ACT Government committing over \$300,000 to a four year Linkage Project (LP110200029) testing theories of extinction in reptiles. In addition, this research generated strong collaborative links with the New South Wales National Parks and Wildlife Service particularly through engagement with monitoring programs, extending the research team's work into New South Wales populations near Queanbeyan and on the Monaro Tablelands. This collaboration enabled the initiation of a research based captive breeding population to be seeded with animals from NSW and for the development of an MSc project focussed on the NSW animals.

E5

Provide details of any other collaborations or partnerships the research involved or led to – for each, as appropriate, list the names of the partner organisation, its type and country of location.

Name of Inst/Org	Type of Inst/Org	Country (if not Australia)
Helmholtz Institute	Research institute	Germany
ACT Government	Government department or agency	Australia
NSW National Parks and Wildlife Service	Government department or agency	Australia
Flinders University	University	Australia

Part F REPORT ON COLLABORATION BY INDUSTRY PARTNER/S

To be completed and certified by each Industry Partner.

You may attach a more extended statement if necessary.

[Industry Partner: 1]

F1 Industry Partner Details

Name of Industry Partner

Canberra International Airport

Name of Industry Partner contact

F2 Please comment on whether this project built on a previously established collaborative relationship or if it was a new initiative.

new initiative

F3 How beneficial has this collaborative research project been from your organisation's viewpoint? Beneficial

F4 Summarise the major outcomes of the project from your perspective with particular comment on the benefits to your organisation.

- 1) Improved knowledge-base for decision making on the management of an endangered species that occurs on Airport land.
- 2) Opportunity for discussing ideas and management options with specialists on this species and on the grasslands more generally.

F5 Provide comment on your intended or actual use of the research outcomes.

In your response comment on the potential for commercialisation or further development of the research results in new products or processes/market opportunities. How is the work consistent with your strategic objectives?

F6 Would your organisation be open to participating in a collaborative arrangement under this program in the future? Not selected

Briefly outline your reasons for your response

Part G PROJECT OUTPUTS

G1 Field of research

<i>RFCD code</i>	<i>% weighting</i>
270203	40
270703	30
270708	30

G2 Socio-economic objective

<i>SEO code</i>	<i>% weighting</i>
710502	40
770903	40
770906	20

G3 Publications and other academic outputs

Enter the number of outputs in each category. For programs other than LIEF, enter full details; for publications, include 'published' and 'in press' publications, but exclude 'forthcoming' and 'submitted' work.

Number

A1 Book—authored research

A2 Book—authored other

A3 Book—edited

A4 Book—revision/new edition

A4 Book—translation

B Book chapter

C1 Journal article—articles in scholarly refereed journal

4

1. Stevens, T.A., Evans, M.C., Osborne, W.S. and Sarre, S.D. (2010). Radio-tracking reveals preference for the structural patchiness of native grasslands for the endangered grassland earless dragon. *Australian Journal Zoology*, 58: 76-84.
2. Ezaz, T., O'Meally, D., Quinn, A.E., Sarre, S.D., Georges, A. and Marshall-Graves, J.A. (2008). A simple non-invasive protocol to establish primary cell lines from tail and toe explants for cytogenetic studies in Australian dragon lizards (Squamata: Agamidae). *Cytotechnology*, 58 (3) 135-139.
3. Dimond, W.J., Osborne, W.S., Evans, M., Gruber, B., and Sarre, S.D. 2012 Back to the brink – population decline of the endangered grassland earless dragon (*Tympanocryptis pinguicollis*) following its rediscovery. *Herpetological Conservation and Biology*. 7: 132–149.
4. Hoehn, M., Osborne, W. S., Aitken, N. and Sarre, S.D. 2010. Isolation and characterization of 10 tetranucleotide microsatellites in the Grassland Earless Dragon (*Tympanocryptis pinguicollis*). *Conservation Genetics Resources*. Volume 2, Supplement 1, 373-375.

C2 Journal article—other contribution to refereed journal

1

McGrath, T., Hunter, D., Osborne, W. and Sarre, S.D. (2012) A trial use of camera traps detects the highly cryptic and endangered Grassland Earless Dragon *Tympanocryptis pinguicollis* (Reptilia: Agamidae) on the Monaro Tablelands of New South Wales, Australia. *Herpetological Review* 43(2), 249–252.

C3 Journal article—non-refereed article

C4 Journal articles—letter or note

D Major reviews

1

Sarre, S.D., & Georges, A. (2009) Genetics in conservation and wildlife management: A revolution since Caughley. *Wildlife Research*, 36: 70-80.

E1 Conference—full written paper-refereed proceedings

E2 Conference—full written paper-non-refereed proceedings

E3 Conference—extract of paper

E4 Conference—edited volume of conference proceedings

E4 Conference—unpublished presentation

Dimond, W., Gruber, B.; Osborne, W; Evans, M. and Sarre, S.D. (2009) Is the grassland earless dragons going extinct? Australasian Wildlife Management Society AGM, Napier, New Zealand.

Castellano, C.M., Hoehn, M., Dimond, W., Sarre, S.D., and Osborne, W. (2008). Conservation genetics of the endangered earless dragon (*Tympanocryptis pinguicolla*) in the vanishing grasslands of the ACT. 6th World Congress of Herpetology, Manaus, Brazil, August 17-22.

Sarre, S.D. (2007) Genetics and Conservation: a revolution in the time since Caughley. Fenner Conference on the Environment (Keynote Speaker)

Dimond, W; Stevens, T; Gruber, B; Evans, M; Osborne, W and Sarre, S. (2007). The use of movement patterns to determine optimal mark recapture sampling approaches. Australasian Wildlife Management Society Conference 2007, Shine Dome, Canberra, Australia.

F Audio-visual recording

G Computer software

H Designs

J1 Major creative works

J2 Creative work included in group exhibition, performance, recording or anthology

J3 Exhibition curatorship

K Other academic outputs (in categories other than those listed above)

Sarre, S.D. (2010) Genetics and Wildlife Conservation. Findlay University, Ohio, USA (invited seminar)

Sarre, S.D. (2009) The application of genetics to wildlife ecology and management. Institute of Zoology, Shaanxi, Xian, China (Nov 13, 2009).

Dimond, W. (2009). Is the grassland earless dragon going extinct?—Demographics of *Tympanocryptis pinguicollis* in the ACT. Field Naturalists Association Canberra, Australian National University, Australia.

Dimond, W. (2009). Conservation biology of grassland earless dragons. DEWHA Grassland Workshop. Canberra, Australia.

Dimond, W; Sarre, S; Osborne, W. (2009) Conserving the grassland earless dragon within Canberra's regional grasslands. IACRC Writers Workshop, Kioloa, Australia.

Sarre, S (2009) Conservation Biology of the Grassland Earless Dragon (*Tympanocryptis pinguicollis*). Grassland Lizards Workshop. Flinders University, Adelaide Australia.

Dimond, W. (2009). Is the grassland earless dragon going extinct?—Demographics of *Tympanocryptis pinguicollis* in the ACT. Grassland Lizards Workshop. Flinders University, Adelaide Australia.

Dimond, W. (2008). Conserving the grassland earless dragon. An update report to the Department of Defence. Department of Defence Offices, Canberra, Australia.

Dimond, W. (2008). Is the grassland earless dragon going extinct?—Demographics of *Tympanocryptis pinguicollis* in the ACT. Institute for Applied Ecology Seminar Series. University of Canberra, Australia.

Dimond, W; Osborne, W; Sarre, S; Evans, M. (2007). Recent surveys and monitoring of grassland earless dragon (*Tympanocryptis pinguicollis*) populations in the ACT. An update report to the Department of Defence. University of Canberra, Australia.

Dimond, W. (2007). The plight of the dragon—modeling to inform management of an endangered lizard. Presentation to the Helmholtz Centre for Environmental Research (UFZ), Leipzig, Germany.

- G4 Have any of the investigators or their works won prizes, awards or other major tributes as a result of the research project? ☒ Yes
If yes, give details.

--

G5 Research commercialisation

Provide details of commercialisation resulting from the research project against the categories listed below.

Commercialisation Types

Patent patents establish legally enforceable protection of rights over intellectual property associated with inventions)			
Patents filed			
Type	Where lodged	Application number	Title
Patents pending			
Type	Where lodged	Application number	Title
Invention disclosure an invention disclosure occurs when a device, substance, method or process that is apparently new, useful and involves an inventive step is made known to personnel within an institution who have responsibility for managing the institution's patenting and research commercialisation activities			
Invention disclosures			<input type="text"/>
Plant breeder right a plant-breeder right is a temporary monopoly granted to a plant breeder seeking registration of a new plant variety. It gives the breeder the exclusive right to produce and reproduce the propagating material of the variety and to stock, sell, import or export the propagating material. In order for a plant-breeder right to be granted, the variety must be novel, distinct, uniform and stable.			
Plant Breeder rights			<input type="text"/>
Application number for each filed		Certificate number for each granted	
Licence executed (include licences, options and assignments) A licence agreement formalises the transfer of technology between two parties, where the owner of the technology (the licensor) permits the other party (the licensee) to share the rights to use the technology. An option agreement grants the potential licensee a time period during which it may evaluate the technology and negotiate the terms of a licence agreement. An assignment agreement conveys all right, title and interest in and to the licensed subject matter to the named assignee.			
Licences executed			<input type="text"/>
Start-up company formed <i>'start-up companies' refers to companies engaged in businesses that were dependent, for their formation, upon licensing or assignment of technology developed in this research project.</i>			
Start-up companies formed			<input type="text"/>
Name of company		ABN	
Describe any other commercial outcomes from the project			

- G6 Evidence of impact and contribution. Is there evidence that this project has had an impact in the research field or the broader public domain? Not selected
If yes, briefly describe the impact and contribution.

The ARC has access to standard citation data on articles published in ISI journals. However, there may be other indicators of impact including, for example, citations to books, re-publication, translations, reviews, invited keynote addresses, other invitations, newspaper/media /expert commentary or advice to Government.

Part H RESEARCH TRAINING, CAREERS AND EMPLOYMENT

H1 Postgraduate research training – Australian postgraduates supported by this project

Stipends: include students receiving ARC-funded stipends under Discovery and Linkage, but exclude DEST Australian Postgraduate Awards (APAs)

Research support: include students whose postgraduate or Honours research is assisted by ARC funding (for example, use of equipment funded under LIEF, international research experience funded under Linkage-International, and project support provided under Discovery-Projects or Linkage-Projects)

Number of PhD students receiving stipends and project support	0
Number of research Masters students receiving stipends and project support	0
Number of PhD students receiving project support but not stipends	3
Number of Masters students receiving project support but not stipends	1
Number of Honours students receiving project support but not stipends	1

H2 Postgraduate research training – Overseas postgraduates supported by this project

Research support: include students enrolled in overseas universities whose postgraduate or Honours research is assisted by ARC funding (for example, use of equipment funded under LIEF, international research experience funded under Linkage-International)

Number of overseas PhD students involved in the project	0
Number of overseas research Masters students involved in the project	1
Number of overseas Honours students involved in the project	0

H3 Early career researchers

Early career researchers are researchers with up to 5 years postdoctoral experience

ECRs named in the application
no ECRs named in the application

Did any other ECRs participate? If so, how many? ☒ Yes

☐ 2

H4 Other employed personnel

Number of research associates/assistants funded (full time)	
Number of research associates/assistants funded (part time)	
Number of professional and/or technical officers	1
Industry Partner employees (not PIs)	
Other personnel involved (provide details below)	

Part I FUNDING CONTRIBUTIONS

I1 Matching funding from industry partners

Provide details of the cash contributions from each industry partner

<i>Industry partner</i>	<i>Amount</i>
Canberra International Airport	141501
TOTAL CASH CONTRIBUTION	<i>141501</i>

I2 Provide details of the in-kind contributions from each industry partner

<i>Industry partner</i>	<i>In-kind contribution \$</i>	<i>Details of in-kind contribution</i>
Canberra International Airport	33000	
TOTAL IN-KIND	<i>33000</i>	

I3 Was the level and type of support provided by the Industry Partner(s) in line with the commitment given by them at the time of entering into the agreement? ☒ Yes

If no, provide details.

I4 Is there appropriate source documentation readily available to demonstrate to an auditor the contribution of the collaborating partner to the project? ☒ Yes

If no, provide details.

Part J OTHER FUNDING

J1 Excluding funding described in Part I, has funding from other sources, including other ARC grants, supported this research? **Not selected**

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	Details of source/grant type	Funding received AUS(\$)
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	Total Host Institution support	0
ARC Funding Programs		
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	Total other Government competitive funds	0
Other Government Non-Competitive Funds		
	Total other Government Non-Competitive funds	0
Other funds from industry		
	Total other industry funds	0
Other external support		
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Part K

Thank you for completing the final report.

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**Malcolmvale West Detention Basin project: Ecological survey
May 2011**



Report to Canberra Airport

by

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June 2011

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Malcolmvale West Detention Basin project: Environmental survey

Summary

The subject site has previously been identified as containing a small patch of Natural Temperate Grassland (endangered ecological community), and native pasture habitat for two threatened fauna species. The area has been degraded in the last eight years, to the extent that it is unlikely to currently contain any threatened flora or fauna, although one small patch of highly modified Natural Temperate Grassland is still present.

Construction of the detention basin as proposed is not considered likely to have a significant impact on any populations of threatened flora or fauna or any ecological community in the Majura valley.

1. Background

Canberra Airport proposes constructing a stormwater detention basin on Defence land at Malcolmvale West, adjacent to the northeastern boundary of the airport. The area is shown in the ACT Government Grassland Conservation Strategy as containing native pasture, a small patch of Natural Temperate Grassland, and habitat for Grassland Earless Dragon *Tympanocryptis pinguicolla* and Golden Sun Moth *Synemon plana* (ACT Government 2005). Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Natural Temperate Grassland is listed as an endangered ecological community, the Golden Sun Moth is listed as a critically endangered species and the Grassland Earless Dragon as an endangered species.

The Department of Defence has requested that the ecological assessment includes Natural Temperate Grassland, Button Wrinklewort *Rutidosia leptorrhynchoidea* and Hoary Sunray *Leucochrysum albicans* subsp. *albicans* var. *tricolor* (endangered flora species), habitat for Striped Legless Lizard *Delma impar* (vulnerable species), Grassland Earless Dragon, Golden Sun Moth, and any other rare or threatened species.

The area investigated is larger than that potentially affected by the works (Figure 1).

2. Management history of site

Canberra Airport has constructed a management history of the site from aerial photographs and documents, including some held by the National Library (Figure 2).

Most of the site was cultivated before 1951, and the plough lines are still visible on recent aerial photographs. These extend onto adjacent parts of the airport around the run-up bay which have been fenced and managed separately from Malcolmvale for nearly 40 years (e.g. see November 2009 aerial photograph, Figure 4).

