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Ginninderry Development

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1. Introduction

1.1. Background

1.1.1. Offset Management Plan Overview

This Offset Management Plan (OMP) has been prepared as an Appendix to the Ginninderry Conservation Corridor Management Plan 2018-2023 (TRC Tourism Pty Ltd 2018, the GCCMP) to specify management actions required to offset residual impacts on *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (box-gum woodland) ecological community and the EPBC Act listed vulnerable pink-tailed worm lizard (*Aprasia parapulchella;* PTWL) in the Ginninderry Conservation Corridor (the 'Corridor', previously referred to as the West Belconnen Conservation Corridor (WBCC), Figure 1).

On 6 April 2016 the 'Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory' Endangered ecological community was updated to the 'Natural Temperate Grassland of the South Eastern Highlands' (NTG-SEH) Critically Endangered ecological community under the EPBC Act. This revision allowed a broader area of grasslands to be recognised and added a 'minimum condition threshold' to recognise which areas of grassland are protected by the EPBC Act. As a result, previously unrecognised patches of 'Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory' are now recognised as NTG-SEH.

In 2020 Capital Ecology was commissioned to reassess and map the extent and condition of the grassland vegetation throughout the western portion of the Ginninderry project area, including areas of the Corridor. The findings are included in this updated OMP to inform future development of Ginninderry Development, including any associated offset requirements and management actions.

1.1.2. Commonwealth Approval

In July 2014, Riverview Projects (ACT) Pty Ltd (Riverview) and the Commonwealth Government commenced a Strategic Assessment under Part 10 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The focus of the agreement was to assess the potential impacts from development of the West Belconnen project area (referred to as "the development" in this report), on Matters of National Environmental Significance (MNES) protected under the EPBC Act.

In September 2017, following endorsement of the Program Report – Urban Development at West Belconnen (AT Adams Consulting April 2017) on 18 July 2017, Riverview received an approval (1 September 2017) under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) to implement the staged development of the project. Attached to the approval are 20 Conditions, many of which need to be met before construction can commence on Stage 2 of the Estate Development Plan (EDP).

Approval Condition 8 requires the preparation of a Ginninderry Conservation Corridor Management Plan providing for an Approved Offset Management Plan required under Approval Condition 9:

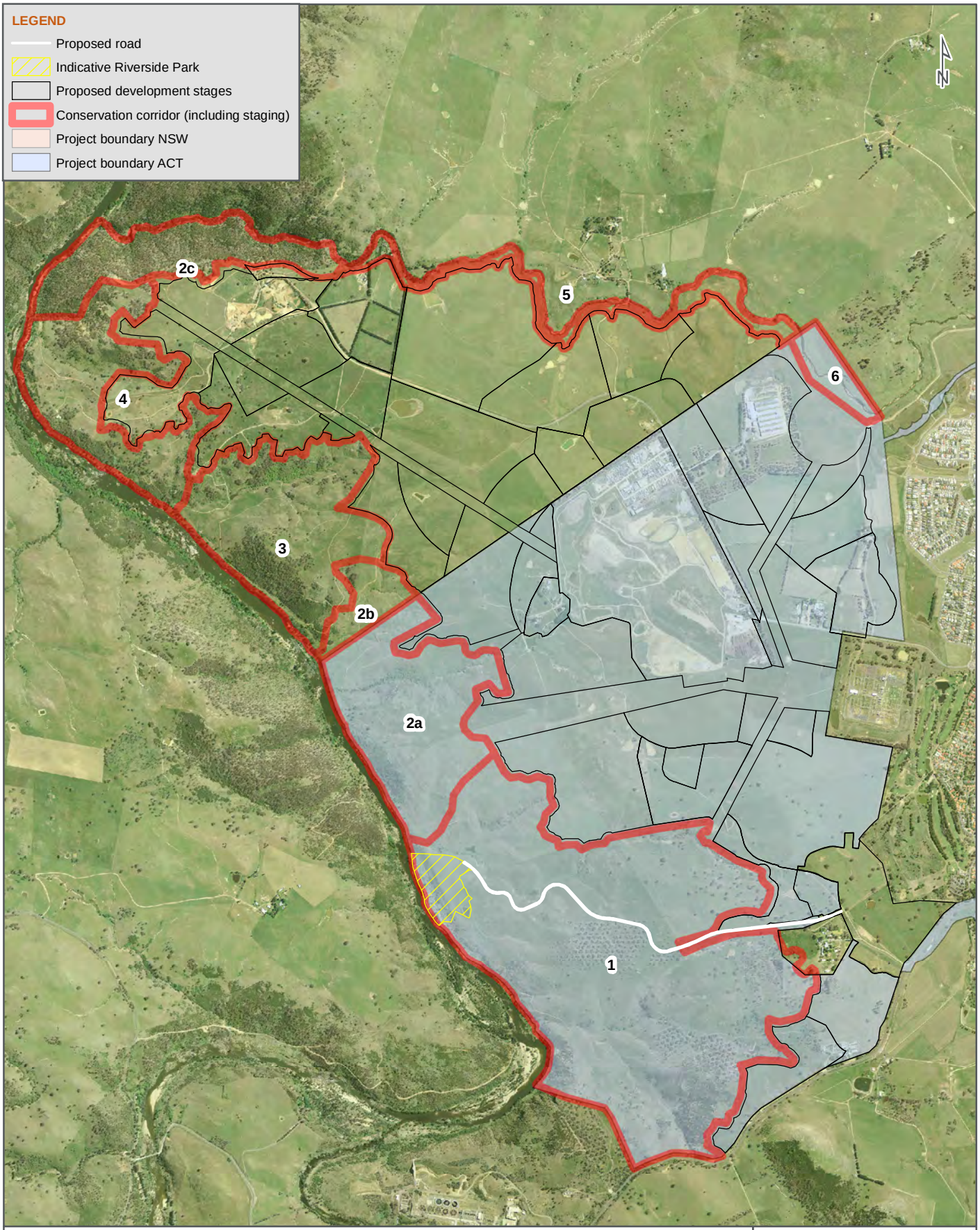
> *'The approval holder must prepare the Ginninderry Conservation Corridor Reserve Management Plan to achieve at a minimum, the conservation outcomes as outlined in Section 5 of the Program. The plan must be prepared in consultation with the Department (regarding Protected Matters), NSW Office of Environment and Heritage (NSW portion of the site), endorsed by the ACT Conservator (for both the ACT and NSW portion of the site) and approved by the ACT Minister for the Environment (ACT portion). Endorsement and approval of the plan must be obtained within two years from the date of endorsement of the Program. The endorsed and approved plan must provide for an approved Offset Management Plan required under condition 9 to be appended. Construction*

(for all areas other than the area marked as stage 1 in the Program, Figure 4) cannot commence before the plan is endorsed and approved. The endorsed and approved plan or a later endorsed and approved plan must be implemented and made available to the public for the life of the Program.'

The Ginninderry Conservation Corridor Management Plan has been prepared to address Approval Condition 8. Specifically, this OMP has been prepared to partially fulfil Approval Condition 9:

'The approval holder must prepare the Offset Management Plan to address the preservation and enhancement of offset areas, including the Golden Sun Moth Conservation Reserves required under condition 7, and to achieve at a minimum the conservation outcomes as outlined in Section 5 of the Program [Adams 2017]. The plan must be prepared in consultation with the Department (regarding Protected Matters), NSW Office of Environment and Heritage (regarding NSW portion of the site), endorsed by the ACT Conservator (for both the ACT and NSW portion of the site) and approved by the ACT Minister for the Environment (ACT portion). Endorsement and approval of the plan must be obtained within two years from the date of endorsement of the Program. Construction cannot commence before the plan is endorsed and approved (for all areas other than the area marked as stage 1 in the Program, Figure 4). The approved Offset Management Plan must be appended to the Ginninderry Conservation Corridor Reserve Management Plan required under Condition 8. The endorsed and approved plan or a later endorsed and approved plan must be implemented and made available to the public for the life of the Program.'

Offset Management Plans required for the Golden Sun Moth Conservation Reserves were prepared separately.