The area has been managed as several paddocks in the past, with a fenceline running approximately east-west dividing it into two main paddocks. There is a major drainage line running south-west through the northern paddock, which ends at a dam on the western boundary. The dam was present in 1946, and by 1988 was surrounded by planted Monterey Pines.

Sheds and vehicle tracks were developed in the paddocks, and inspection of thirteen aerial photographs from 1946 to 2010 shows evidence of continuous pastoral management compared to the less disturbed area of grassland to the north in the Majura Training Area and adjacent areas of the airport managed by mowing. Changes in vegetation patterns over time suggest there has been addition of pasture species and fertilisers to the site more than once since 1951, intermittent heavy grazing, and occasional harvesting of fodder by slashing.

In 2008 Defence resumed the grazing lease, the site was destocked and structures removed. Management since 2008 has consisted of weed control by spot spraying and some kangaroo culling. Grazing by kangaroos was heavy during the recent long drought, with almost all standing vegetation removed from the site. The grazing became heavier at Malcolmvale after December 2007 when kangaroos were excluded from a large area of high quality grassland to the north (Photograph 1). With a reduction in kangaroo numbers and heavy rainfall in late 2010, the grassland on the site has recently become tall and very dense.

3. Previous surveys

The site was surveyed in December 2003 by this consultant, as part of a survey of a larger area of land surrounding the airport. Vegetation quality was assessed, and potential fauna habitats mapped (Rowell & Bishop 2004). At that time, ACT government provided their threatened species records for the area. A summary of both these data sets appears in maps in the ACT Government Grassland Conservation Strategy (ACT Government 2005). Most of the site is shown as native pasture, which is native-dominated grassland that is degraded to the point where it is no longer the threatened community, but still provides habitat for some grassland fauna. There was a small patch of Natural Temperate Grassland in the northwest corner of the site, and a record of a Grassland Earless Dragon in the southeast corner of the site (Nelson *et al.* 1998). Very low numbers of Golden Sun Moths were recorded on the site in December 2003. The whole site was mapped as habitat for the Grassland Earless Dragon and Golden Sun Moth. There are no known surveys for Striped Legless Lizards on the site.

There is a large area of Natural Temperate Grassland directly north of the site, which is known habitat for Grassland Earless Dragon, Striped Legless Lizard, Golden Sun Moth, Button Wrinklewort and Perunga Grasshopper *Perunga ochracea* (vulnerable in the ACT) (ACT Government 2005). There is a population of Hoary Sunray in woodland on the eastern side of Malcolmvale, with rare records of the species on the airport (pers. obs.).

Grassland Earless Dragons were relatively common in Natural Temperate Grassland at the northern end of the airport in the late 1990s, but are now rare there (WRM 2000, Rowell 2011 in prep.). Pitfall trapping at the airport by ACT government in the 1990s did not find Striped Legless Lizard. There is a large Golden Sun Moth population in the northern half of the airport, and Perunga Grasshopper is occasionally recorded there.

4. Current survey and methods

The current survey was undertaken over four days between 2 and 18 May 2011. The site was traversed and the vegetation associations and potential fauna habitats were mapped using a hand-held GPS unit and aerial photographs.

The preferred time for assessing vegetation quality is spring, but an autumn survey can record most of the vegetation values if seasonal conditions are good (Rehwinkel 2007), as they were for this survey. Vegetation quality was measured using three standard vegetation quadrats placed to sample the better quality vegetation in each category (Figure 3). All plant species and their cover/abundance were measured. Quality was assessed using the Floristic Value Score method (Rehwinkel 2007), and Botanical Significance Ratings (ACT Government 2005). The vegetation was divided into three categories:

-) Natural Temperate Grassland threatened community – dominated by native grasses, with a variety of native forbs and a Floristic Value Score >4, Botanical Significance Rating <5
-) Native Pasture – dominated by native grasses but with a very low cover of a few disturbance tolerant native forbs
-) Exotic-dominated grassland

5. Results

5.1 General condition

The vegetation was tall and dense, and much of the northern paddock showed signs of having been flooded during the wet summer. Two birds typical of dense rank grassland habitats (Brown Quail and Golden-headed Cisticola) were observed on the site, and there were Pacific Black Ducks and Wood Ducks on the dam. Fox scats were common, and there was a rabbit warren near the dam.

Kangaroos were seen across the site, but evidence of grazing was restricted to mown tracks and patches of shorter vegetation on higher ground. The history of the site (cultivation, continuous stock grazing, pasture improvement) and the current condition of the vegetation (see below) makes it very unlikely that any threatened grassland flora species would be present, and none were seen. The western edge of the site (i.e. the area that would be affected by construction of the detention basin) is generally in poorer condition than land to the east, due to impeded drainage and disturbance from boundary tracks.

Major changes in the condition of the site since 2003 are described in Section 6 below.

5.2 Vegetation condition

5.2.1 Exotic-dominated grassland

Most of the site was dominated by exotic vegetation (Figure 3), being a mixture of pasture species (especially *Phalaris aquatica*, also Ryegrass *Lolium perenne* and clovers *Trifolium* spp.) and weeds. Common weed species were *Paspalum dilatatum*, Goose Grass *Eleusine tristachya*, Paterson's Curse *Echium plantagineum*, Fleabane *Conyza* sp., and several species of thistle. Native cover was very low in this association, and restricted to a few disturbance-tolerant grasses and forbs. This association was found over most of the low-lying northern paddock, along the drainage lines and around the dam. Quadrat 1 was in one of the less weedy parts of this association (Table 1).

5.2.2 Native Pasture

The next largest area was weedy native pasture (Quadrat 2). This association was dominated by Tall Speargrass *Austrostipa bigeniculata*, with up to 25% cover of *Phalaris*, occasional patches of taller species of Wallaby Grass, and many weed species. There were few native forbs, and all were disturbance-tolerant species. The species present were typical of a site that has been ploughed and pasture improved in the past. This association was mainly at the southern end of the site, with two smaller patches in the north where drainage was better.

5.2.3 Natural Temperate Grassland

The small area mapped as Natural Temperate Grassland in 2003 (north-western corner of site) has been degraded by vehicle tracks, loss of sensitive species and weed invasion, and is now categorised as native pasture. Quadrat 3 was in another very small area (<0.1 ha) which received a Floristic Value Score of 5, which is at the lowest end of the Natural Temperate Grassland category, i.e. highly modified Natural Temperate Grassland with a Botanical Significance Rating of 4 (low). Only ten native plant species were recorded, while moderate quality Natural Temperate Grassland surveyed in spring would be likely to have 20 or more native species and a Floristic Value Score of 15 or more. This patch is on slightly raised ground, and is better drained than the surrounding paddock. It was the only area dominated by a shorter species of Wallaby Grass (*Austrodanthonia auriculata*), and was being used as a resting and grazing area by kangaroos. It is bounded by dense *Phalaris* and the weedy drainage line.

5.3 Fauna habitat condition

5.3.1 Golden Sun Moth

Good habitat for this species contains moderate to high cover of the larval food plant (Wallaby Grasses *Austrodanthonia* spp.) and low open areas for basking, displaying, mating and egg-laying (DEWHA 2009). In December 2003 Wallaby Grasses were common in the medium height native pasture area (25-50% cover) as was bare ground (5-25% cover), but few Golden Sun Moths were recorded. The species is not usually found in areas that have been ploughed or cropped, which may account for the low numbers observed in the otherwise apparently suitable habitat at that time. In 2011 the native pasture was much less suitable, with average vegetation height (excluding flowering stems) of 50-100 cm, cover of Wallaby Grasses <5%, and no bare ground. The small patch of Natural Temperate Grassland was dominated by a short Wallaby Grass in 2011, but its size (<0.1 ha) and separation from adjacent habitat make it insignificant as habitat.

5.3.2 Grassland Earless Dragon

In its current tall dense weedy condition (Photographs 4 and 5), the native-dominated grassland on this site does not appear suitable for Grassland Earless Dragon. No invertebrate burrows suitable for inspection with a fibrescope were found, due to the dense vegetation. As there is a previous (1998) record for the site, some areas could be restored as potential habitat if the biomass was reduced, but it is considered very unlikely that the species is currently present.

5.3.3 Striped Legless Lizard

The current dense tussock structure makes most of the site resemble potential habitat for Striped Legless Lizard, though it has not been identified as such in the past. This includes much of the exotic-dominated grassland and weedy native pasture, but excludes the areas prone to inundation. However, the history of the site makes the presence of Striped Legless Lizard less likely. Sites which have been ploughed usually do not contain the species (ACT Government 1997). The length of time since ploughing (possibly more than 40 years) and the adjacent known habitat makes it possible that the species could have reoccupied this site in recent years. However, the recent period of drought and overgrazing which almost bared the site for up to three years would have made it unsuitable for the species during that time (Photograph 1), as would flooding of the northern paddock in December 2010.

5.3.4 Perunga Grasshopper

The vegetation on the site is of a lower quality than that usually associated with this species, and it is not considered likely to be present.

6. Discussion

This site has become more degraded since 2003 (see Table 1 and Photographs 1 to 3). The data collected in 2003 were less detailed, but significant differences are apparent. Large areas which were mapped as native pasture (and hence threatened fauna habitat) in 2003 are now dominated by exotic pasture species and weeds. These changes cannot be fully accounted for by the recent wet season and differences in timing of the surveys (summer 2003 versus autumn 2011). *Phalaris* cover has increased from < 5% in 2003 to 25-75% cover across the site in 2011, and Ryegrass has also become much more common. White and Strawberry Clovers were not recorded in 2003, but were common in 2011. These changes, and the dense growth of grasses, increase in weed cover and reduction in native grass cover, and loss of some more sensitive native species suggest strongly that the site was fertilised and oversown with pasture seed between 2003 and 2008.

Although habitat for the above threatened fauna was formerly present, the site is considered unlikely to be currently occupied by those species, or possibly at very low levels in the case of Golden Sun Moth and Striped Legless Lizard. The fauna habitats have been degraded since 2003 by pasture improvement, weed invasion, overgrazing, major fluctuations in biomass and inundation. When Grassland Earless Dragons were recorded near the site in 1998, the species was much more common in the Majura Valley. Intensive survey for Grassland Earless Dragons in better habitat to the north and north-west of the site in late summer 2011 found only three dragons for a combined survey effort of 8960 trap nights (Rowell in prep, Wendy Dimond pers. comm. May 2011), and although they were formerly recorded in low numbers on other parts of Malcolmvale, they are now likely to be surviving only in the core areas of good habitat.

7. Conclusions

No data is available on likely area and frequency of inundation following construction, so the following assessment is made on the basis that most of the area bounded by the basin wall could occasionally be affected, and that soil moisture in this area may be raised for much of the time.

The area directly affected by construction of the detention basin wall (within the construction silt fence) is 1.6 ha. 0.25 ha of this area is currently part of the 5 m wide boundary track/fire break which follows the fence. This is regularly slashed and traversed by vehicles, and is not considered to provide potential habitat for any of the species of concern.

The small patch of Natural Temperate Grassland falls outside the construction zone, and is unlikely to be inundated due to its raised position and distance from the western retaining wall, but may be affected by changes in soil moisture after construction. This patch currently has low potential for regeneration and would be likely to degrade further under existing management, as its diversity is low and it is surrounded by exotic grassland.

There have been no recent surveys to confirm the presence or absence of threatened species in the areas previously identified as habitat, but now degraded and probably unoccupied, so these areas should be recognised as having potential for rehabilitation. Therefore, the area likely to be affected by construction of the detention basin and occasional inundation thereafter has the following ecological values:

-) highly modified Natural Temperate Grassland: less than 0.1 ha
-) former Golden Sun Moth habitat: about 2.5 ha
-) former Grassland Earless Dragon habitat: about 2 ha
-) potential Striped Legless Lizard habitat: about 4 ha

Construction and operation of the detention basin as proposed are not considered likely to have a significant effect on the above community and populations in the Majura valley, as there are large areas (150 - 200 ha) of better quality endangered grassland community and fauna habitat in adjacent areas of the airport and the Majura Training Area (ACT Government 2005). There is an additional 150 ha of native pasture in similar and better condition in the adjoining part of Malcolmvale, which may provide additional low quality habitat for Golden Sun Moth, Grassland Earless Dragon, Striped Legless Lizard and Perunga Grasshopper.

The basin and bank are not likely to be a barrier to movement of animals between the known habitat areas on airport and Defence land, as such movement can occur more directly where these areas meet at the northern and north-eastern boundary of the airport.

8. Recommendations

Although the project as proposed is not considered likely to have a significant impact on a matter of national environmental significance or to have a significant impact on the environment in general (as an action on Commonwealth land), it is recommended that the potential need for a referral under the EPBC Act be discussed with the relevant section of the Department of Sustainability, Environment, Water, Population and Communities. This is because the site is shown in Action Plan 28 (ACT Government 2005) as containing habitat for endangered and critically endangered species and an endangered community.

Recommended mitigation measures include:

-) Working within the silt fence envelope, to minimize soil disturbance and compaction
-) Minimizing the area to be inundated, and the length of inundation
-) Weed control after construction

Offsets for damaging former or potential marginal habitat for threatened fauna include:

-) Rehabilitation works in the area between the basin wall and the existing water diversion bank to improve fauna habitat values. This could involve harvesting of excess biomass in winter by slashing to 15 cm, baling and removing, followed by spot-spraying of weeds in spring and summer.