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COORDINATE SYSTEM GDA 1994 MGA Zone 55

FIG NO. 1

FIGURE TITLE **Ginninderry Conservation Corridor (the Corridor)**

PROJECT NO. 3002638

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY N.Crook

SOURCES Riverview

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Location: X:\Projects\3002638 Ginninderry Offset Managment Plan\GIS\MXD\OMP\Figure 1 Belconnen Conservation Corridor rev1.mxd

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1.1.3. Program Report

The Program Report (A T Adams Consulting 2017) sets out the program of works, actions, management and funding arrangements, and commitments for the protection of MNES. The program was presented to the Minister for the Environment (Commonwealth) for endorsement and consideration of an approval for a class of actions for urban development under Part 10 of the EPBC Act.

Section 4 of the Program Report identifies MNES that will be potentially impacted by the Program and outlines specific measures, including avoidance and mitigation strategies to offset the impacts. Section 5 outlines the outcomes and commitments for MNES, including conservation outcomes, required actions, responsibility of the action and timing.

Specifically, the Program Report states the following offset requirements for box-gum woodland and PTWL:

- Box-gum Woodland (Program Section 4.1, p30; Section 5)
- 'Impacts on the 3.8 ha Drake Brockman Drive woodland patch will be offset by enhanced management of the West Molonglo patch to achieve biodiversity outcomes over and above the requirements of the Molonglo NES Report.'
- 'Upon approval of the Program, measures to transfer the entirety of the WBCC into secure tenure and conservation zoning will be implemented in addition to the commencement of management consistent with the Program objectives. A further twenty years has been allowed for to implement management practices that will enhance the site condition by targeting diversity of ground layer vegetation, condition in relation to the prevalence of non-native species and improvements in structure by encouraging natural and assisted regeneration of currently degraded sections. The entire area of box-gum woodland within the WBCC will be subject to offsetting actions under the Program, above the commitment by the Molonglo Strategic Assessment which proposed only to protect the woodland from future development. The modest improvement in quality is achieved by targeting site condition. This would result in a wider extent of box-gum woodland that is recognisable by its woodland form as opposed to the derived native grassland, a reduced incidence of non-native species and an increase in the diversity of associated diagnostic flora species.'
- Pink-tailed Worm Lizard (Program Section 4.2.4, p41; Section 5)
- 'The entirety of the avoided area of habitat will be brought into the 549.9 ha WBCC and managed as a conservation area. This is comprised of numerous patches of habitat separated by areas of native vegetation within the river corridor and currently by exotic pastures across the proposed urban development area.'
- 'Without the proposed offset, the calculations predict a decline in quality of the pink-tailed worm lizard habitat. This is based on the encroachment of weeds and an associated change in diversity, particularly within areas along the upper slope, nearer to the pasture. As a result of the change in the management there will be improvements to habitat quality variables due to a decrease in threats and weed management in addition to increased certainty from the transition to conservation zoning.'
- 'The Program intends to establish the WBCC with a formalised plan for recreation that will manage human activity to protect areas of greatest ecological sensitivity such as pink-tailed worm lizard habitat. This concept will be effective in avoiding incursions into areas of ecological value. With implementation of the management plan and avoidance of pink-tailed worm lizard habitat on the layout of the proposed facilities and movement corridors (e.g. vehicle access, walking trails, etc.), the effect of any future recreation is likely to be negligible.'

1.1.3.1. *Defined Process Strategy*

This component of the Program (Section 5.3.4 of the Program Report) seeks to define a process that will apply to future development within the Project Area; which will be implemented when either of the following occurs:

- Proposal to develop any area dominated by native grasses that is part of a larger patch of native grassland which includes high or moderate quality pink-tailed worm-lizard habitat as mapped by Osborne and Wong (2013). (Action 27)
- Additional servicing or infrastructure requirements within the WBCC that impact MNES beyond what is already described by the Program. (Action 28)

In these instances, the Defined Process will provide the Commonwealth with the confidence that impacts to MNES from actions outside of those specified in the Program will be consistently and appropriately assessed and managed. In achieving this outcome, the relevant conservation advice, recovery plans, significant impact assessment guidelines and offset policy under the EPBC Act will be applied in order to ensure a consistent outcome for MNES across the implementation of the Program.

In summary, the Defined Process relating to MNES within the Project Area is as follows:

1. Where development within the Project Area triggers the need to implement the Defined Process Strategy, assess the impact of the proposed development using data collected from site-based, field verified surveys that are consistent with EPBC Guidelines.
2. Implement avoidance and mitigation measures to the greatest extent practicable through design.
3. Determine offset requirements for any residual impacts using the criteria outlined above and applied in assessment of the Program.
4. Identify an appropriate offset and establish according to the relevant State or Territory jurisdiction.
5. Prepare and implement an offset management plan either for incorporation into the WBCC management plan or as a stand-alone plan in the instance that the offset cannot be co-located in or adjoining the WBCC. Any management plan will include all aspects that apply to other MNES such as adaptive management and ensuring delivery of the offset and environmental values in perpetuity.

Any actions undertaken and offsets established using the Defined Process will be included in the Program's annual report. Any amendments to the Defined Process or offset assessment criteria will be managed through the adaptive management process and also reported annually.

1.1.4. Assessment Report

The Assessment Report (Umwelt Pty Ltd 2017) presents an assessment of the impacts of the program on MNES and the extent to which those impacts will be avoided, mitigated or offset by actions proposed as part of the program.

The Assessment Report includes an assessment of the proposed offset measures in Section 5. The Assessment Report identifies that the improvement of site condition and site context factors for PTWL and the improvement of site condition factors for box-gum woodland comprise the key offset management goals.

1.1.5. Ginninderry Conservation Corridor Management Plan

Overview

The GCCMP takes a strategic approach that recognises that further research in some areas, detailed planning and design of infrastructure and staged development of the Corridor will occur over time. The GCCMP has been developed to:

- Provide a framework for consistent planning and management for the protection of natural and cultural values, ecosystem restoration and sustainable visitor use of the Corridor over the long term (what we want to achieve in the long term) (Section 1.5.1).
- Require the preparation of detailed supporting plans and the conduct of necessary research covering detailed, technical management prescriptions and monitoring of threatened species habitat, other significant biodiversity areas and Aboriginal cultural heritage. The details relating to these supporting plans are provided in the text and actions in Chapters 4, 5 and 6. A list of the supporting plans is provided in Table 2 of the GGCMP (Section 1.5.1).
- Provide guidance on management activities, infrastructure and visitor use in significant areas of the Corridor (threatened species and ecological communities, the Murrumbidgee River and Ginninderra Creek riparian zone, Ginninderra Gorge and visitor nodes near the Murrumbidgee River and Ginninderra Falls) (Section 1.5.1).
- Give priority to actions needed to develop the first stage of the Corridor and prepare for the development of Stage 2 (what we want to achieve in the first 5 years) (Section 1.5.1).

As required in Approval Condition 8, the GCCMP includes provision for the inclusion of a PTWL Habitat Management Plan and a box-gum woodland Management Plan as part of the reserve Ecological Restoration and Biodiversity Management Plan. Specific requirements relevant to the box-gum woodland management Plan are summarised in Section 3.

The GCCMP specifies five-year and long-term objectives for managing PTWL habitat and box-gum woodland, high level actions to guide management planning and evaluation.

Pink-tailed worm lizard

The primary objective for management of PTWL habitat specified in the GCCMP is Objective G (Section 5.1.1):

> *'Protection of habitat for the nationally significant pink-tailed worm lizard and the associated lizard population in the Reserve will be a high priority. The habitat will be conserved and managed to promote the long-term survival of the lizard in the region and improve the connectivity between habitat patches within the Reserve and with other nearby lizard populations.'*

Five-year and long-term objectives for the management of PTWL habitat specified in the GCCMP are presented in Table 1–1.

Table 1–1. Objectives for PTWL habitat within the Corridor

5-year plan	Long term plan
• Planning the details for science-based management of PTWL habitat in accordance with MNES approval conditions. • Beginning implementation of habitat protection and restoration measures in the areas transferred to Trust management. • Establishment of ongoing monitoring programs to assess the condition of the habitat and the lizard population. • Location of initial Corridor infrastructure (such as trails) to avoid or manage impacts on PTWL habitat in accordance with MNES approval conditions. • Community and visitor education on PTWL habitat and recreation requirements for habitat protection. • Annual reporting on management of PTWL habitat in accordance with MNES approval conditions.	• Preservation and enhancement of PTWL habitat areas in the Corridor, with no appreciable long-term net reduction in total PTWL habitat areas. • Maintenance and enhancement of connectivity between PTWL habitat areas in the Corridor and nearby areas. • A thriving population of PTWLs in the Corridor. • Protection of PTWL from predation by feral and domestic animals. • Ongoing monitoring of the condition and impacts on habitat and the PTWL population. • The local community and visitors appreciate the significance of PTWL habitat, cooperate in complying with management and recreation requirements in PTWL habitat, and participation actively in habitat management.

Management actions specified in the GCCMP for PTWL are summarised in Table 1–2.

Table 1–2. Management Actions Specified in the GCCMP for PTWL

Code	Action	Priority
PTWL 1	Designate a PTWL Habitat Management Area where protection and improvement of PTWL habitat will be a priority. This Area should encompass the areas to which the EPBC Act approval applies.	1
PTWL 2	Prepare a science-based PTWL Habitat Management Plan as a sub-plan of the Reserve Ecological Restoration Plan. The PTWL Habitat Plan should: • Be compatible with the findings, requirements and recommendations in the MNES approval conditions • Contain measures for habitat management, restoration, control of threats and fire management • Contain guidelines for recreational use and infrastructure in and near the PTWL Habitat Management Area • Require periodic field research to assess changes in the quality and extent of PTWL habitat utilising data in Osborne and Wong (2013) as baseline data and the condition of the PTWL population • Identify potential opportunities for agency, institution, conservation group and community involvement in habitat restoration and management.	1
PTWL 3	Implement of habitat protection and restoration measures in accordance with the PTWL Management Plan in the areas transferred to Trust management.	1 and ongoing
PTWL 4	Locate and design management trails, recreation trails, vehicle roads and other infrastructure to avoid or minimise impacts on PTWL habitat and enable the passage of lizards between habitat patches in accordance with MNES approval conditions.	1 and ongoing
PTWL 5	Prepare and distribute information for the community and visitors to educate them on recreation requirements to protect PTWL habitat.	2 and ongoing

Code	Action	Priority
PTWL 6	Within 2 months of the end of each financial year prepare an annual report on outcomes in PTWL habitat in accordance with MNES approval conditions and including outcomes achieved in the previous year, lessons learned and a financial audit. The annual report is to be submitted to the ACT Conservator or Flora and Fauna and to be made publicly available.	Ongoing

This document addresses the requirements for Action PTWL 1 by specifying a PTWL management zone within the Corridor and comprises the PTWL Habitat Management Plan required by Action PTWL 2.

The GCCMP specifies that details of evaluation indicators and monitoring methods will be in the PTWL Habitat Management Plan (Section 5.1.1). Specifically, there is a requirement for:

- Periodic monitoring of the condition of PTWL habitat utilising the baseline data established by Osborne and Wong (2013)
- Monitoring of the condition of the PTWL population.
- Visitor attitudes to and awareness of PTWL habitat in the visitor satisfaction survey.

Box-gum woodland

The primary objective for management of box-gum woodland specified in the GCCMP is Objective H (Section 5.1.2):

> *'Protection of the nationally significant box-gum woodland critically endangered ecological community in the Reserve will be a high priority. The ecological community will be conserved, restored and managed to achieve a healthy ecosystem with a vegetation structure and ground cover that provides habitat for a range of native fauna and the potential for reintroduction of locally extinct species.'*

Long term objectives are presented in Table 1–3.

Table 1–3. Long-term objectives

5-year plan	Long term plan
• Planning the details for science-based management of box-gum woodland in accordance with MNES approval conditions. • Beginning implementation of protective measures and ecosystem restoration activities including enhancement of plant diversity. • Establishment of ongoing monitoring programs to assess the condition of remediation measures. • Location of initial Corridor infrastructure to avoid or manage impacts on box-gum woodland in accordance with MNES approval conditions. • Community and visitor education on box-gum woodland and recreation requirements for its protection.	• No appreciable long-term net reduction in total box-gum woodland habitat areas. • Maintenance and enhancement of connectivity between box-gum woodland habitat areas. • Protection and enhancement of a healthy box-gum woodland ecological community that provides habitat for a diversity of native species. • If feasible, native flora species that were previously indigenous to the area have been re-introduced. • Effective control of the area from degradation due to weed invasion, grazing and browsing. • Ongoing monitoring of the condition and impacts on the habitat. • The local community and visitors appreciate the significance of box-gum woodland, cooperate in complying with management and recreation requirements in the area, and participate actively in habitat management and restoration.

The Box-Gum Woodland Management Plan will also improve habitat for threatened woodland birds through improved management of existing and potential habitat.

Management actions specified in the GCCMP for box-gum woodland are summarised in Table 1–4.

Table 1–4. Management Actions Specified in the GCCMP for box-gum woodland

Code	Action	Priority
BGW 1	Designate a **Box-Gum Woodland Management Area** over the area to which the MNES approval applies.	1
BGW 2	Prepare a science-based **Box-Gum Woodland Management Plan** as a sub-plan of the Reserve Ecological Restoration Plan. The Box-Gum Woodland Management Plan should: • Be compatible with the findings, requirements and recommendations in the MNES approval conditions • Contain measures for habitat management, restoration, control of threats and fire management • Contain guidelines for recreational use and infrastructure in and near the Box-Gum Woodland Management Area • Require periodic field research to assess changes in the quality and extent of box- gum woodland utilising data recorded by Nash and Hogg (2013) as baseline data [DRAFT MNES approval condition] • Identify potential opportunities for agency, institution, conservation group and community involvement in restoration and management.	1
BGW 3	Locate and design management trails, recreation trails, vehicle roads and other infrastructure to avoid or manage impacts on box-gum woodland restoration in accordance with MNES approval conditions.	1 and ongoing
BGW 4	Prepare and distribute information for the community and visitors to educate them on recreation requirements to protect box-gum woodland and restoration activities.	1 and ongoing
BGW 5	Develop a partnership with the Strathnairn Arts Association on land management practices that will contribute to box-gum woodland and restoration activities.	2
BGW 6	Liaise with managers of the West Belconnen urban construction on measures to reduce run-off and other potential construction impacts on box-gum woodland.	1 and ongoing
BGW 7	Within 2 months of the end of each financial year prepare an annual report on outcomes in box-gum woodland in accordance with MNES approval conditions and including outcomes achieved in the previous year, lessons learned and a financial audit. The annual report is to be submitted to the ACT Conservator or Flora and Fauna and to be made publicly available.	Ongoing

This document addresses the requirements for Action BGW 1 by specifying a box-gum woodland management zone within the Corridor and comprises the box-gum woodland management plan required by Action BGW 2.

The GCCMP specifies that details of evaluation and monitoring will be contained in the Box-Gum Woodland Management Plan (Section 5.1.2). Specifically, there is a requirement for:

- Periodic monitoring of the condition of the box-gum woodland ecological community and progress of restoration utilising the baseline data established by Nash and Hogg (2013)
- Visitor attitudes to and awareness of Box-Gum Woodland in the visitor satisfaction survey.

Staging

The GCCMP and hence these offset plans will be applied by the land manager of the Corridor. Indicative stages for development of the Corridor are summarised in Section 1.4 of the GCCMP.

1.1.6. Molonglo River Corridor & Offset Areas Ecological Management Guidelines

Ecological Management Guidelines prepared for the Molonglo River Corridor & Offset Areas (ACT Government 2015a) are directly applicable to the management of pink-tailed worm lizard habitat and box-gum woodland within the Corridor. These guidelines apply to management of box-gum woodland in the Corridor, as maintenance of the condition of box-gum woodland within the Corridor is a condition of the Molonglo Strategic Assessment.

The Ecological Management Guidelines (ACT Government 2015a) are the most current, detailed and locally applicable guidelines relevant to the management of box-gum woodland and PTWL habitat within the Reserve. This report is extensively referenced as a source of best practice ecological management guidelines in the context of the Corridor.

1.2. Purpose and Scope

This offset plan specifically addresses Offset Management Requirements for pink-tailed worm lizard and box-gum woodland. This plan also concurrently delivers four of the conditions in the GGCMP, namely PTWL 1 and 2, and BGW 1 and 2. Offset actions for threatened woodland birds identified within the Strategic Assessment Report are incorporated within offset actions for box-gum woodland.

The purpose of the plan is to:

- Define the restoration management actions to be undertaken within the Ginninderry Conservation Corridor over and above the maintenance requirements specified in the GCCMP to meet the requirements to offset residual actions on box-gum woodland and pink-tailed worm lizard through improvement measures
- Outline monitoring requirements
- Specify condition thresholds that may trigger alternative management actions.