Table 1. Plant species recorded at and near Malcolmvale Detention Basin site

		See end of table for explanation of frequency codes				
Native species		Quadrat 1 2011	Quadrat 2 2011	Quadrat 3 2011	Whole site 2011	Whole site 2003
Family	Species					
Amaranthaceae	<i>Alternanthera denticulata</i>				R	
Poaceae	<i>Amphibromus nervosus</i>				R	
Poaceae	<i>Austrodanthonia auriculata</i>			3	R	
Poaceae	<i>Austrodanthonia caespitosa</i>	1	1		C	C
Poaceae	<i>Austrodanthonia carphoides</i>					O
Poaceae	<i>Austrodanthonia duttoniana</i>					O
Poaceae	<i>Austrodanthonia laevis</i>				R	
Poaceae	<i>Austrodanthonia linkii</i> var. <i>fulva</i>			1	R	
Poaceae	<i>Austrodanthonia linkii</i> var. <i>linkii</i>				R	
Poaceae	<i>Austrodanthonia racemosa</i>	1			O	
Poaceae	<i>Austrodanthonia</i> sp.			1		C
Poaceae	<i>Austrostipa bigeniculata</i>	2	4	2	SD	D
Poaceae	<i>Austrostipa scabra</i>			2	O	O
Poaceae	<i>Bothriochloa macra</i>				R	
Chenopodiaceae	<i>Chenopodium pumilio</i>				R	
Poaceae	<i>Chloris truncata</i>				O	
Asteraceae	<i>Chrysocephalum apiculatum</i>	r		#	R	
Convolvulaceae	<i>Convolvulus angustissimus</i>		r		R	R
Fabaceae	<i>Desmodium varians</i>					R
Cyperaceae	<i>Eleocharis acuta</i>				O	O
Poaceae	<i>Elymus scaber</i> var. <i>scaber</i>	r			R	O
Poaceae	<i>Eragrostis trachycarpa</i>		r		R	
Geraniaceae	<i>Erodium crinitum</i>	#			O	O
Apiaceae	<i>Eryngium rostratum</i>					O
Asteraceae	<i>Euchiton sphaericum</i>		#		O	O
Goodeniaceae	<i>Goodenia pinnatifida</i>			#	R	
Juncaceae	<i>Juncus</i> sp.				O	O
Lomandraceae	<i>Lomandra bracteata</i>			1	R	
Lythraceae	<i>Lythrum hyssopifolia</i>				R	O
Oxalidaceae	<i>Oxalis perennans</i>		1		R	O
Oxalidaceae	<i>Oxalis</i> sp.	r				
Oxalidaceae	<i>Oxalis thompsoniae</i>				O	
Poaceae	<i>Panicum effusum</i>	1	2	#	O	
Poaceae	<i>Paspalum distichum</i>				R	
Plantaginaceae	<i>Plantago varia</i>					R
Polygonaceae	<i>Rumex brownii</i>	r	r		R	O
Polygonaceae	<i>Rumex dumosus</i>			r	R	
Asteraceae	<i>Senecio quadridentatus</i>		r		R	
Anthericaceae	<i>Tricoryne elatior</i>				R	
Asteraceae	<i>Vittadinia muelleri</i>		r		R	
Asteraceae	<i>Vittadinia gracilis</i>			r	R	O
Campanulaceae	<i>Wahlenbergia communis</i>	r	r		O	O
Campanulaceae	<i>Wahlenbergia luteola</i>					O
Campanulaceae	<i>Wahlenbergia multicaulis</i>					O
Campanulaceae	<i>Wahlenbergia</i> sp.					
		FVS 0	FVS 0, BSR 5	FVS 5, BSR 4		

Exotic Species		Quadrat 1 2011	Quadrat 2 2011	Quadrat 3 2011	Whole site 2011	Whole site 2003
Poaceae	* <i>Aira sp.</i>					O
Polygonaceae	* <i>Acetosella vulgaris</i>					R
Poaceae	* <i>Avena sp.</i>	1			O	
Poaceae	* <i>Bromus hordeaceus</i>	r	r		O	O
Poaceae	* <i>Bromus unioloides</i>				R	
Asteraceae	* <i>Carthamus lanatus</i>	#	r		O	O
Asteraceae	* <i>Chondrilla juncea</i>		#		R	O
Asteraceae	* <i>Conyza sp.</i>	1	1		C	
Cucurbitaceae	* <i>Cucumis myriocarpus</i>				R	
Poaceae	* <i>Cynodon dactylon</i>		r		O	R
Cyperaceae	* <i>Cyperus eragrostis</i>				O	
Boraginaceae	* <i>Echium plantagineum</i>	2	1	r	C	O
Poaceae	* <i>Eleusine tristachya</i>	1	1		C	
Poaceae	* <i>Eragrostis curvula</i>		r		R	
Poaceae	* <i>Eragrostis cilianensis</i>				O	
Geraniaceae	* <i>Erodium botrys</i>				O	
Poaceae	* <i>Festuca arundinacea</i>	2	#	r	O	
Asteraceae	* <i>Gnaphalium sp.</i>		#		O	
Brassicaceae	* <i>Hirschfeldia incana</i>	1		#	O	R
Poaceae	* <i>Holcus lanatus</i>				O	
Poaceae	* <i>Hordeum leporinum</i>	1			O	R
Asteraceae	* <i>Hypochaeris radicata</i>	#	1		C	O
Clusiaceae	* <i>Hypericum perforatum</i>		1		O	R
Brassicaceae	* <i>Lepidium africanum</i>				O	
Poaceae	* <i>Lolium perenne</i>	2			C	O
Poaceae	* <i>Nassella neesiana</i>					R
Poaceae	* <i>Nassella trichotoma</i>				O	
Asteraceae	* <i>Onopordum acanthium</i>		r		O	R
Poaceae	* <i>Panicum capillare</i>				R	
Poaceae	* <i>Paspalum dilatatum</i>		r		C	R
Poaceae	* <i>Phalaris aquatica</i>	4	2	#	SD	C
Plantaginaceae	* <i>Plantago lanceolata</i>	2	1	r	C	O
Polygonaceae	* <i>Polygonum aviculare</i>					R
Asteraceae	* <i>Pseudognaphalium luteo- album</i>				R	
Lamiaceae	* <i>Salvia verbenaca</i>					R
Rosaceae	* <i>Sanguisorba minor</i>				O	R
Poaceae	* <i>Setaria parviflora</i>				R	
Asteraceae	* <i>Silybum maireanum</i>	r			R	
Solanaceae	* <i>Solanum nigrum</i>	#			R	
Asteraceae	* <i>Sonchus sp.</i>			r	O	
Asteraceae	* <i>Tragopogon sp.</i>		r		R	
Fabaceae	* <i>Trifolium arvense</i>					O
Fabaceae	* <i>Trifolium fragiferum</i>				O	
Fabaceae	* <i>Trifolium glomeratum</i>					O
Fabaceae	* <i>Trifolium repens</i>	#	1		C	
Scrophulariaceae	* <i>Verbascum thapsus</i>				O	
Poaceae	* <i>Vulpia sp.</i>					O

Cover/abundance codes for Table 1:

r - <5% cover, solitary/<4 individuals

- <5% cover, few/4-15 individuals

1 - <5% cover, numerous/>15 individuals

2 - 5-25% cover

3 - 25-50% cover

4 - 50-75% cover

5 - >75% cover

D - dominant (>50% cover or most common species)

SD – subdominant (<50% cover, one of most common species)

C – common

O - occasional

R – rare

FVS = Floristic Value Score (Rehwinkel 2007)

BSR = Botanical Significance Rating (ACT Government 2005)



Photograph 1. July 2007. Study site from western boundary. Airport security fence in foreground, pines near dam at right. Note very short grass, extensive bare patches, kangaroos, roosting ducks. Shows part of same area as Photographs 2 and 3.



Photograph 2: May 2011, from centre of site facing SSE. Tall dense exotic dominated grassland with patches of Phalaris, Paspalum, tall weeds, Tall Speargrass. Fence hidden by vegetation.



Photograph 3. December 2003, same photopoint: showing medium height (fence visible) and medium density native pasture, with Tall Speargrass and Wallaby Grasses, few weeds.



Photograph 4. Tall dense weedy native pasture in southern paddock (Quadrat 2). Tall Speargrass and Phalaris, little Wallaby Grass, no bare ground.



Photograph 5. Closer view of above, showing dense native grasses and Phalaris, no bare ground.