Offset Management Plans to address the preservation and enhancements of the Golden Sun Moth Conservation Reserves, required under Condition 9, have been developed separately. These offset plans are not included as part of this document.
As specified in the GCCMP (TRC Tourism Pty Ltd 2018) the PTWL Habitat Management Plan should:

- Be compatible with the findings, requirements and recommendations in the MNES approval conditions
- Contain measures for habitat management, restoration, control of threats and fire management
- Contain guidelines for recreational use and infrastructure in and near the pink-tailed worm lizard Habitat Management Area
- Require periodic field research to assess changes in the quality and extent of pink-tailed worm lizard habitat utilising data in Osborne and Wong (2013) as baseline data and the condition of the pink-tailed worm lizard population
- Identify potential opportunities for agency, institution, conservation group and community involvement in habitat restoration and management.

As specified in the GCCMP (TRC Tourism Pty Ltd 2018) the Box-Gum Woodland Management Plan should:

- Be compatible with the findings, requirements and recommendations in the MNES approval conditions

- Contain measures for habitat management, restoration, control of threats and fire management
- Contain guidelines for recreational use and infrastructure in and near the Box-Gum Woodland Management Area
- Require periodic field research to assess changes in the quality and extent of box-gum woodland utilising data recorded by Nash and Hogg (2013) as baseline data [DRAFT MNES approval condition]
- Identify potential opportunities for agency, institution, conservation group and community involvement in restoration and management.

1.3. Roles and Responsibilities

Implementation of the OMP will be consistent with the responsibilities under the GCCMP (TRC Tourism Pty Ltd 2018). The Corridor will be managed as a single unit, i.e. including both the ACT and NSW components, which is environmentally appropriate given that it is a single landscape unit. The requirements specified in this plan must be met by the party responsible for implementing the GCCMP (TRC Tourism Pty Ltd 2018).

1.4. Statutory Bodies and Community Consultation

This OMP has been prepared in consultation with Territory, State and Commonwealth Government representatives from:

- ACT Government - Transport Canberra and City Services Directorate
- ACT Government - Environment, Planning and Sustainable Development Directorate
- ACT Conservator for Flora and Fauna
- NSW Office of Environment and Heritage
- Commonwealth Department of Environment and Energy

An early draft of this OMP was also provided to the Ginninderry Bush on the Boundary reference group, which includes representatives from ACT Conservation Council, Ginninderra Catchment Group, Friends of Grasslands, and other community representatives. The OMP has since been made publicly available on the Ginninderry Conservation Trust website.

2. Pink-tailed Worm Lizard Management Plan

2.1. Background

The Pink-tailed worm lizard (*Aprasia parapulchella;* PTWL) is listed as vulnerable under the Commonwealth EPBC Act and is declared a vulnerable species under the ACT *Nature Conservation Act* (2014). Commonwealth threatened species conservation advice can be found on the Species Profile and Threats Database (Threatened Species Scientific Committee 2015).

The ACT Government has prepared an Action Plan (ACT Government 2017) providing ACT specific ecological information and conservation advice for PTWL. This document should be referenced for species description, habitat description and a discussion of the species' ecological requirements. Ecological management guidelines have been prepared for Molonglo Valley which relate to PTWL and are also likely to be applicable (Sharp *et. al.* 2015).

2.2. Corridor Context

A 147-hectare band of PTWL habitat, up to one kilometre wide in places, extends through the Corridor from Stockdill Drive in the south to about one kilometre north of the ACT/NSW border (Figure 2). Further discrete habitat patches occur between the main habitat band and Ginninderra Creek. Approximately 142 ha of habitat is in good condition and consists of modified native grassland with scattered surface rocks in hilly terrain.

Areas of moderate to high quality PTWL habitat (as mapped by Osborne and Wong 2013 and Capital Ecology 2019) was found to closely align with patches of NTG-SEH, with 38.56 ha (86.7%) of NTG-SEH in moderate to high quality PTWL habitat and 0.37 ha (0.8%) in low quality PTWL habitat. The remaining 5.54 ha (12.5%) of NTG-SEH was not in any PTWL habitat (Capital Ecology 2020).

2.3. Offset Requirements

The proposed offset plan is to guide the following offset requirements:

- Preservation and enhancement of existing PTWL habitat (Program Report Action 20)
- No appreciable long-term net reduction in total PTWL habitat areas (Program Report Action 22)
- Provide for offsetting opportunities through creation and /or improvement of PTWL habitat to ensure that any works undertaken within the Ginninderry Conservation Corridor achieve No Net Loss of PTWL habitat.

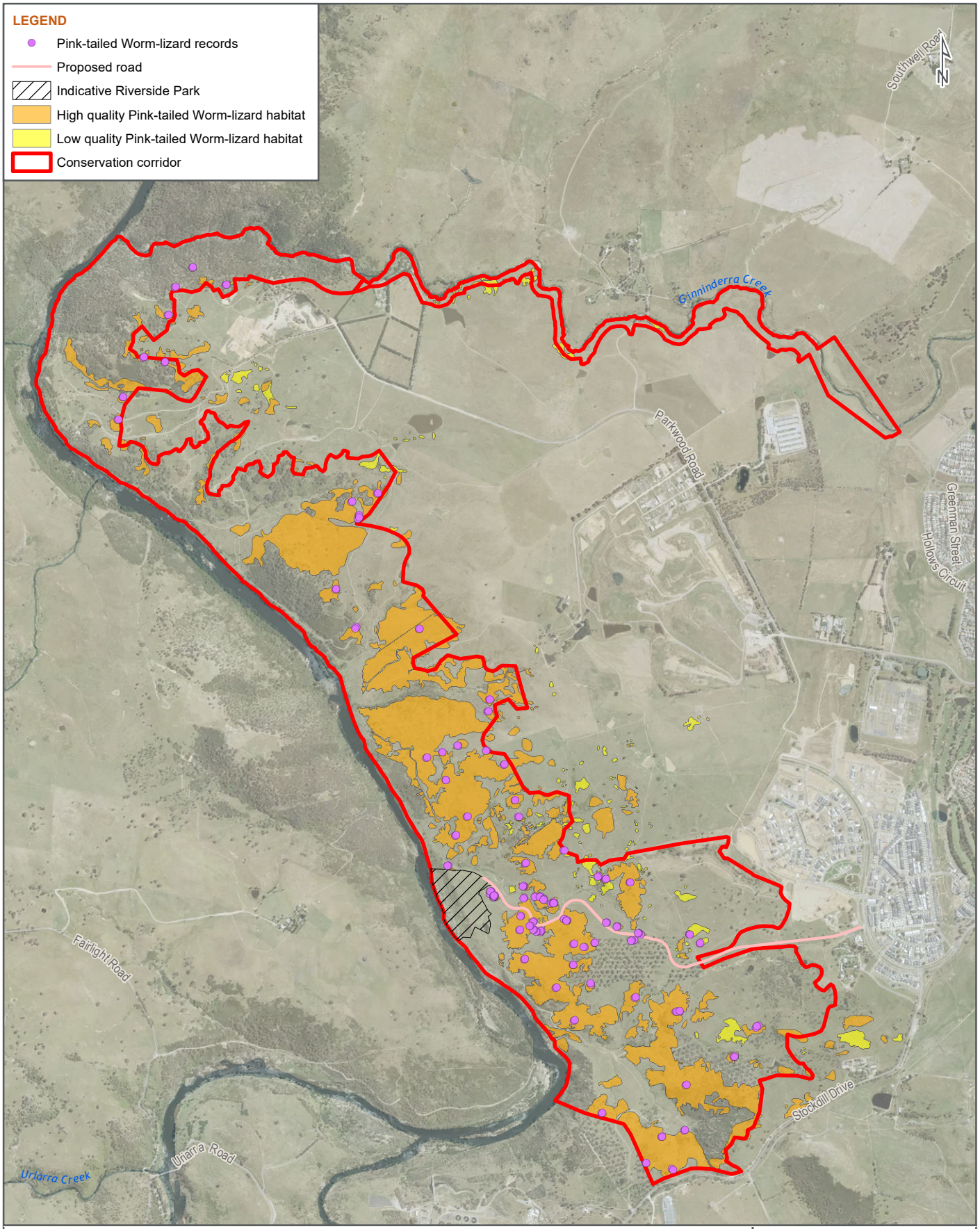
Table 2–1 shows how each of these requirements is addressed.

Table 2–1. Summary of habitat requirements and proposed restoration areas

Requirement	Proposed
Preservation and enhancement of existing PTWL habitat	Buffer to assist in habitat avoidance. All works in this area are required to demonstrate specific measures to manage (e.g. avoid and minimise) adverse impacts on PTWL habitat. Measures to maintain existing habitat are specified in the GCCMP (TRC Tourism Pty Ltd 2018).
No appreciable long-term net reduction in total PTWL habitat areas.	This plan identifies approximately 44.1 ha in which habitat improvement and creation activities can be carried out to offset up to 16.4 ha (as required) of the approved adverse impacts on PTWL habitat in the development area.
Provide for offsetting opportunities through creation and /or improvement of PTWL habitat to ensure that any works undertaken within the Ginninderry Conservation Corridor achieve No Net Loss of PTWL habitat.	This plan identifies 44.1 ha of land in which additional habitat creation equal to or exceeding the area of additional adverse impacts of developments in the PTWL habitat in the Conservation Corridor.

2.4. Maintenance

The GCCMP (TRC Tourism Pty Ltd 2018) addresses maintenance of biodiversity values in the Ginninderry Conservation Corridor. This includes management actions to maintain the condition of existing PTWL habitat, including management of pests, human use and biomass.



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COORDINATE SYSTEM
GDA 1994 MGA Zone 55

FIG NO. 2

FIGURE TITLE Pink-tailed Worm-lizard habitat and records in the Corridor

PROJECT NO. 3002638

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY FA13847

SOURCES Riverview, Mills (2009), Osborne and Wong (2013) and Capital Ecology (2019)
Roadnet MDS 2020, MetroMap Imagery © Aerometrex Pty Ltd

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2.5. Restoration Opportunities

Restoration opportunities for PTWL habitat include:

- Habitat improvement in low quality PTWL habitat comprising intensive weed control, targeted to significant threats (i.e. woody weed and exotic perennial tussock grass invasion) and native groundcover establishment
- Low intensity habitat creation (e.g. rock placement) typically within degraded native pasture where suitable rocks are absent or sparse to improve connectivity and expand patches of restricted habitat. This approach may or may not include revegetation, depending on the site condition. If revegetation is undertaken, appropriate site preparation (including an intensive weed control program) and follow up maintenance is essential.
- High intensity habitat creation (e.g. topsoil stripping, rock placement and native groundcover establishment) typically in highly degraded exotic pasture areas where suitable rocks are absent or sparse to improve connectivity and expand patches of restricted habitat.

Scientific research should inform restoration measures (e.g. McDougall *et. al.* 2016) and should be adaptive to respond to additional habitat restoration opportunities, which may arise during the implementation of this management plan. The following guidance is provided to inform proposed work plans, but does not exclude other approaches, which are supported by published research or advice from the ACT Parks and Conservation Service. Research, to determine the effectiveness of novel restoration approaches, may also be undertaken.

2.5.1. Habitat Improvement

Intensive weed management

Habitat improvement may be undertaken by intensive weed management where existing rocky habitat is present, but native groundcover is absent or highly degraded by weeds, using techniques including, but not limited to:

- Targeted control of woody weeds (including *Cratageus monogyna*, *Kunzea ericoides*, *Rubus fruticosus*, *Rosa rubignosa*) in degraded habitat areas, exceeding the minimum GCCMP requirement, to reduce shading of PTWL habitat
- Targeted control of invasive exotic tussock grasses which are declared pest plants (e.g. *Eragrostis curvula, Nassella neesiana, Nassella trichotoma*) in degraded habitat areas, exceeding the GCCMP minimum requirement, to manage biomass reduce shading of rocks and improve the native condition of PTWL habitat.
- Targeted control of other highly competitive exotic grasses (e.g. *Avena* sp., *Paspalum dilatatum, Phalaris aquatica, Setaria* sp.) and forbs (e.g. *Verbascum* spp.) in degraded habitat areas, exceeding the GCCMP minimum requirement, to manage biomass, reduce shading of rocks and improve the native condition of PTWL habitat.

Native groundcover restoration

Habitat improvement may be undertaken by enhancing or restoring native groundcover diversity, where existing rocky habitat is present, but native groundcover is absent or highly degraded by weeds, using techniques including, but not limited to:

- Broad-scale planting of native forbs and grasses (e.g. tubestock) if conditions are favourable
- Planting islands of native forbs and grasses (e.g. tubestock) to act as islands of diverse seed sources
- Using tubestock plantings comprising predominantly of species associated with PTWL habitat (e.g. *Themeda triandra*, *Poa sieberiana*, *Austrostipa bigeniculata*, *Chrysocephalum apiculatum*, *Leptorhynchos squamata* and *Lomandra longifolia*)

- Planting tubestock at densities of 5-10 individuals per square metre depending on the site condition.
- Sourcing seed for tubestock locally, unless there is no alternative or otherwise determined in consultation with the ACT Parks and Conservation Service.

2.5.2. Low Intensity Habitat Creation

ACT Parks and Conservation Service and ANU have been conducting research to optimise PTWL habitat restoration (McDougall *et. al.* 2016). Critical habitat elements were restored through adding 20% to 50% rock cover, revegetation with native grasses (*Themeda triandra* and *Poa sieberiana*) and application of herbicide or a combination of fire and herbicide.

The rock placement treatment for habitat creation should be consistent with those specified in McDougall *et al.* (2016), other published research or with advice from the ACT Parks and Conservation Service. The following specifications based on McDougall *et al.* (2016), should be used, unless otherwise specified in a site-specific work plan to be consistent with published or un-published research:

- Exotic grassy vegetation should be treated with Glyphosate herbicide (or other if appropriate) at least one month prior to restoration and preferably several times in the year or years leading up to revegetation works.
- Rock size should be approximately 225-625 cm^3 corresponding with the preferred rock size of PTWL (i.e. approximately football sized)
- Rocks should be placed at a density of approximately 20%-30% rock cover (i.e. approximately 6.5 rocks/m^2, 700 tonnes/ha)
- Locally sourced rocks collected within the Ginninderry Development (or unearthed through works in the Conservation Corridor) area are to be imported into the PTWL Conservation Area to minimise the risk of transferring weeds
- Bedrock, crushed to the required size range, should be used when rocks are imported to site to avoid introduction of weeds
- Existing rocky areas must be avoided and soil disturbance minimised during rock placement
- Where required, native grass and forb species associated with PTWL habitat (e.g. *Themeda triandra*, *Poa sieberiana, Austrostipa bigeniculata, Chrysocephalum apiculatum, Leptorhynchos squamata* and *Lomandra longifolia*) and grown from locally sourced seed (unless otherwise approved by ACT Parks and Conservation Service) should be sown at an approximate density of 5-10 individuals per square metre depending on the site condition.

Values advised for rock placement and planting densities provided above may be context dependent and should be confirmed by advice from a qualified ecologist.

2.5.3. High Intensity Habitat Creation

In highly degraded areas where elevated nutrient levels are present, the rock placement approach described in Section 2.5.2 may also be combined with high intensity techniques for grassland restoration being trialled in the ACT (R. Milner, pers. comm.), comprising scalping and removal of fertile topsoil supporting the exotic seed banks, followed by direct seeding with a diverse native grassland seed mix (Gibson-Roy, Moore and Delpratt 2010; Gibson-Roy and Delpratt 2015).

If soils are highly erodible, this method should not be considered. This approach may carry significant risks (e.g. erosion), however if undertaken with appropriate level of planning, site selection and species selection, the approach is likely to be extremely successful.

2.6. PTWL Management Zone

The PTWL Management Zone is shown in Figure 3a and Figure 3b, and comprises the following areas:

- A 20 m buffer around all confirmed and potential PTWL habitat
- All confirmed and potential PTWL habitat within the Corridor
- Priority management areas in the ACT for habitat creation and improvement
- Potential future habitat improvement and creation area in NSW.

The total area identified as the PTWL Management zone is 278 ha comprising confirmed and potential PTWL habitat (146.7 ha), the potential future habitat creation and improvement areas (52.5 ha) and the buffer zone (83.5 ha).