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Figure 1. Study Site

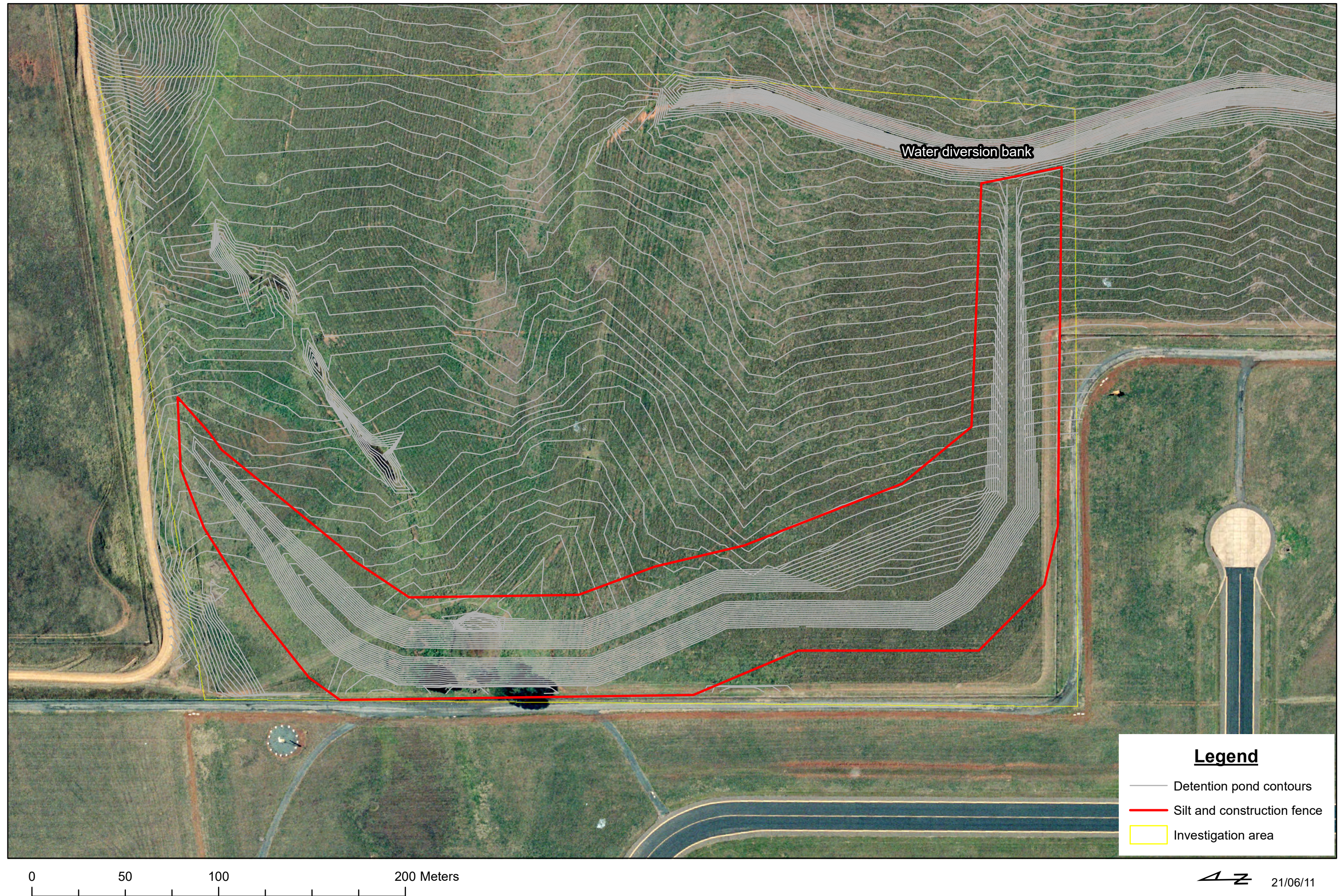


Figure 2. Site Management History

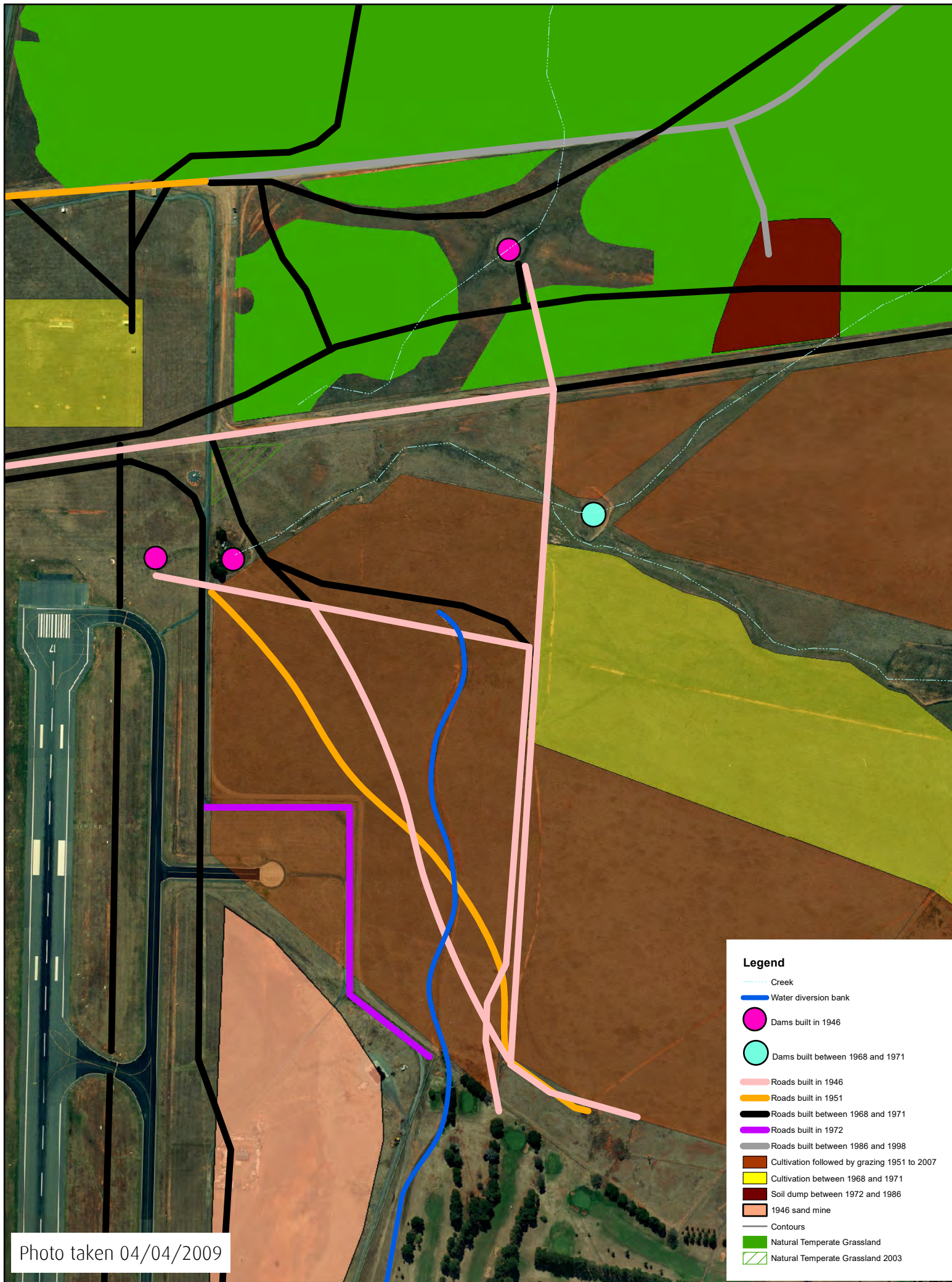


Figure 3. Vegetation Mapping

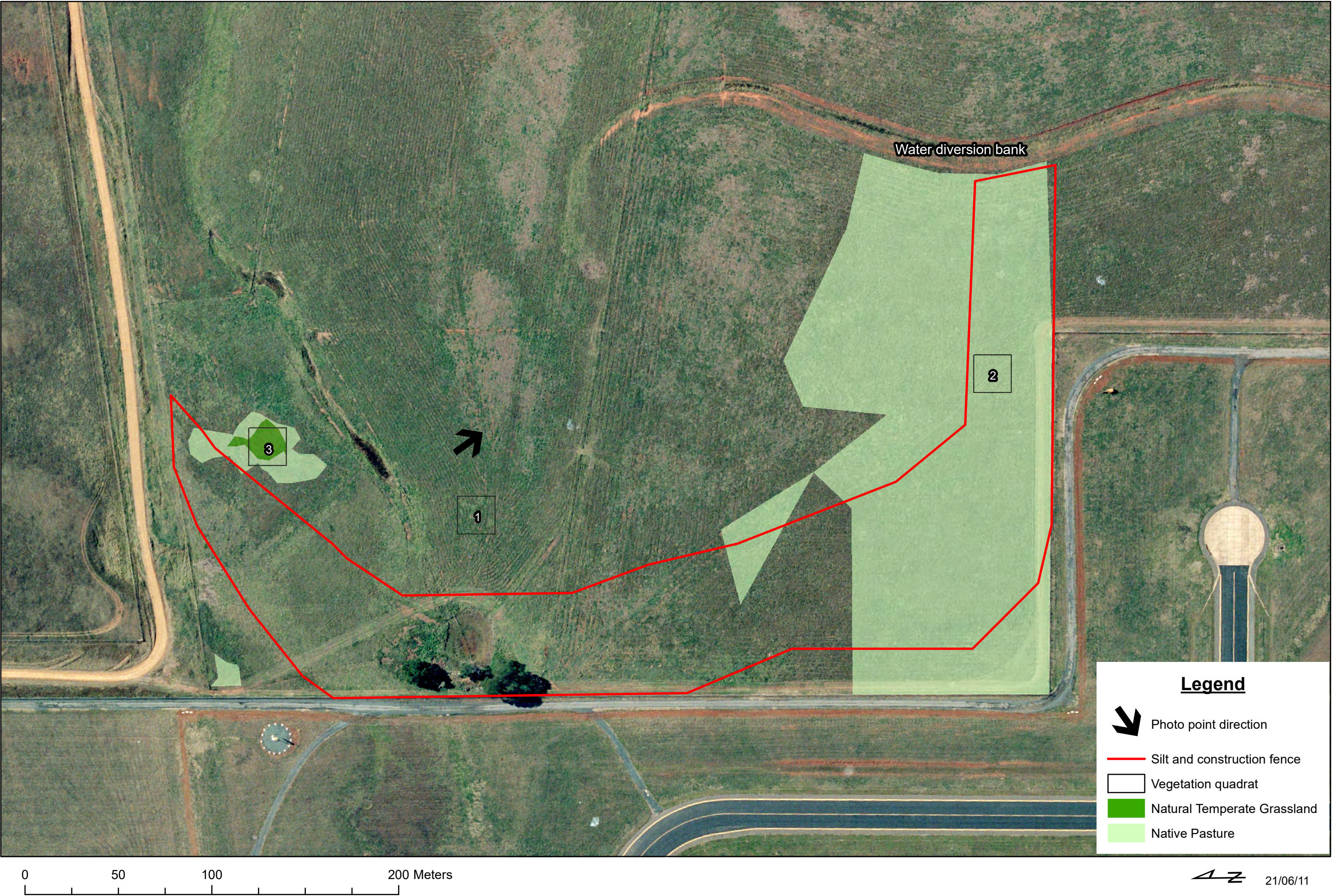
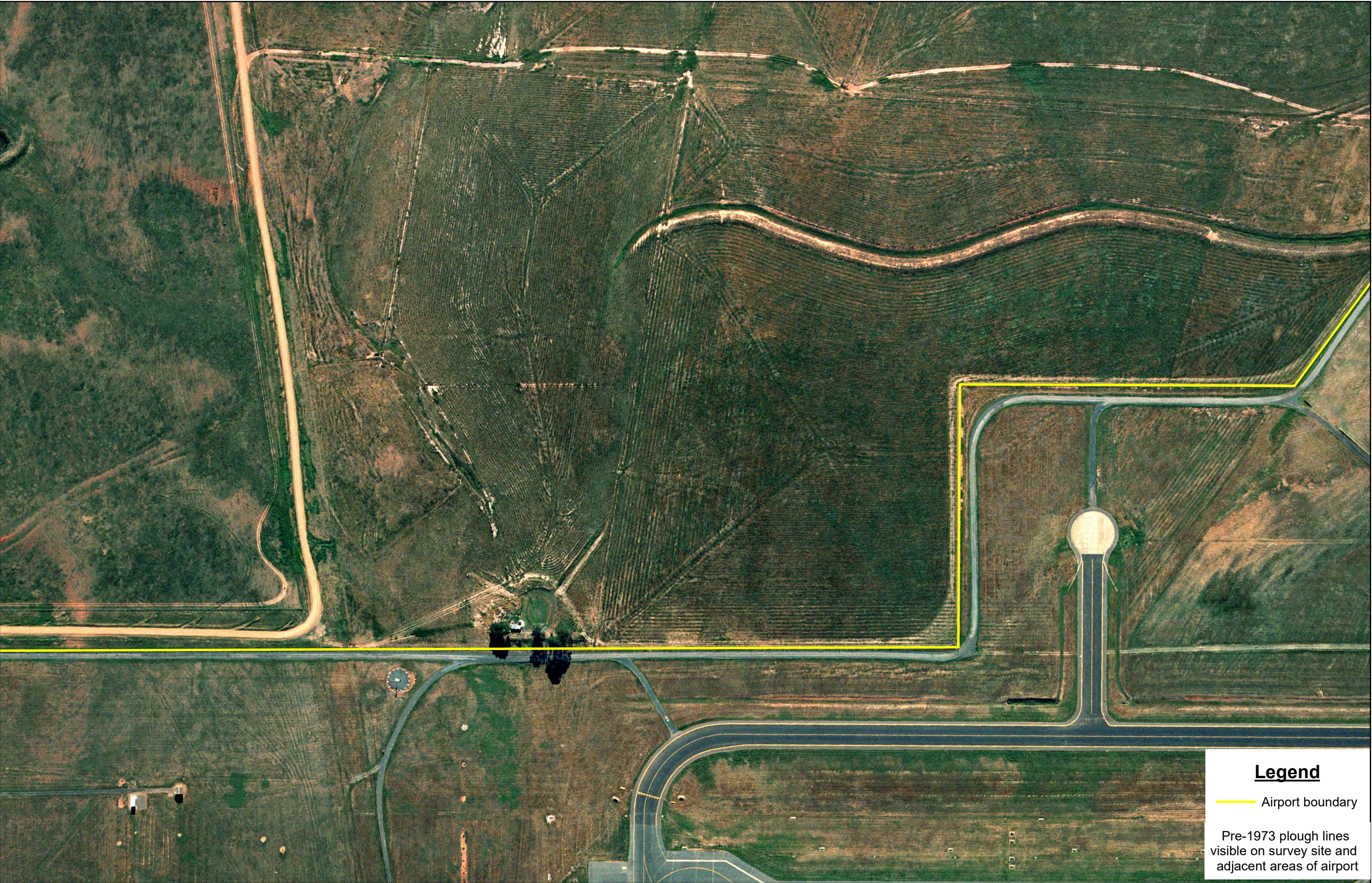


Figure 4. November 2009



Legend

- Airport boundary
- Pre-1973 plough lines visible on survey site and adjacent areas of airport

0 75 150 300 Meters

5/7/2020

Proposed Northern Road alignment and enclosed land

Ecological Surveys

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REPORT PREPARED FOR CAPITAL AIRPORT GROUP, APRIL 2020

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Summary

This report contains results of surveys for threatened species and ecological species in the proposed Northern Road alignment (Figure 1) to meet conditions of Referral 2009/4748 *Environment Protection and Biodiversity Conservation Act 1999* (and approved variations).

The designated construction zone for the proposed road contains a threatened ecological community and potential habitat for several threatened or near-threatened fauna species. It also has the potential to increase the fragmentation of fauna habitats and decrease movements of animals between habitat patches. These effects and potential mitigations are summarised in the table below, and other protections are detailed in the draft Northern Road Construction and Operations Strategy (Canberra Airport, 2020).

Summary of potential losses and mitigations

Species or community	Area of community or habitat within construction zone	Estimated area removed by construction	Area that could be protected within construction zone	Potential area of enhanced habitat in construction zone or on enclosed land	Potential area of additional created habitat in construction zone or on enclosed land
Natural Temperate Grassland	6800 m ² high to very high quality habitat	5830 m ²	970 m ² (likely to be lower quality)	0	0
Grassland Earless Dragon	6800 m ² (very low quality and/or transit habitat)	5830 m ²	970 m ²	Option to design and maintain road crossing zones	12500 m ² (enclosed land on southern part of route, low quality habitat created within 5-6 years of completion)
Golden Sun Moth	15175 m ² (significant impact under EPBC Act, requires referral) (13200 m ² low-very low, 1975 m ² medium)	14200 m ²	970 m ²	13000 m ² (on Malcolmvale Road verge and on enclosed land on southern part of route, enhance from low to medium by 2023)	36000 m ² (enclosed land on southern part of route, low quality habitat created within 5-6 years of completion)
Striped Legless Lizard	0	0	0	0	0
Perunga Grasshopper	(6800 m ² of intermittent transit habitat only)	(5830 m ² of intermittent transit habitat)	(970 m ² of intermittent transit habitat, unlikely to be used)	0	
Canberra Raspy Cricket	15175 m ² of low quality habitat	14200 m ²	(970 m ² , unlikely to be used)	12500 m ² (on enclosed land, as for GSM, by 2023)	0

Proposed Northern Road alignment and enclosed land – ecological surveys

1. The project

Canberra Airport has proposed constructing an access road (the Northern Road) between the Fairbairn Business Park and Majura Road, on the alignment shown in Figure 1. The southern section of the proposed road passes through part of the Majura Training Area (MTA, Defence land) and the northern section lies within the current easement of Malcolmvale Road. The proposed road is the subject of referral conditions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC 2009/4748 and approved variations).

The Northern Road is identified as potentially impacting a threatened ecological community and several threatened species in the above referral. The verges of Malcolmvale Road are currently mown regularly and closely as a fire break for MTA, and there is selective weed control and some kangaroo grazing in the southern section of the route.

The current report contains the results of ecological surveys undertaken in January to April 2020 to determine the current condition of the communities and habitats and the area of these potentially impacted by construction of the road on the alignment in Figure 1 and in the area of land enclosed between the Northern Road and the eastern fence of Canberra Airport ('enclosed land'). The central part of this alignment was also surveyed in 2011 (Rowell 2011).

The Northern Road construction zone is 35 m wide (Figure 1) and the road will be contained within it, but not all of this width will necessarily be destroyed/disturbed for construction. For example, Airport regulations require the road to be set back at least 3 metres from the airport fence so part of that strip could be protected from disturbance, and the existing unsealed Malcolmvale Road could be used as a haul road to protect such areas during construction.

The direct effect of the road construction and operation on ecological values within the road easement is considered, as well as the potential effect of creating an additional barrier between any threatened species populations on MTA and Canberra Airport, or on the land enclosed between the new road and the Airport boundary.



Figure 1. Proposed route of Northern Road.

2. Methods

The surveys were designed to produce the best results within the constraints of the survey period (January to April 2020). The methods were submitted to the Defence Regional Environment and Sustainability Manager before the survey began, and she advised that the surveys would not require a separate Defence Environmental Clearance Certificate.

The threatened species and communities to be considered in this report were determined from an EPBC Act Protected Matters search, threatened species and community mapping from the ACT Government's interactive mapping service (www.actmapi.act.gov.au), threatened species monitoring reports prepared for the Department of Defence, and mapping and monitoring carried out at Canberra Airport.

The threatened vegetation community likely to be present is Natural Temperate Grassland of the South Eastern Highlands (NTG), which is listed as a critically endangered ecological community under the EPBC Act and as an endangered ecological community under the ACT *Nature Conservation Act 2014* (NC Act). The community and threatened species considered in this report are shown in Table 2.1.

The proposed road travels through an area that is within the original occupied by the NTG community, and the route now contains relatively well-drained grassland with few surface rocks. Threatened flora and fauna species which do not occur in this type of habitat were excluded from the survey.

Table 2.1. Threatened species and communities potentially present in Northern Road area.

Species	Common name	Status	
		EPBC Act	NC Act
Natural Temperate Grassland of the South Eastern Highlands	Natural Temperate Grassland (NTG)	Critically Endangered	Endangered
<i>*Tymanocryptis lineata</i> (Melville <i>et al.</i> 2019)	Canberra Grassland Earless Dragon	*Endangered	Endangered
<i>Delma impar</i>	Striped Legless Lizard	Vulnerable	Vulnerable
<i>Synemon plana</i>	Golden Sun Moth	Critically endangered	Endangered
<i>Perunga ochracea</i>	Perunga Grasshopper	-	Vulnerable
<i>Cooraboorama canberra</i>	Canberra Raspy Cricket	Threatened species nomination under preparation	-
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	Endangered	-
<i>Rutidosis leptorrhynchoides</i>	Button Wrinklewort	Endangered	Endangered

* Endangered species currently listed under *T. pinguicollis* in EPBC Act, *T. lineata* is likely to be re-listed as Critically Endangered

2.1 Natural Temperate Grassland (NTG)

The Northern Road route and the land enclosed between its southern section and the Airport fence was mown short in April 2019 to facilitate a survey for unexploded ordnance. The winter of 2019 and the following summer were very dry and in January 2020 the vegetation remained very short and not in suitable condition for assessment. After 80mm of rain in February 2020 plant growth resumed and the grassland was assessed and mapped in late March to early April.

Areas dominated by native grasses and containing native forbs were searched for and mapped. Two 400m² quadrats in the better quality grassland on the verges of Malcolmvale Road were assessed against the threshold criteria for the threatened community (TSSC 2016). These quadrats were 10x40 metres rather than the usual 20x20 metres due to the linear road verge. A 100 metre step-point transect was measured close to the quadrats and compared against the benchmarks for ACT native vegetation types (ACT Government 2016).

2.2 Grassland Earless Dragon (GED)

This section discusses GED habitat and various survey methods, and explains the rationale for methods used in this project.