Where works are planned to take place in the PTWL management zone, including the buffer area, an impact assessment should be conducted to determine the extent of impacts on PTWL habitat, if any, to identify measures required to manage (e.g. avoid or mitigate) potential adverse impacts and to specify any restoration required to offset residual impacts.

2.6.1. Buffer area

The 20 m buffer around confirmed and potential PTWL habitat in the Corridor has been defined to guide avoidance of adverse impacts on PTWL habitat during infrastructure planning in and adjacent to the Corridor. The buffer zone includes areas outside the Corridor boundary, but immediately adjacent to PTWL habitat in the Corridor.

Works undertaken in the buffer should be assessed to determine whether any adverse impacts on PTWL habitat may occur, to identify measures required to manage (e.g. avoid and mitigate) potential adverse impacts and to specify any restoration required to offset residual impacts. Note that works includes, but is not limited to, building roads, tracks and trails and constructing the Riverside Park. Unless otherwise specified, no specific restoration or management works are required within the buffer area. The assessment should follow the Defined Process Strategy as outlined in Section 1.1.3.1, if the Defined Process Strategy is triggered.

The total area of the buffer zone is 83.5 hectares.

2.6.2. Confirmed and Potential PTWL Habitat

The PTWL Management Zone includes all areas within the Ginninderry Conservation Corridor that have been mapped by Osborne and Wong (2013) and / or Capital Ecology (2017) as medium-high quality (141.7 ha) or low quality (4.9 ha) PTWL habitat.

Works undertaken in confirmed and potential PTWL habitat should be assessed to determine whether any adverse impacts on PTWL habitat may occur, to identify measures required to manage potential adverse impacts and to specify any restoration required to offset residual impacts. The assessment should follow the Defined Process Strategy as outlined in Section 1.1.3.1.

Unless otherwise specified, no specific restoration or management works, beyond the maintenance measures specified in the GCCMP (TRC Tourism Pty Ltd 2018), are required in the medium-high quality PTWL habitat areas. Habitat improvement works may be undertaken in identified low quality PTWL habitat areas.

Habitat improvement works in medium-quality habitat areas is not proposed, in order to minimise disturbance to these areas. This does not exclude targeted weed control from being undertaken when an increase in cover of woody weeds or highly competitive exotic grasses or broad-leafed weed is identified in these areas.

2.6.3. Priority Management Areas

Priority management areas for habitat creation and improvement are defined as follows:

- Habitat creation areas
- Areas where creating habitat would provide significant benefits through improved connectivity and expansion of restricted habitat
- The alignment of existing tracks to be closed and rehabilitated
- Habitat improvement areas
- Areas where improving habitat condition would provide significant benefits through improved connectivity and or removal of specific threats.

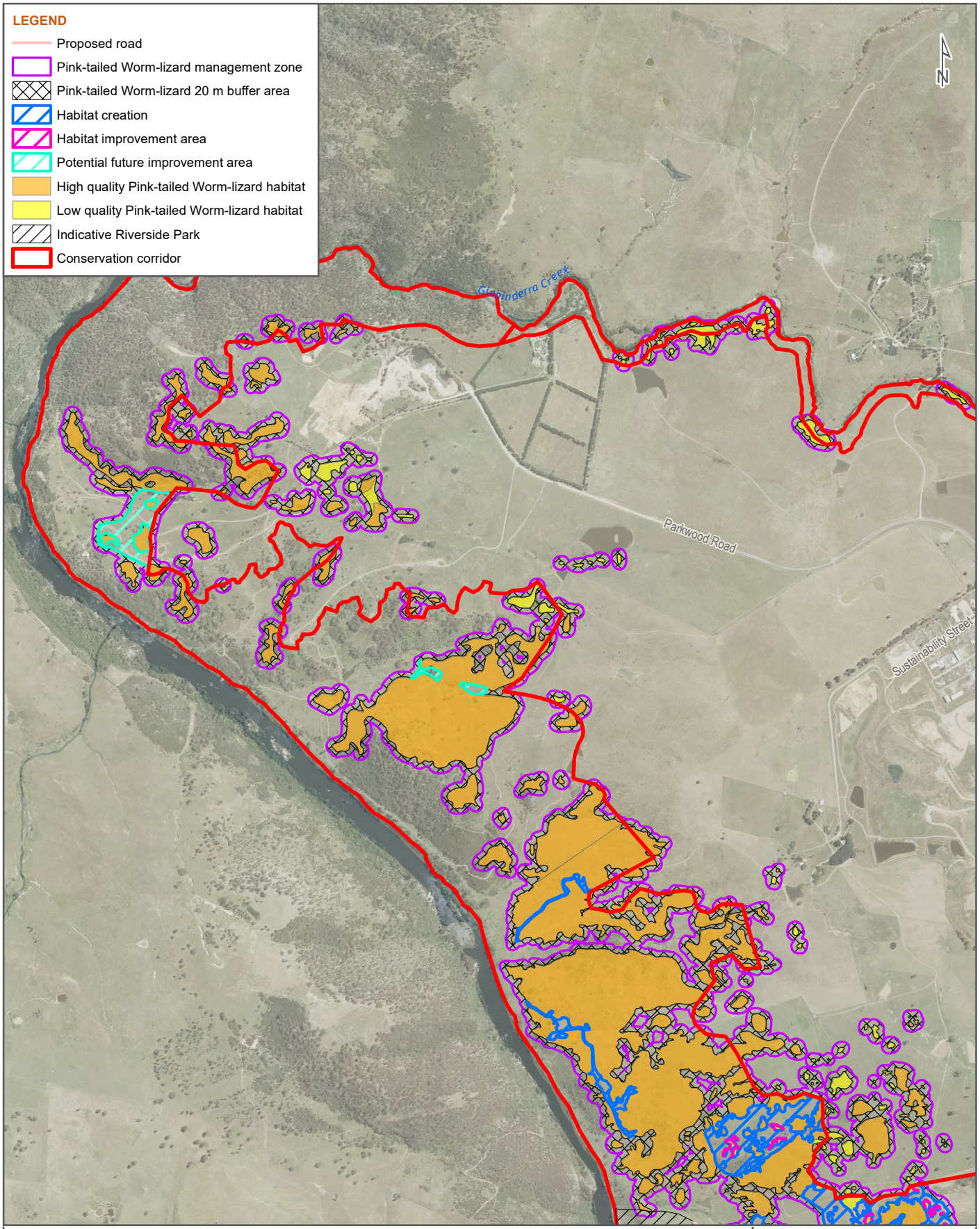
2.6.3.1. *ACT and NSW*

For sites in ACT, habitat improvement would take place in 4.6 ha of low quality habitat where restoration works to improve connectivity and remove specific threats would have high value, refer to figure 3.

Habitat creation would take place in 39.5 ha of land, not identified as PTWL habitat but is adjacent to and between existing PTWL habitat areas, and where habitat creation would provide significant benefits through improving connectivity and expanding restricted habitat, refer to figure 3.

The entire extent of the identified habitat improvement or creation areas need not be subject to restoration works, but rather these are the areas within which habitat creation and improvement works required to offset adverse impacts on PTWL habitat would be undertaken. The locations of specific restoration works in these areas would be determined by work plans developed to guide works, and the scale of restoration works would be determined depending on the impact areas to be offset.

Sites in NSW potentially suitable for future habitat creation or improvement works have been identified. This plan does not allow for habitat restoration works in these areas but identifies that future restoration works may be planned in those areas, where offsetting of PTWL habitat in NSW may be required.



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COORDINATE SYSTEM GDA 1994 MGA Zone 55

FIG NO. 3A

FIGURE TITLE Pink-tailed Worm-lizard management zone (Northern Area)

PROJECT NO. 3002638

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY FA13847

SOURCES Osborne and Wong (2013) and Capital Ecology (2019)
Roadnet MDS 2020, MetroMap Imagery © Aerometrex Pty Ltd

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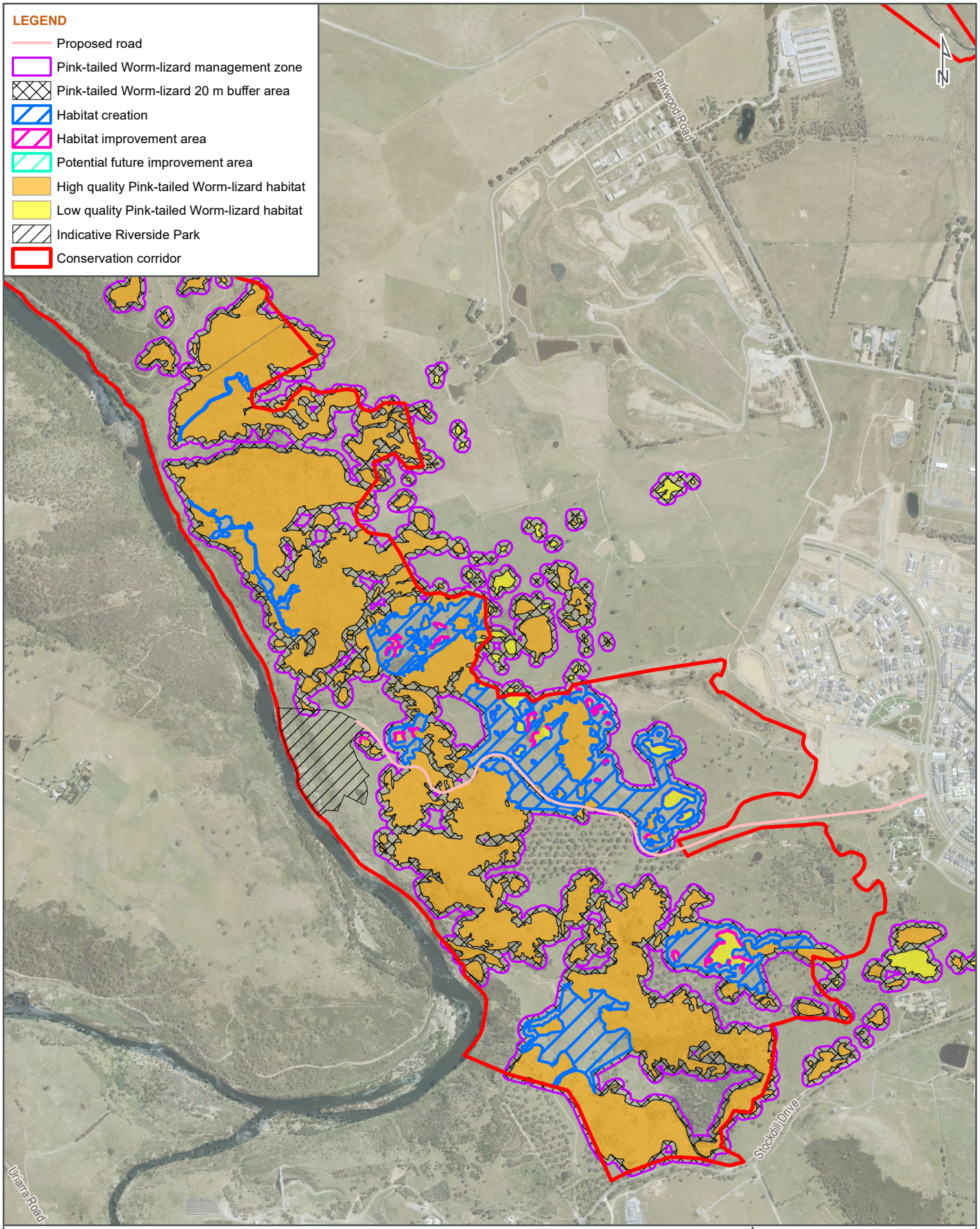

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COORDINATE SYSTEM GDA 1994 MGA Zone 55

FIG NO. 3B

FIGURE TITLE Pink-tailed Worm-lizard management zone (Southern Area)

PROJECT NO. 3002638

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY FA13847

SOURCES Osborne and Wong (2013) and Capital Ecology (2019)
Roadnet MDS 2020, MetroMap Imagery © Aerometrex Pty Ltd

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2.7. PTWL Management Actions

Table 2–2 presents PTWL management actions. Different management actions would apply to each of the identified zones. A five-yearly work plan must be developed to guide specific PTWL habitat restoration works in the applicable period, including at a minimum, restoration methods, work locations and monitoring requirements. Research and PTWL restoration activities being undertaken in the Corridor should inform management actions in each five-year work plan. Specific work plans must be developed for restoration actions prior to works commencing.

Table 2–2. PTWL management actions

Activity	Reference	Class	Description	Zone	Estimated timeframe for completion
Develop 5-year work plan	Action #20, Section 5.0 of the Program Report Action PTWL 1 and 2, Section 5.1.1.1 of the Corridor Management Plan (CMP)	Planning	Works guided by the Ginninderry Conservation Trust Plan of Management 2018-2023, Ginninderry Conservation Corridor Ecological Monitoring Framework and Ginninderry Development Offset Management Plan	All	2 years from commencement, subsequently every 5 years
Restoration work plan	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP	Planning	Detailed description requirements and processes for individual restoration works will be implemented, including site plans and measures to minimise adverse impacts on MNES.	All	Prior to restoration works commencing
Road Crossings	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP Action PTWL 4, Section 5.1.1 of the CMP	Maintenance (Additional to GCCMP (TRC Tourism Pty Ltd 2018))	Include grated road crossings in the design of any access roads in the Corridor passing through PTWL habitat or potential movement corridors.	Management Zone	Ongoing

Activity	Reference	Class	Description	Zone	Estimated timeframe for completion
Trail design	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP	Maintenance (Additional to GCCMP (TRC Tourism Pty Ltd 2018))	Include raised and/or grated paths in the design of trails in PTWL habitat to minimise disturbance to habitat and maintain connectivity.	Management Zone	On going
Track remediation and habitat creation	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP	Restoration	Remediate retired tracks in PTWL habitat areas to restore native groundcover and PTWL habitat. This would comprise ripping, topsoil removal, seeding with diverse native grassland mix and rock placement.	Habitat creation and improvement zone	5 years from commencement of each development stage.
Intensive weed management	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP	Restoration	Improving habitat quality in degraded areas by targeting woody weeds and high risk exotic grass and exotic broad-leaf weeds, above and beyond requirements specified in the GCCMP (TRC Tourism Pty Ltd 2018).	Habitat creation and improvement zone	5 years from commencement of each development stage.
Native groundcover restoration	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP	Restoration	Improving habitat quality in degraded areas by improving native groundcover diversity by planting islands of native forbs.	Habitat creation and improvement zone	5 years from commencement of each development stage.

Activity	Reference	Class	Description	Zone	Estimated timeframe for completion
High Intensity habitat creation in exotic pasture	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP	Restoration	Create habitat in priority exotic pasture areas identified as expanding restricted habitat areas or improving connectivity. Works would comprise stripping topsoil to remove weed seed bank and fertilised soil, seeding with diverse native grassland mix and rock placement.	Habitat creation zone	5 years from commencement of each development stage.
Low intensity habitat creation in native pasture	Action #22, Section 5.0 of the Program Report Action PTWL 3, Section 5.1.1 of the CMP	Restoration	Create habitat by rock placement in priority areas of native groundcover to expand habitat.	Habitat creation zone	5 years from commencement of each development stage.

2.8. PTWL Monitoring Plan

2.8.1. Monitoring Requirements

The monitoring requirements specified in the Program Report (Section 5) are presented in Table 2–3. A suitably qualified ecologist must conduct the monitoring.

Table 2–3. PTWL monitoring requirements

Outcome	Action	Baseline	Frequency
Ongoing monitoring of impact on habitat. Monitoring will be consistent with PTWL monitoring across the ACT.	Conduct field research to assess change in the extent and quality of PTWL habitat.	Adopt field data recorded by Osborne and Wong 2013 as baseline data.	Every two years from date of endorsement. Ability to review monitoring period if impacts have stabilised

2.8.2. Baseline Data

Field data recorded by Osborne and Wong 2013 and RJPL 2017 provides the baseline data relating to the extent and quality of PTWL habitat, and the distribution of PTWL in the habitat areas. Revision of habitat mapping conducted in 2017 and 2018 (Capital Ecology 2018a; Capital Ecology 2019) confirmed the accuracy of the Osborne and Wong (2013) PTWL habitat mapping and recommended that existing mapping, prepared by Osborne and Wong in (2013), be taken to provide an accurate representation of the current extent and quality of the PTWL habitat in the Ginninderry project area.

Prior to habitat improvement or creation works, baseline assessment of habitat extent, quality and PTWL presence or absence (if rocks already present) should be recorded as per the methods described in Section 2.8.3.