2.2.1 Available Grassland Earless Dragon survey methods

The Grassland Earless Dragon which occurs in the Canberra/Queanbeyan area is now more properly referred to as the Canberra Grassland Earless Dragon since a recent taxonomic revision renamed the species *Tympanocryptis lineata*, separating it from three other species which occur (or occurred) in Victoria and other parts of NSW (Melville et al. 2019). This will necessitate changes in the threatened species listing for the four species of earless dragons which are currently treated as one species in the National Recovery Plan (Robertson & Evans 2009/2012). The relisting of the Canberra Grassland Earless Dragon (probably as critically endangered) is likely to be a priority as it has a restricted distribution and is known to have declined in the last ten years, while one of the other species may be extinct and very little is known about another.

GED are known to occur in NTG at MTA and at the northern end of Canberra Airport, which until 1961 was part of MTA. In the ACT GED are found in NTG and native pastures, usually on well-drained sites dominated by Tall Speargrass *Austrostipa bigeniculata* and patches of shorter Wallaby Grasses *Rytidosperma* with open spaces between the tussocks. Most occupied sites have had little or no ploughing or pasture improvement (ACT Government 2017). GED shelter from predation and temperature extremes in burrows created by large grassland invertebrates, including Wolf Spiders and Canberra Raspy Crickets.

Areas identified as potential habitat for GED were the close-mown NTG on the verges of Malcolmvale Road and patches of mixed native-exotic grassland with moderate cover of Tall Speargrass in the southern part of the alignment. Malcolmvale Road is a little used unsealed road which may allow occasional movements of GED between MTA and Canberra Airport.

In the ACT, surveys for this species are usually undertaken by the installation of grids containing 56 artificial burrows (spider tubes) which are then checked 18 times during February and March (Stringer 2018). This is also the preferred method in the Commonwealth guidelines (DSEWP&C 2011).

There are four permanent monitoring grids of this type at MTA in the grassland north of the Airport, which have been monitored annually (except for 2005) since 2002 (Stringer 2018). Recent surveys of the MTA grids found 16 adults in 2016, then no adults in 2017, two in 2018 and two animals in 2019 (Stringer 2018, ACT government staff 2019).

There are two similar grids at the northern end of the Airport, which have been monitored in 2007, 2008, 2009, 2010, 2011, 2013, 2015, 2017 and 2019. No GED were recorded at the Airport grids between 2007 and 2010, one to four animals were found in the surveys between 2011 and 2017, and none were seen in 2019 (Rowell 2018 and pers. obs. 2019).

Dimond *et al.* (2012) identified drought as a likely cause of population declines for GED, and this appears to be occurring currently in the Majura Valley population.

There would not have been enough time to install grids of tubes along the Northern Road alignment and allow the requisite number of 'settling' weeks before beginning the survey. It was also considered that there was not enough suitable habitat for GED on the Northern Road alignment to make this type of survey useful, given the ongoing dry conditions and the recent very low capture rates in larger areas of much better adjacent habitat at MTA and Canberra Airport.

GED were found in 2007 in three of 26 eight unit grids of wooden blocks and roof tiles laid out in MTA to survey for Striped Legless Lizards in grassland north and east of the Northern Road alignment (ERM 2008). This was during the millennium drought when the grass cover was sparse and short, and GED have not been found at these artificial shelters in surveys carried out for Defence in subsequent years.

Artificial burrows (spider tubes) sunk under roof tiles have been used successfully to survey for the threatened Little Whip Snake near Bungendore NSW, with the tubes being used to increase the attractiveness of the tiles by providing additional shelter and thermal buffering for the reptiles (Rowell 2005b).

Stringer (2018) found increased captures in artificial burrows (tubes) between ambient temperatures of 22.5°C and 26.6°C when compared with higher or lower temperatures and suggested that surveying when dragons are least active (and more likely to be in their burrows) could improve their detectability. She also used a pencil torch to detect GED in natural burrows.

A fibrescope which allows detection of GED in deeper burrows containing bends has been used successfully to detect GED at Canberra Airport during two salvage projects and in undisturbed habitat (Rowell 2001, Rowell 2019b). These projects followed a pre-construction protocol which has also been proposed for the Northern Road project (Canberra Airport 2020).

2.2.2 Grassland survey methods used on Northern Road route

Survey was undertaken on all parts of the route and on enclosed land, not just areas identified as potential habitat.

Using information in the section above, the targeted GED survey design consisted of:

- 160 roof tiles, installed in January 2020 and checked 12 times (by turning and replacing tiles) in cool morning temperatures (12-24°C) from February to April (Figures 2 and 3):
 - 70 tiles along the eastern boundary of the road alignment south of Malcolmvale Road
 - 45 tiles (9 groups of 5) between road easement and Airport fence ('enclosed land')
 - 25 tiles on verges of the north-south section of Malcolmvale Road
 - 20 tiles on verges of the east-west section of Malcolmvale Road
 - With spider tubes to buffer temperatures sunk under 30 of the roof tiles, spread evenly across the alignment (Photographs 1 to 3).
- On each of the 12 visits, four pieces of roofing iron and pieces of timber from a collapsed shed were turned near the southern end of the alignment during above surveys.
- Inspection of 158 natural burrows (>6 cm deep) with a fibrescope, from February to April. Some were repeat checks of larger burrows marked with flagging tape when first found.
- One inspection of twelve 8 unit (block and tile) grids in adjacent areas of MTA in March (see under SLL below).
- Recording reptiles seen while installing tiles/tubes, during vegetation and habitat mapping and while walking across the site.



Figure 2. Tile locations on northern section of route.
Red = tiles



Figure 3. Tile locations on southern section of route.

Red = tiles

White = Northern Road footprint

2.3 Striped Legless Lizard (SLL)

In the ACT this species has been found to prefer structurally complex grasslands of intermediate biomass. SLL has also been recorded in degraded native grasslands that have become dominated by exotic species such as *Phalaris* (ACT Government 2017).

Striped Legless Lizards are known to occur at in NTG at MTA but have not been found in targeted surveys at Canberra Airport where the grassland is mown regularly. Previous habitat mapping of the southern part of the road alignment in 2011 suggested that some areas of relatively dense exotic grassland and mixed native-exotic grassland had a structure potentially suitable for SLL but that the site's history (previous ploughing, stock grazing until 2007, ground bared by drought and overgrazing during millennium drought) made it unlikely that the species would occur there (Rowell 2011).

A site inspection in December 2019 showed that (due to drought) the vegetation had not grown since close mowing in April 2019 ahead of unexploded ordnance surveys, biomass was very low and the site did not resemble SLL habitat. However, SLL have sometimes been found in relatively sparse grasslands (e.g. Rowell 2005a) and are known to occur at MTA adjacent to Malcolmvale Road, so a survey was undertaken.

Commonwealth guidelines (DSEWP&C 2011) recommend installation of tiles three months ahead of surveys undertaken from September to December for best results, though surveys at some ACT sites have found that tiles can be checked much sooner after installation under some conditions (e.g. Moore et al 2011). The guidelines suggest that shelter sites should be checked weekly at ambient temperatures below 28°C, that tiles may be checked during summer/autumn for shed skins, and that active searching (under surface rock/debris, around tussocks) can be undertaken throughout the year.

The methods used for Grassland Earless Dragon above were also used for SLL (i.e. a combination of morning tile/tube surveys, hand-searching and burrow inspection).

45 eight unit grids of roof tiles and wooden blocks have been laid out in MTA to survey for Striped Legless Lizards in grassland north and east of the Northern Road alignment (AECOM 2012). Twelve of the grids closest to the road alignment were surveyed on 31 March by turning and replacing the tiles/blocks in the morning when the temperature was under 17°C, to test whether SLL could be detected under similar (but longer-established) shelters in known and potential habitat during the survey period.



Photograph 1. Artificial burrow (tube) under tile, insert removed.
Insert has drainage hole at base and a roughened lining which allows animals to enter and leave.



Photograph 2. Group of tiles in exotic grassland between Airport fence and Northern Road route south of Malcolmvale Road, January 2020.



Photograph 3. Tile in exotic grassland in same area as above, April 2020.

2.4 Golden Sun Moth (GSM)

GSM habitat in the ACT is usually low open grassland with a moderate cover of larval food plants and areas of bare ground between the grass tussocks (ACT Government 2017). Known food plants are Wallaby Grasses *Rytidosperma* species (primary food plants), Tall Speargrass *Austrostipa bigeniculata* and the introduced Chilean Needlegrass *Nassella neesiana* (and possibly Serrated Tussock *Nassella trichotoma*).

GSM are known to occur at MTA and Canberra Airport and have been recorded in low numbers in the southern part of the Northern Road alignment near the Airport fence (Rowell & Bishop 2004).

The survey period was after the flying season of GSM in the ACT in 2019, with the last flying male being observed on 11 December (ACT shared data), so the survey for GSM consisted of mapping potential habitat and a search for pupal cases in December.

After mapping of the grassland, three 100 metre step-point transects were assessed in areas of potential habitat with methods used by ACT government to monitor GSM habitat quality in reserves and offsets. A tape was laid out and at each one metre mark the dominant habitat parameters were measured from the list below, providing a percentage cover for each of the habitat features:

- Cryptogams (moss/lichen)
- Bare ground
- Rock
- Plant litter
- Chilean Needlegrass
- Serrated Tussock
- Annual exotic grass
- Other perennial exotic grass
- Exotic broadleaved plant
- Wallaby grass
- Speargrass
- Other native perennial grass
- Other native plant

A one square metre quadrat was placed every at each 10 metre point along the transect and the average grass height and the average litter depth was measured.

2.5 Perunga Grasshopper (PG)

In the ACT, PG has been found in Natural Temperate Grassland and other native grassland, usually with a dense or patchy tussock structure, and it is known to occur at MTA and Canberra Airport (ACT Government 2017). It is a cryptic flightless species which is usually only seen after it is disturbed, when it jumps then hides in tussocks. Nymphs hatch in late summer and autumn and develop during winter and early spring, and adults have been recorded between October and February.

As the reptile surveys and vegetation/habitat mapping required repeated traverses of the whole site on foot, this was used as the search method for PG. This has been successful at Canberra Airport where PG is mostly seen during vegetation quadrat surveys and adults have been recorded as late as March (Rowell 2016).

2.6 Canberra Raspy Cricket (CRC)

CRC is a large wingless omnivorous burrowing cricket and its habitat appears to be restricted to areas of natural temperate grassland and native pasture where the soil surface has undergone minimal disturbance. It constructs and lives in distinctive burrows which are perfectly vertical, round in cross-section, 12–20 mm in diameter, and greater than 12 cm deep (Reid et al. 2018). The burrows may be open or capped with a clay and silk lid. The species has recently been proposed for listing as endangered under the EPBC Act, and its importance is enhanced by its association with the endangered GED which sometimes uses its abandoned burrows.

Adults have been recorded between November and April, with nymphs occurring in most months (Reid et al. 2018, Rowell pers. obs.). CRC is known to occur at Canberra Airport and at MTA, and a nymph was found in a burrow near the southern end of the proposed route in September 2012 (Rowell 2012).

The CRC survey involved searching for and marking potential burrows with flagging tape and inspecting them with a portable fibrescope on one or more occasions between January and April.

2.7 Hoary Sunray (HS)

The Hoary Sunray *Leucochrysum albicans* var. *tricolor* is a small, perennial paper daisy which has declined in range and abundance due to degradation and loss of habitat for agriculture and land development. Many remaining populations are small and fragmented, and threatened by further habitat disturbance and loss.

There is a large population of HS in woodland at MTA, about 2 km east of the Northern Road route. A few HS plants occur on the Airport south of Fairbairn, and some also have been planted in that area.

2.8 Button Wrinklewort (BW)

BW is a perennial daisy that grows in grassland and woodland. There are fewer than 30 known populations across ACT, NSW and Victoria. Threats to the species include habitat loss, invasive weeds, changed fire regimes, grazing, herbicide and mowing impacts.

There are two known populations in the Majura Valley, in MTA 1.2 km east of the Northern Road route and at Campbell Park 1.8 km to the west of Majura Road.

3. Results

3.1 Natural Temperate Grassland

For a grassland patch to qualify as NTG it must be at least 0.1 ha (1000 m²). Patches totalling 6,800 m² (0.68 hectares) on the vegetated verges of Malcolmvale Road were found to contain the Tablelands Dry Tussock Grassland vegetation type and exceeded the thresholds for High to Very High quality NTG critically endangered ecological community (Figure 4, Table 3.1, Photographs 4 and 5). These patches were considered together as they are semi-continuous with one another and/or with the larger areas of NTG in the adjacent Airport and MTA.

The NTG condition rating was determined by putting the quadrat data into a Floristic Value Calculator (Rehwinkel 2015). The TSSC (2016) minimum values for High to Very High condition NTG are:

- Percentage cover of native vascular plants in the patch is greater than the percentage cover of perennial exotic species
AND
- At any time of the year there are:
 - At least 12 non-grass native species
 - OR
 - At least 3 indicator species
 - OR
 - A Floristic Value Score (FVS) of at least 6.5.

Table 3.1 shows that the NTG on the verges of Malcolmvale Road exceeds all the requirements for High to Very High condition NTG.

Table 3.1. Condition indicators for NTG quadrats

Quadrat	Number of native species	Number of non-grass native spp.	Number of indicator species	Floristic Value Score
Q1	27	15	7	24.07
Q2	25	18	6	24.87

Most of the 35 metre wide Northern Road easement south of Malcolmvale Road was found to contain exotic-dominated grassland or patches of mixed native-exotic grassland where Tall Speargrass was common but native forbs were rare or absent (Figure 5). The minimum condition for grassland containing native grasses to reach the level that is protected as NTG under the EPBC Act is that 'the percentage cover of native vascular plants (including annual and perennial species) in the patch must be greater than the percentage cover of perennial exotic species' (TSSC 2016). A 100m transect measured in the best part of the mixed native-exotic grassland contained some native grasses and almost no native forbs (T2 in Table 3.2), and total native cover was 23% while perennial exotic cover was 30%, so this type of grassland was not NTG. Compared to the NTG transects, the mixed grassland also had a high cover (28%) of dead plant litter, reflecting the tall exotic vegetation such as Wild Oats and broad-leaved weeds such as thistles, Paterson's Curse and St John's Wort which had been cut or had fallen during the preceding summer and had reduced the inter-tussock spaces. African Lovegrass *Eragrostis curvula* has recently invaded much of this section despite some ongoing weed-spraying.

An isolated small (<0.1 ha) patch of NTG east of the alignment which was identified in 2011 is still present but is outside the area affected by this proposal.



Photograph 4. NTG Quadrat 1 on verge of Malcolmvale Road.



Photograph 5. Detail of above, showing Redleg Grass, bare ground and native forbs.



Figure 4. Vegetation communities and Transect and Quadrat locations, northern section.
Yellow = high to very high quality NTG



Figure 5. Vegetation and transect in southern section.
Orange = mixed native-exotic grassland with moderate cover of Tall Speargrass (not NTG)

3.2 Golden Sun Moth

Habitat was mapped fence to fence on Malcolmvale Road, 20 to 30 metres beyond the eastern boundary of the construction zone on the part of the route south of Malcolmvale Road, and on the land enclosed between the southern part of the route and the eastern boundary fence of the Airport.

Areas along Malcolmvale Road that contained NTG and the patches south of Malcolmvale Road containing mixed native-exotic grassland with a moderate cover of Tall Speargrass were mapped as GSM habitat (Figures 6 and 7). Wallaby Grasses (preferred larval food plants) were rare in both areas.

A GSM pupal case was found on the southern part of the route in an area containing Tall Speargrass during the initial site inspection on 11 December 2019, close to the end of the flying season (Photograph 6). Empty pupal cases are fragile and usually break down in less than two weeks. A further four pupal cases were found in late March under a sheet of corrugated iron, where they had presumably been protected from the weather (Figure 7).

The habitat transects in the NTG on Malcolmvale Road were dominated by native grasses and forbs and contained moderate amounts of bare ground and relatively low levels of litter (Table 3.2, Photographs 7 to 12). The habitat structure was good but these areas represent low and moderate quality GSM habitat as the cover of Wallaby Grasses (preferred food species) was very low and the best area had moderate cover of Tall Speargrass (secondary food species).

The dominance of Redleg grass *Bothriochloa macra* (not a larval food plant) which had a cover of 25-50% in most of this area is probably due to repeated low mowing of the road verges (<5 cm). The adjacent part of the Airport has also been managed by mowing for many years, but at a higher cutting level (8-12 cm), and contains higher cover of Wallaby and Speargrasses.

The transect in the mixed grassland in the southern part of the easement represented low to very low quality GSM habitat, with no Wallaby Grasses, moderate cover of Tall Speargrass and high levels of plant litter indicating previous cover of tall exotic species such as Wild Oats. Much of this habitat is also under threat from expanding patches of African Lovegrass.

About 1.25 ha of this low to very low GSM habitat was also found on the land enclosed between the Airport boundary fence and the southern part of the route.

If all GSM habitat within the 35 metre road easement (construction zone) were to be removed by construction, 13200m² of low to very low quality habitat would be lost, and 1975m² of medium quality habitat, a total of 1.5 ha. The significant impact threshold under the Commonwealth guidelines for an area of large or contiguous habitat (>10 ha) is loss, degradation or fragmentation of more than 0.5 ha of GSM habitat (DEWHA 2009). The Malcolmvale Road route passes between large known areas of GSM habitat at MTA and the Airport which are considered to be contiguous under the Commonwealth guidelines definition as only areas separated by more than 200 metres are considered to be effectively isolated (DEWHA 2009).

The loss of 1.5 ha of GSM habitat would therefore be considered a significant impact requiring a referral under the EPBC Act. Protection and mitigation measures to reduce the area lost, including protection of some habitat within the construction zone, enhancement of low quality habitat and creation of habitat are discussed in Section 5.



Photograph 6. Golden Sun Moth pupal case found near southern section of Northern Road route in December 2019.



Figure 6. Golden Sun Moth habitat on northern section of route.

Orange = low quality habitat

Green = moderate quality habitat

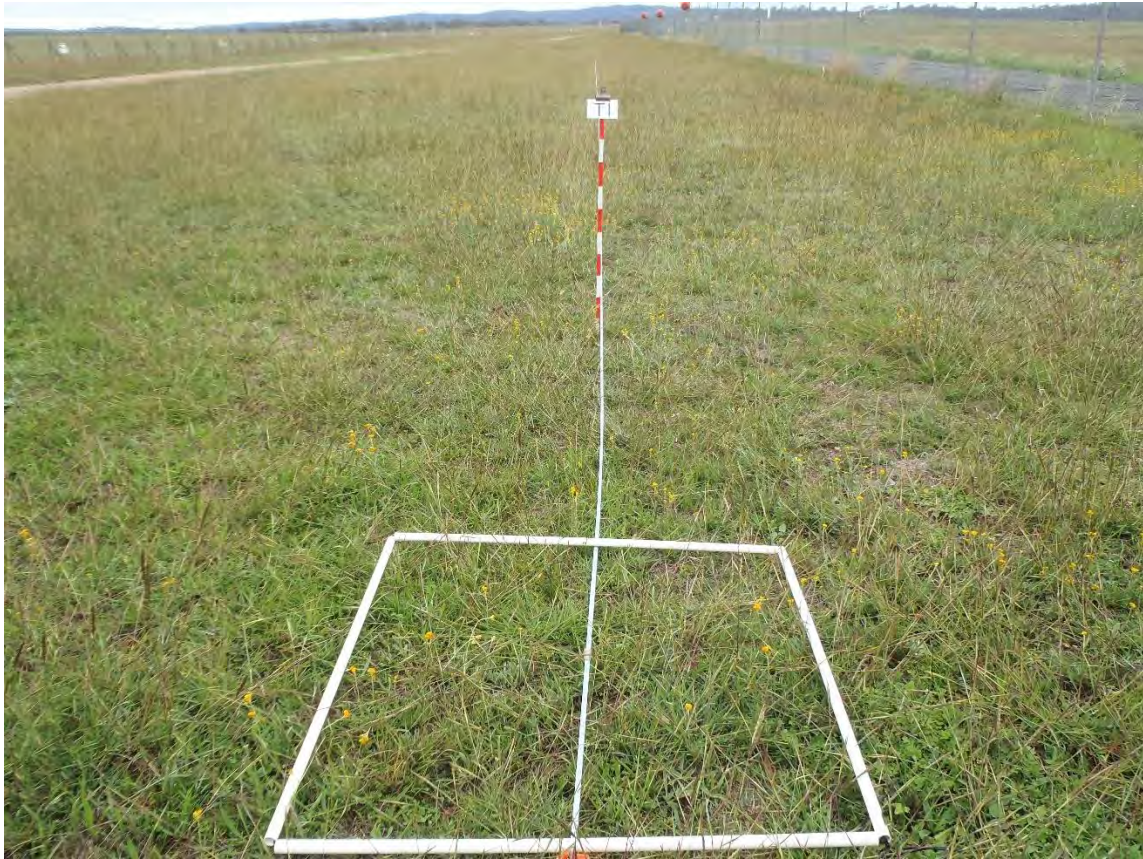


Figure 7. Golden Sun Moth habitat on southern part of route.

Orange = low quality habitat

Green = moderate quality habitat

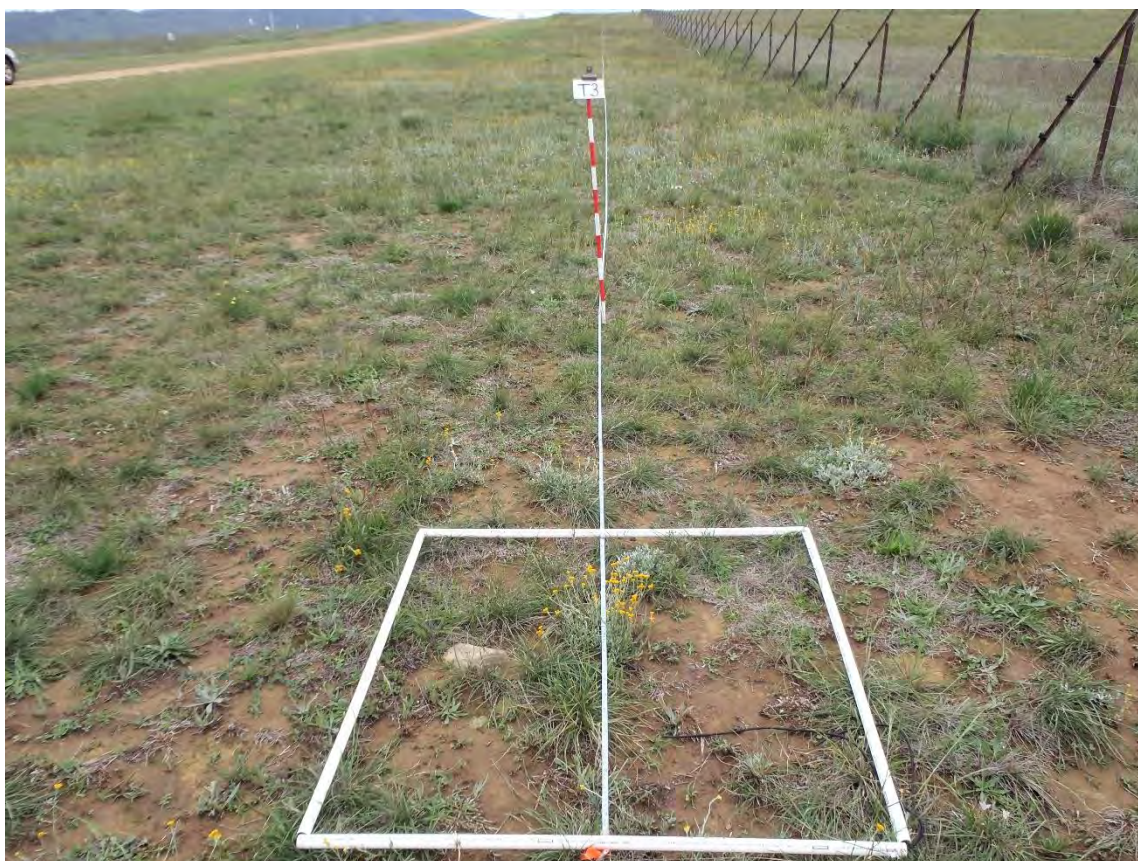
Yellow = GSM pupal case locations, 2019/2020



Photograph 7. GSM Transect 1, Malcolmvale Road southern verge, north of Airport.



Photograph 8. Detail of above, showing Redleg Grass and native forbs.



Photograph 9. GSM Transect 3, Malcolmvale Road eastern verge, east of Airport.



Photograph 10. Detail of above, showing Tall Speargrass, native forbs and bare ground.



Photograph 11. GSM Transect 2 in mixed native-exotic grassland, southern section of route.



Photograph 12. Detail of above, showing Tall Speargrass, thatch, exotic grasses and forbs.

Table 3.2. Step-point transects, GSM habitat measurements

Transect	Bare earth %	Rock %	Cryptogam %	Litter %	Wallaby Grass %	Speargrass %	Other native grass %	Other native plant %	Chilean Needlegrass %	Serrated Tussock %	Other perennial exotic grass %	Annual exotic grass %	Exotic forb %	Average tussock height (cm)	Average thatch depth (cm)
1	10	0	3	8	2	0	40	15	0	0	0	0	22	2.5	<.5
3	19	0	1	9	2	18	16	17	0	0	4	0	14	2.1	<.5
2	10	0	0	28	0	19	4	0	0	0	21	6	12	2.0	1.0

3.3 Grassland Earless Dragon

No GED were observed during the tile or burrow surveys. Checking all the tiles and the roofing iron 12 times represents 1,968 shelter checks, plus the additional check of older grids of tiles and blocks for GED presence east of the easement. A standard 18-visit survey of one 56-tube grid of tubes during the same survey period represents 1008 shelter checks.

There were 158 fibrescope inspections of natural burrows 9-16 cm deep. 26 of these were repeat checks of larger burrows (i.e. 132 individual burrows inspected). Many burrows were occupied by Wolf Spiders *Tasmanicosa godeffroyi* and at least nine appeared to be old burrows constructed by Canberra Raspy Cricket (see below).

Potential GED habitat was identified in NTG on the verges of Malcolmvale Road, near where GED are known to occur on adjacent parts of Canberra Airport and MTA. This was considered to be very low quality habitat due to repeated low mowing of the verges producing the condition shown in Photograph 17, with very short vegetation and higher ground scalped by the mower blades.

Grassland with moderate cover of native grasses on and near the southern portion of the road alignment (mapped as GSM habitat) contained some suitable burrows and had a structure similar to low quality GED habitat, but was considered very unlikely to be occupied by GED due to its history and recent fluctuations in condition (see Discussion).

3.4 Striped Legless Lizard

1,968 checks of shelter sites (tiles/tubes and roofing iron) were carried out over 12 days between February and April. No SLL were observed during the survey in the Northern Road area. The grassland on and near the easement was short and sparse due to drought and mowing, and was not considered to be currently in suitable condition for occupation or transit by SLL.

The survey was outside the usual SLL peak activity period of early spring, but the temperatures and rainfall from mid-February 2020 were probably more favourable to SLL activity than conditions in early spring 2019. The presence of tiles over a 12 week period presented an additional opportunity for detection of shed skins.

No live SLL were seen in the check of twelve grids of previously established roof tiles and blocks in MTA to the east of the Northern Road alignment (Figure 8). Many of the tiles installed in 2011 had been broken, apparently mostly by machinery during planting of trees and shrubs in the grassland.

One of the old shelter grids in NTG contained a shed skin that appeared to be SLL (Figure 8, Photograph 13), adjacent to a grid where SLL was recorded in 2007 (ERM 2008). SLL have previously been found on at least seven of the shelter grids in the NTG area of MTA, but none have been found in the newer grids south of Malcolmvale Road which are in grassland in similar condition to the southern part of the route.

Other MTA NTG grids contained a small dead Brown Snake *Pseudonaja textilis* and a Smooth Toadlet *Uperoleia laevis*.

3.5 Other fauna in tile and burrow surveys

Two species of common small grassland skinks were observed during the first check in early February and on every subsequent visit, under tiles, in tubes or in the grassland. These were Delicate Skink *Lampropholis delicata* and Boulenger's Skink *Morethia boulengeri*.

Assuming that skinks seen in the same place on different dates were the same animal, a minimum of 21 individual *L. delicata* were seen (33 sightings), and three individual *M. boulengeri* (14 sightings). Two *M. boulengeri* and three *L. delicata* were seen repeatedly under roofing iron at the southern end of the easement, shelters which had been in position longer than the survey tiles, were larger, and had different thermal properties.

The skinks were not evenly distributed through the grassland, but were concentrated in the NTG along Malcolmvale Road and in native-dominated grassland at the southern end of the road alignment (71% of sightings), even though there were more tiles in exotic dominated grassland (Figures 9 to 11).

Spotted Grass Frogs *Limnodynastes tasmaniensis* were found at three locations, in a tube on the verge of Malcolmvale Road and under a tile and in a tube in low-lying exotic-dominated grassland south of Malcolmvale Road near the site of a former dam.

Many invertebrates were found under tiles and in the tubes from the beginning of the survey. These included Wolf Spiders, Red-backed Spiders, Sac Spiders, several species of native cockroaches, Scolopendrid centipedes, Portuguese Black Millipedes, pill bugs, slaters and several species of ants. Red-backed Spiders were the species most commonly encountered, and as these spiders are known to occasionally kill small skinks, their presence may have deterred small reptiles from using some of the tiles. The diversity of invertebrates was greater in areas of NTG and mixed native-exotic grassland.

Two deep burrows of the Red-headed Mouse Spider *Missulena occatoria* were found in NTG on the verge of Malcolmvale Road. This species is also known to occur on Canberra Airport.

After heavy rain in February, many freshly-dug burrows appeared in the native-dominated grassland areas. Most of these appeared to be due to dung beetles burying kangaroo dung, and in some the soil was loosened or removed to a depth of 20 cm. Some were inspected with the fibrescope but did not contain dung beetles or other fauna.



Photograph 13. Shed skin of Striped Legless Lizard at MTA tile grid.

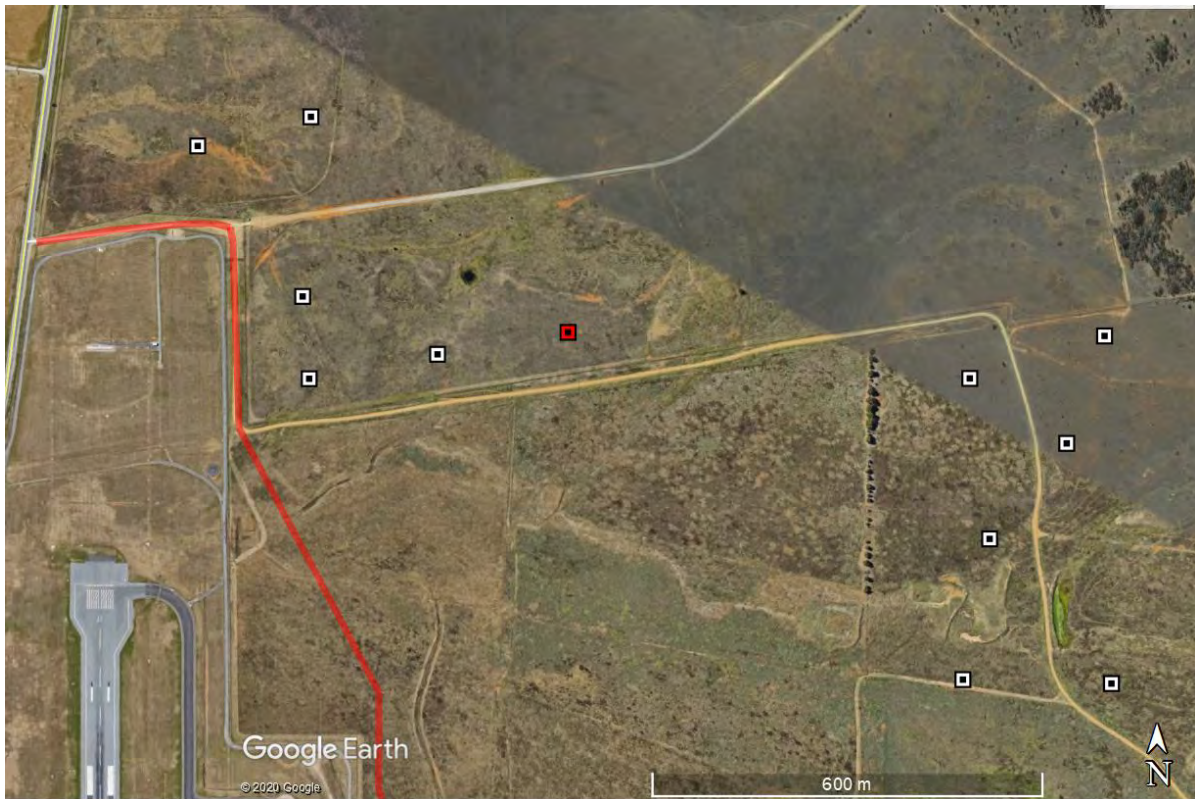


Figure 8. Location of existing tile/block grids checked.
 Red square = shed skin of SLL White squares = no SLL



Figure 9. Vertebrate records on northern section of route.

Red = tiles and tubes

Blue = skink sightings

Green = frog sighting

Yellow = NTG



Figure 10. Vertebrate records on central section of route.

Red = tiles and tubes

Blue = skink sightings

Green = frog sightings

Orange = mixed native-exotic grassland

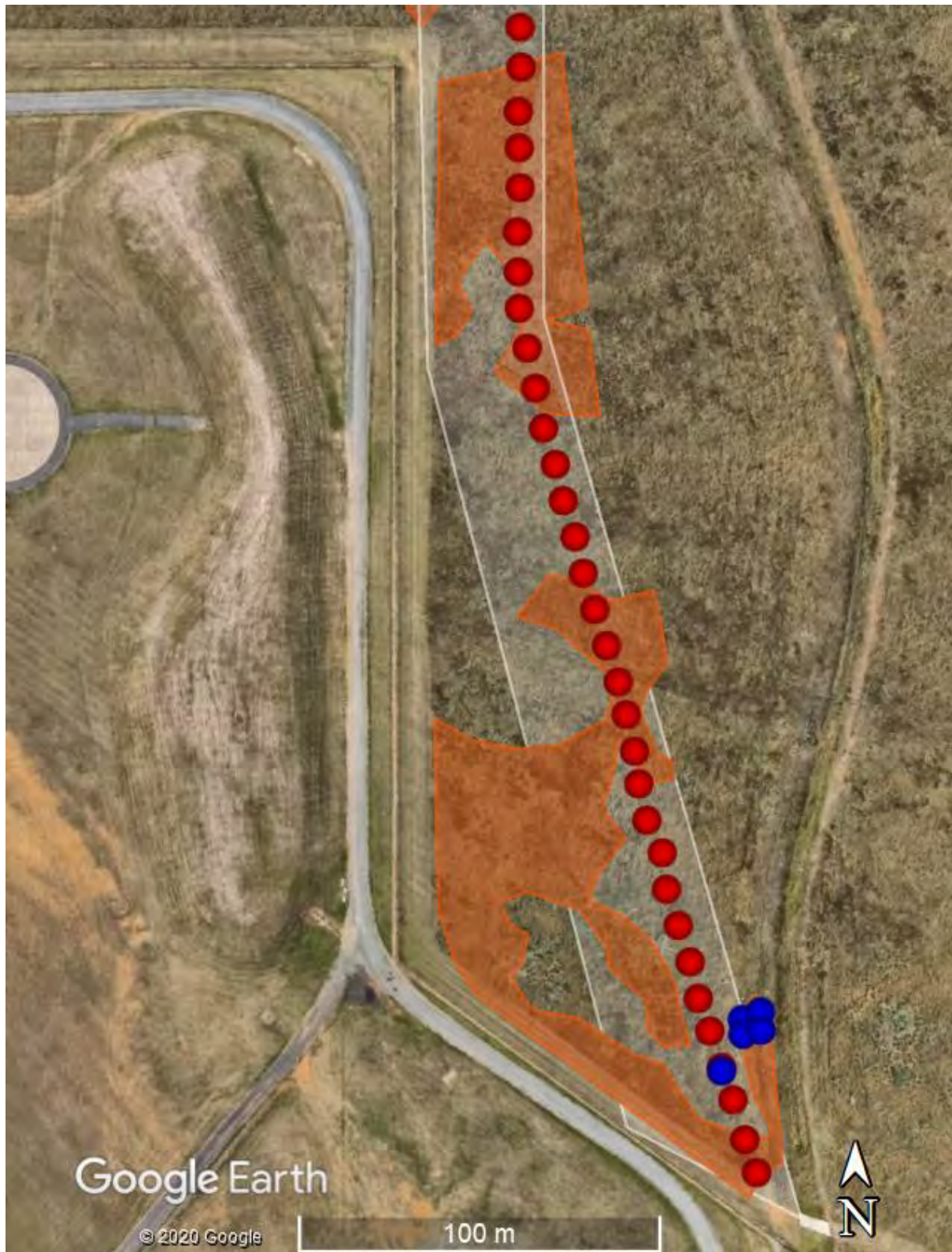


Figure 11. Vertebrate records on southern section of route.

Red = tiles and tubes

Blue = skink sightings

Orange = mixed native-exotic grassland

3.6 Perunga Grasshopper

Perunga Grasshopper was not recorded during the survey. If appropriately managed the NTG along Malcolmvale Road could be potential habitat for Perunga and a potential crossing area between MTA and the Airport, but the frequent low mowing associated with its maintenance as a fire break means that the habitat structure on the verges would almost always be unsuitable for this species. The species is also considered unlikely to cross the open gravel road. The Malcolmvale Road verges should therefore be regarded as low quality potential transit habitat which is unlikely to be permanently occupied by Perunga and only occasionally (if at all) used for transit.

The grassland south of Malcolmvale Road was considered too weedy and disturbed to be habitat for this species.

3.7 Canberra Raspy Cricket

The high degree of disturbance of the grassland on the Northern Road route makes it low quality habitat for CRC. This is due to the frequent mowing of Malcolmvale Road verges and weediness of the southern section.

No CRC were recorded during the survey, but nine empty burrows that appeared to have been constructed by this species were found on and near the easement, in grassland containing Tall Speargrass at the southern end of the route and in NTG on the verges of Malcolmvale Road (Figure 12). The burrows were mostly found in or near areas where skinks and/or GSM were also recorded.

Burrows were 10-14 cm deep with a distinctive shape and some had the typical surrounding clay pad and remains of a clay lid (Photograph 14), suggesting that they had been occupied earlier in the 2019-2020 season. Adult CRC usually die between February and April and very few were seen on other known sites in the ACT in 2019-20, presumably due to the drought.

The raised edges of the water diversion swale just east of the southern part of the easement contained patches of native-dominated grassland, and an occupied CRC burrow was found in this area in 2012 (Figure 12) (Rowell 2012).

The maximum loss of habitat for CRC was calculated by measuring the area of NTG and mixed native-exotic grassland in the Northern Road footprint, which is about 1.5 ha. The actual area of habitat affected is probably lower, given the small number of burrows detected.



Photograph 14. Empty Canberra Raspy Cricket burrow in mixed native-exotic grassland on southern section of route.

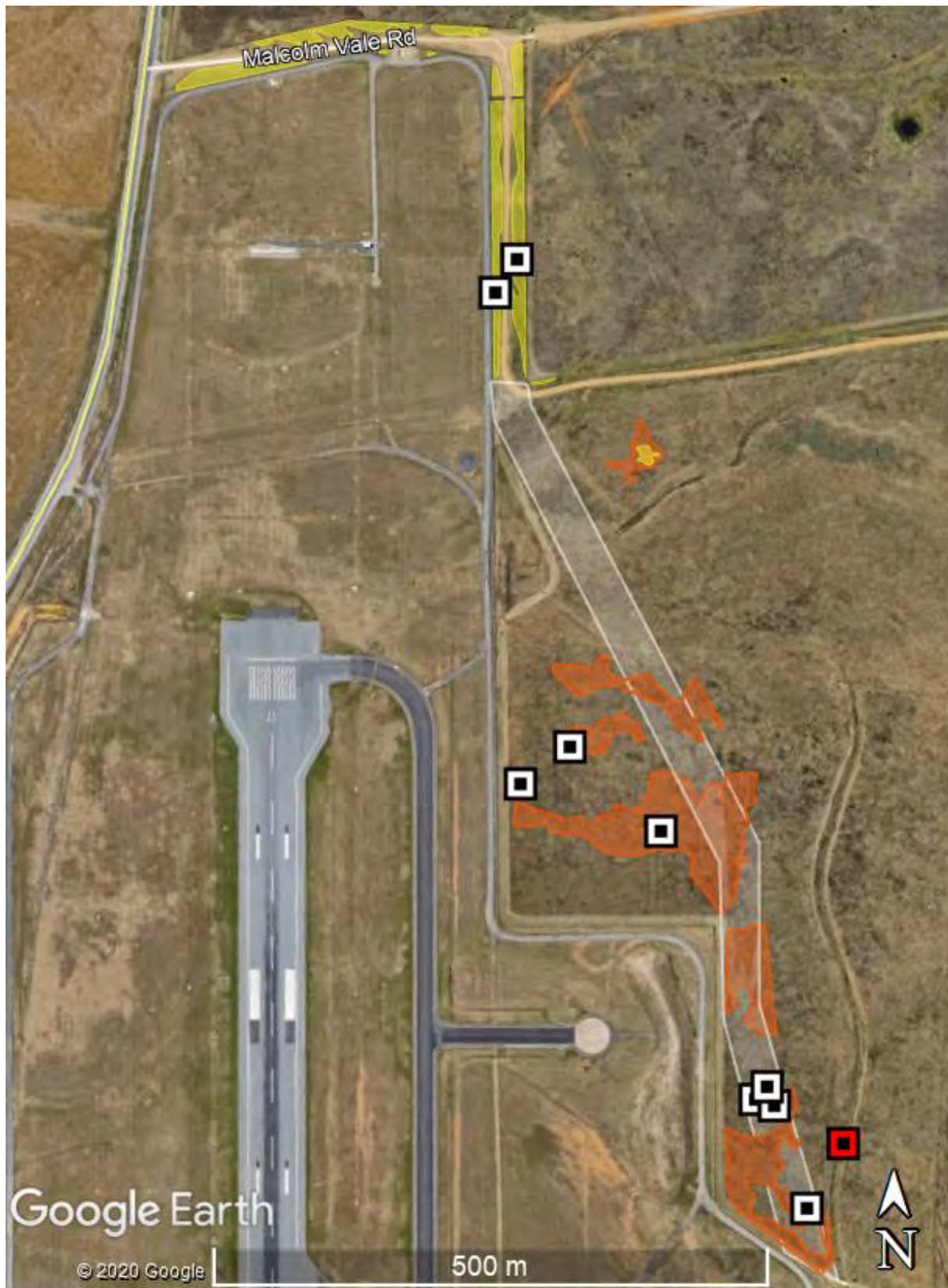


Figure 12. Canberra Raspy Cricket burrows near route.

White squares = unoccupied CRC burrows

Red square = CRC present in 2012.

Yellow – NTG

Orange = mixed native-exotic grassland

3.8 Hoary Sunray (HS)

The mown verges of Malcolmvale Road are suitable habitat for HS but none were present. HS plants were visible at nearby known sites on Mt Ainslie and Australian Defence Force Academy during the survey period, so any HS present on or near the Northern Road route would have been detected.

3.9 Button Wrinklewort (BW)

The grassland on the Northern Road route is either too disturbed or too frequently mown to allow BW to survive there. No BW were seen in the Northern Road area, but the species was in flower at a known site at MTA 1.2 km east of the survey site and any BW plants on or near the route would have been easily detected.

4. Discussion

4.1 Habitat loss and fragmentation

Habitat loss results in direct loss of plant communities and the species they contain. Habitat fragmentation makes populations vulnerable to decline in many ways, including reduction in immigration and emigration, inbreeding or genetic loss due to decreased flow of genes between isolated populations, smaller populations being more vulnerable to chance extinction, and larger perimeter to area ratio increasing degradation by weeds, disturbance and predation.

4.1.2 Natural Temperate Grassland

The 6800 m² of NTG on the verges of Malcolmvale Road is in good condition, apart from contour banks maintained to divert water and some damage from vehicle parking near the MTA Grenade Range gate. Much of this NTG would be lost during construction of the Northern Road on the proposed alignment, which would also be an increased barrier to movement of plant propagules and fauna including GED, GSM, SLL, Perunga and CRC. Areas lost and mitigation measures are discussed in Section 4.3 and summarised in Table 5.1.

The Malcolmvale Road NTG is likely to be habitat for GSM. It would also be potential transit habitat for GED and potential low quality habitat if there are times when it is not mown very short. It is low quality potential habitat for CRC, very low for Perunga Grasshopper and probably unsuitable for SLL, due to the frequent low mowing.

4.1.3 Area south of Malcolmvale Road

The paddocks south of Malcolmvale Road have a long history of ploughing, stock grazing and pasture improvement which reduces their potential to contain native vegetation and habitat for threatened species (Rowell 2011). The native vertebrate and invertebrate fauna records in this survey occurred mostly in the Malcolmvale Road NTG and in the parts of the southern section of the route that have a higher cover of native grasses (Figures 7 and 9 to 12), i.e. native fauna was associated with native vegetation.

For reasons discussed below, construction of the southern section of the route is not considered likely to significantly increase fragmentation of habitat for threatened fauna.

4.1.3.1 Golden Sun Moth

The area containing native grasses which is mapped as GSM habitat in the southern part of the Northern Road easement and enclosed land is patchy, and most is probably only intermittently occupied by GSM due to the extreme fluctuations in biomass that occur in this area between wet and dry years due to the presence of exotic pasture grasses and other environmental weeds (Photographs 15 and 16). The presence of GSM pupal cases in parts of this area in 2019-20 indicates that those areas have been suitable for occupation for at least 2-3 years (generation time of GSM), possibly due to reduced biomass during the current drought. In wetter years the dense structure of the grassland as seen in this area in 2012 (Photograph 16) is likely to reduce breeding success by interfering with emergence of adults, basking, mate searching and egg-laying (ACT Government 2017). This ongoing variability in GSM habitat quality under current management methods (selective weed control and kangaroo grazing only) puts the survival of the GSM population in this area at risk.

Land to the east of the road easement is in similar condition, and GSM habitat there is likely to also be very low quality and/or intermittently occupied.

4.1.3.2 Grassland Earless Dragon and Canberra Raspy Cricket

The patches of mixed native-exotic grassland mapped as GSM habitat in the southern part of the easement also contain some invertebrate burrows and under the current drought conditions have the structure of marginal GED habitat, with occasional CRC burrows and bare ground between Tall Speargrass tussocks.

In July 2001, when GED numbers were higher in the Majura Valley, 160 burrows were inspected with a fibrescope and excavated in 3.3 ha of mostly native-dominated grassland at Canberra Airport ahead of construction activity. Eight GED and 30 CRC were retrieved, and most of these animals were detected with the fibrescope before excavation. A similar number of burrows (158) was inspected during the current survey on the Northern Road route without detecting any GED or CRC, suggesting that these species are not present on the route or, if present, are in very low numbers.

In March-April 2019, 665 invertebrate burrows were inspected and dug out from a construction zone at Canberra Airport in grassland mostly in similar condition to the southern part of the Northern Road route (i.e. exotic grassland with patches of native grasses). Invertebrate burrow density on that part of the Airport was three times higher in the native grass patches compared to exotic dominated areas, a similar situation to the current survey. One GED and one CRC were found on the edge of a diverse native patch which lay mostly outside the construction zone and was known to contain those species previously, and no GED or CRC were found in the exotic or more degraded native-dominated grassland. This finding supports other data showing that GED numbers are currently very low in the Majura Valley, and that under these conditions they are most likely to be found only in higher quality habitat.

There are historic records of GED to the east of the southern section of the Northern Road route, but the vegetation on the former Malcolmvale grazing lease has degraded since stock were removed in about 2007, becoming denser and weedier and less suitable for GED. It is considered unlikely that GED would currently be present on or near the southern part of the Northern Road easement. This is because the habitat structure is only suitable (patchy and with low biomass) in extended drought periods when GED numbers are typically low, and GED is then most likely to be restricted to core areas of much better habitat in NTG at MTA and Canberra Airport. After wetter years when GED population numbers increase, the species is also not likely to move through or occupy the mixed native-exotic grassland due to the high biomass of pasture grasses and tall weed species after rain. These contrasting habitat states are illustrated in Photographs 15 and 16.



Photograph 15. Mixed native/exotic grassland in low biomass state near southern end of Northern Road route, December 2019.



Photograph 16. Area of grassland near above site in high biomass state, May 2011.

4.2 Direct loss of fauna as road kill

The existing unsealed Malcolmvale Road is level with grassland on each side at the Airport and MTA and currently carries sparse and slow-moving vehicle traffic (Photograph 17). There is currently a very low risk that small animals crossing the road would be killed by vehicles, but they would be exposed to predation due to their higher visibility on gravel and mown verges and to the large number of perching sites on the adjacent fences for predatory birds such as magpies, ravens and kestrels (all common at the Airport).

If an effort is made to retain all or parts of the new Northern Road as crossing areas for fauna such as GED and GSM, higher volumes of faster traffic would increase the risk of animals being killed by vehicles. This is unlikely to have a significant impact on GSM as there are large populations at MTA and the Airport, and the less mobile females are unlikely to move into the road easement. It could be significant for GED as occasional dispersing subadults could be lost from a population that has already been identified as declining, in a species that is likely to be relisted as critically endangered in the near future.

A University of Canberra report (IAE 2013) noted that migration between the Majura and Airport GED populations was likely to be infrequent because of the presence of the gravel road and that genetic studies suggest that more substantial paved roads are likely to represent a greater barrier. It was also considered that GED already faces extinction on the Airport, and that experimental facilitated transfer or colonisation using animals from the MTA population or captive bred animals could be considered as an approach to maintaining the Airport population.

For this reason, the real risk of increased GED loss to vehicle strike should be considered against the potential benefits of genetic mixing between the Airport and MTA GED and the potential support given to the sparse Airport population from possible continued rare immigration across the Northern Road from MTA.

Options include:

- Designing, constructing and maintaining the road, verges and fences with the aim of facilitating GED crossing on all parts of the road, e.g. as far as possible making the easement level from fence to fence, and without dense grass at the fence bases or in swales and without gutters or grids to impede or trap GED, and making the road surface a similar colour to the surrounding soil and vegetation to minimise overheating and exposure to predation by birds.
- Making limited zones more suitable for GED crossing, with the above design features and then funnelling animals to the crossing zones by netting the lower parts of the MTA fence outside the zones. Crossing zones would ideally be where vehicles are travelling slowly and would have good GED habitat on both sides of the road.
- Preventing natural GED crossings by netting the lower part of both boundary fences, and relying on artificial introduction or transfer to maintain the Airport population.

Canberra Raspy Crickets are nocturnal and wingless, and very little is known about their movements or ability to disperse. It is possible that they could occasionally use any crossing areas maintained for GED, but the suggestion above about occasional artificial transfer between MTA and the Airport could also be applied to this species.



Photograph 17. Malcolmvale Road north of Canberra Airport, MTA on left, airport on right. April 2020, after close mowing for fire hazard reduction.

4.3. Mitigation and protection

General environmental protection for unused parts of the construction zone and areas outside the zone would follow the prescriptions of the *Draft Northern Road Construction and Operations Strategy* (Canberra Airport 2020) after its approval under a variation to the existing referral. A similar Strategy is currently approved as a condition of EPBC Act referrals for works undertaken on the Airport and is being modified to address construction of the Northern Road.

The protective measures include:

- Vehicle washdown to minimise transfer of soil and weed seeds
- Fencing of construction zone and vehicle routes
- Silt fencing of the construction zone for erosion and sediment control and to prevent GED moving into the zone during and after inspection of burrows for GED
- Reinstatement of areas disturbed by construction with native grasses, either by natural regeneration or seeding.

4.3.1 Golden Sun Moth

The requirement for a 3 metre setback of the Northern Road from the Airport fence would allow protection of a 2.5 m strip of existing GSM habitat, an estimated area of 970 m². This strip would need ongoing mowing and weed control to retain it as GSM habitat. If the parts of this strip which are not currently GSM habitat could be successfully planted with appropriate native grasses it would represent an additional 530 m² of created habitat, a total of 1500 m² retained habitat (0.15 ha).

Much of the 5.7 ha of grassland enclosed between the eastern Airport boundary fence and the Northern Road route south of Malcolmvale Road (Figures 1 and 7) has potential for rehabilitation as GSM habitat as it contains mostly poor soils and parts have a moderate cover of Tall Speargrass and some bare ground in drought years (Photographs 11, 12 and 15). The 1.25 ha of this area shown as low quality GSM habitat in Figure 7 probably currently contains a sparse GSM population, based on habitat condition and the presence of GSM pupal cases in 2020, but is likely to become unsuitable for occupation by GSM in wetter years due to its high cover of tall exotic species (63% of vegetative cover on Transect 2 was exotic in 2020).

Rehabilitation of this grassland could begin with control of African Lovegrass and regular mowing to about 8 cm to weaken and suppress other tall weeds and exotic pasture grasses, with removal of slashed material if necessary to reduce thatch. Wallaby Grasses (preferred GSM larval food plants) are currently rare in this area, probably because these smaller native grasses are smothered by the high biomass that develops in wetter years while Tall Speargrass can persist under those conditions (Photograph 16). This change in management to regulate biomass within a suitable range would immediately protect the 1.25 ha of habitat that is currently thought to be occupied by GSM but at risk of degradation in non-drought years.

This grassland could be further enhanced as GSM habitat by ongoing herbicide control of other exotic species such as Phalaris, St John's Wort and Paterson's Curse, followed by the addition of Wallaby Grass and Speargrass seed harvested from MTA or the Airport. These actions would improve the condition of the existing habitat, and could convert some of the currently exotic-dominated areas into low quality GSM habitat over a period of 5 to 6 years. The area currently not mapped as habitat but available for rehabilitation is estimated to be 2.3 ha, and if this could be turned into low quality GSM habitat there would eventually be 3.55 ha of GSM habitat on the enclosed land, in contact with GSM habitat on the Airport.

The mostly low quality of the GSM habitat on the Northern Road alignment means that harvesting of GSM larvae for direct translocation (as trialled by ACT government with some success, SMEC 2018, Rowell 2019a) is not likely to be worthwhile as any larvae are likely to be sparsely distributed. However, any larvae found incidentally during burrow excavation could be relocated to the roots of Tall Speargrass tussocks on the land enclosed between the road and the Airport fence if permitted under the Referral variation.

4.3.2 Grassland Earless Dragon and Canberra Raspy Cricket

After a period of the more intensive rehabilitation as GSM habitat described above, the 1.25 ha between the southern part of the route and the Airport which already contains moderate cover of native grasses could become enhanced CRC habitat and low quality GED habitat connected with habitat at the Airport. If achieved, this would represent an additional 1.25 ha of GED habitat under Airport management in the longer term. This area may also be suitable for installation of artificial burrows under the ACT government's current research plan (ACT Government 2019).

Despite the current survey finding that GED is unlikely to be present on the Northern Road route, the presence of some suitable invertebrate burrows means that any construction should be preceded by inspection and digging out of all burrows in the affected area, as prescribed in the *Draft Northern Road Construction and Operations Strategy* (when approved, Canberra Airport 2020). Any GED found would be translocated to created burrows in adjacent areas of better habitat on the adjacent part of the Airport, and a blood sample would be taken for the University of Canberra's genetic database.

CRC found in burrows should also be relocated, as they are not currently listed in the ACT or nationally but they construct burrows used by GED and are currently the subject of a listing proposal. In July 2001, 13 CRC nymphs salvaged from a construction zone on the Airport were relocated into holes created with a piece of dowel in undisturbed NTG on the Airport. Four months later, 12 of the animals were still present in these burrows (Rowell, pers. obs. 2001).

Any Perunga Grasshoppers found before construction could also be relocated into areas of dense native tussocks if permitted by ACT government.

4.4.3 Natural Temperate Grassland

The 3 metre setback of the road from the Airport fence would allow the retention of a 2.5 m strip (970 m²) of the area mapped as NTG, but proximity to the road would be likely to result in its degradation without intensive management measures.

It would be worthwhile to trial transplantation of long-lived native forbs from sections of NTG on the Malcolmvale Road verges affected by construction. These forbs could either be replanted in parts of the Airport grasslands that would benefit from enhancement or could be used as seed orchard plants by Greening Australia. This would include species such as *Glycine tabacina*, *Desmodium varians*, *Tricoryne elatior*, *Eryngium ovinum*, *Rumex brownii* and *Lomandra bracteata* and could increase the seed volume and variety available from Greening Australia for rehabilitation of parts of the current project area disturbed by construction.

Table 4.1. Summary of potential losses and mitigation

Species or community	Area of community or habitat within construction zone	Estimated area removed by construction	Area that could be protected within construction zone	Potential area of enhanced habitat in construction zone or on enclosed land	Potential area of additional created habitat in construction zone or on enclosed land
Natural Temperate Grassland	6800 m ² high to very high quality habitat	5830 m ²	970 m ² (likely to be lower quality)	0	0
Grassland Earless Dragon	6800 m ² (very low quality and/or transit habitat)	5830 m ²	970 m ²	Option to design and maintain road crossing zones	12500 m ² (enclosed land on southern part of route, low quality habitat created within 5-6 years of completion)
Golden Sun Moth	15175 m ² (significant impact under EPBC Act, requires referral) (13200 m ² low-very low, 1975 m ² medium)	14200 m ²	970 m ²	13000 m ² (on Malcolmvale Road verge and on enclosed land on southern part of route, enhance from low to medium by 2023)	36000 m ² (enclosed land on southern part of route, low quality habitat created within 5-6 years of completion)
Striped Legless Lizard	0	0	0	0	0
Perunga Grasshopper	(6800 m ² of intermittent transit habitat only)	(5830 m ² of intermittent transit habitat)	(970 m ² of intermittent transit habitat, unlikely to be used)	0	
Canberra Raspy Cricket	15175 m ² of low quality habitat	14200 m ²	(970 m ² , unlikely to be used)	12500 m ² (on enclosed land, as for GSM, by 2023)	0

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