2.8.3. Monitoring Approach

Habitat Extent

Habitat monitoring is required to assess change in the extent and quality of PTWL habitat and if appropriate trigger adaptive management responses. Monitoring would be undertaken with the following objectives:

- To detect declining trends in PTWL habitat condition, extent or occupancy
- To evaluate the success of restoration activities in improving condition, extent or connectivity of PTWL habitat
- To minimise disturbance to PTWL
- To trigger adaptive management action
- To demonstrate delivery of the commitments of section 5 of the endorsed Program Report.

Habitat extent monitoring should be undertaken to classify PTWL habitat in accordance with Osborne and Wong (2013), as described in Table 2–4, through a targeted sampling approach, as follows:

- Mapping of habitat extent and category, as per the criteria presented in Table 2–4 at and surrounding habitat improvement and creation works should be undertaken prior to works being undertaken, and every two years unless impacts have stabilised
- Plot-based mapping of habitat extent and category, as per the criteria presented in Table 2–4, at thirty randomly located one hectare plots throughout the PTWL habitat area to confirm that PTWL habitat condition and extent is maintained by the management regime specified in the

GCCMP (TRC Tourism Pty 2018) should be undertaken every two years unless impacts have stabilised

- Monitoring intensity should be revised following baseline monitoring.

Table 2–4. PTWL potential habitat categories (Osborne and Wong 2013)

PTWL Potential Habitat Category*	Description
High quality	Suitable rocky areas dominated by, or with a large component of, kangaroo grass (*Themeda triandra*) - and often containing *Aristida ramosa*, *Cymbopogon refractus*, *Poa sieberiana* and *Lomandra* spp. - and often a high diversity of disturbance-sensitive native forbs. Exotic annual species, such as Haresfoot Clover (*Trifolium arvense*) and *Vulpia* spp., may also be present.
Moderate quality	Suitable rocky areas usually dominated by Spear Grasses (*Austrostipa* spp.) and Wallaby Grasses (*Rytidosperma* spp.). Native forb species and exotic annual species, such as Haresfoot Clover (*Trifolium arvense*), Wild Oats (*Avena* sp.), and Saffron Thistle (*Carthamus lanatus*), may also be present.
Low quality	Suitable rocky areas that have been subject to high levels of disturbance in the recent past (e.g. areas previously under mature pine plantation) displaying high levels of disturbance to the soil layer or dominated by sown pasture grasses, other agronomic species and weeds; includes former sheep camps that no longer support native ground cover.

Habitat Quality

Habitat quality should be assessed in 15 randomly located plots throughout the PTWL habitat area as per the method specified in Sharp (2015) to assess grassland floristic condition and rock cover.

Work plans for PTWL habitat restoration works must include details of site-specific monitoring requirements. Site-specific monitoring methods would consider the extent and type of habitat restoration works, and may be plot or sample-based. Habitat condition should be assessed against baseline habitat quality data (RJPL 2017) at the following times:

- Prior to habitat creation or improvement works being undertaken
- Every two years unless impacts have stabilised.

Interpretation of vegetation monitoring results must consider inter-annual variation in site quality.

PTWL Distribution

Monitoring PTWL presence or absence will be required to assess the effectiveness of habitat creation and improvement works, and specifically to confirm whether PTWL use established or recovered rocky habitat. Work plans for habitat creation and improvement works should specify monitoring requirements for the works consistent with the method details later in this section.

Broader PTWL presence or absence surveys to assess PTWL persistence and distribution throughout the management zone may also be undertaken, however rock dislodgement as required by rock rolling is recognised as a threat to habitat (ACT Government 2017).

ACT Parks and Conservation Service are currently trialling a low impact monitoring technique using artificial shelters (i.e. solid red house bricks). This method may allow more frequent monitoring with reduced impact disturbance of uniformly shaped shelters may be less likely to disturb the burrow networks.

Monitoring of PTWL presence or absence throughout the management zone should be undertaken by applying a plot-based rock-rolling sampling approach in a manner consistent with applicable ACT Government and Commonwealth guidelines (e.g. *Guidelines for detecting reptiles listed as threatened*

under the EPBC Act (Commonwealth Government 2011)). Monitoring would be undertaken according to the following principles, unless otherwise informed by research, updated guidelines or required due to a specific monitoring purpose:

- Implementing plot-based sampling of monitoring areas (e.g. 30 20 m x 20 m plots randomly located within medium-high quality habitat)
- Turning a maximum of 30% of rocks in each plot
- Applying a minimum sampling effort to avoid unnecessary habitat disturbance.
- To avoid disturbing surface rocks, permanent brick-based monitoring plots may be established if approved by Parks and Conservation Service.

PTWL presence or absence should be monitored in the first year following works, third year and every five years subsequently, or until PTWL use of created rocky habitat is confirmed.

PTWL presence or absence should be monitored in the first year and third year following endorsement of this plan and subsequently every five years across the PTWL management area using a plot based sampling approach to detect any significant long-term changes.

Due to the high level of stochastic variation in PTWL detection, inter-annual comparison of PTWL detection rates is likely to be of limited value. Long term trends may be detected from long term monitoring where equal sampling effort is implemented.

2.8.4. Performance Measures

The following performance measures will be used to measure the success of the management program in Offset Areas:

- Maintenance of the current extent and condition of existing PTWL habitat in the Offset Area
- Measured improvement in the quality of PTWL habitat in habitat creation and improvement areas
- Increase in the overall extent of PTWL habitat due to habitat creation and improvement in the Corridor consistent with offset requirements.

These will be measured by:

- Changes in the extent of different PTWL habitat quality types suitable for PTWL in sampled areas of PTWL habitat
- Changes in the incidence of invasive weed species in sampled areas of the management zone
- Changes in the floristic condition and rock cover in sampled areas of the management zone
- Presence or absence of PTWLs recorded in sampled areas of the management zone.

Triggers and corrective actions based on these measures presented in Section 2.9.

2.8.1. Performance Targets

Habitat parameter	Target
Extent of medium – high quality habitat	15% increase in extent of medium – high quality habitat in sampled areas
Weed prevalence in medium – high quality habitat	30% reduction in weed cover in sampled areas of medium – high quality habitat
Extent of habitat improved or created	Exceed 5 yearly targets for PTWL habitat improvement or creation
Floristic condition of habitat improvement or creation zones	20% increase in floristic condition (cover of native grasses) of habitat improvement or creation zones following activities

2.8.2. Monitoring Schedule

Approval conditions require that monitoring be undertaken every two years following the date of endorsement. The monitoring schedule for assessing PTWL habitat is presented in Table 2–5. The monitoring schedule may be reviewed at any time after the second monitoring period.

Table 2–5. PTWL monitoring program

Year	Task	Monitoring approach
First year following endorsement, the third year and every five years subsequently.	Monitoring changes in the extent of PTWL habitat.	Mapping of habitat extent and category, as specified in Table 2–4, at 30 1 ha plots in the PTWL habitat area.
First year following endorsement, the third year and every five years subsequently.	Monitoring changes in the condition of PTWL habitat.	Plot-based assessment of floristic condition and rock cover at 15 plots within the PTWL habitat area according to methods specified in Sharp (2015), consistent with the Ginninderry Conservation Corridor Ecological Monitoring Framework.
First year following endorsement, the third year and every five years subsequently.	Monitoring PTWL presence or absence throughout the habitat area.	Rock rolling in 30 20 m x 20 m plots distributed randomly within medium – high quality habitat *Or* Permanent brick-based monitoring plots if approved by ACT Parks and Conservation Service.
First year following works, the third year and every five years subsequently.	Monitoring changes in the extent of PTWL habitat and habitat categories in habitat creation or improvement areas.	Mapping of habitat extent and category, as specified in Table 2–4. Details to be confirmed in the work plans.
First year following works, the third year and every five years subsequently.	Monitoring changes in the condition of PTWL habitat and habitat categories in habitat creation or improvement areas.	Plot-based assessment of floristic condition and rock cover according to methods specified in Sharp (2015) Details to be confirmed in work plans.
First year following works, the third year and every five years subsequently, or until PTWL use of created rocky habitat is confirmed.	Monitoring PTWL presence or absence in habitat creation or improvement areas.	Plot-based rock-rolling sampling approach. Details to be confirmed in the work plans.

2.9. Triggers and Corrective Actions

Corrective actions must be implemented if, as determined by the monitoring program, offset requirements are not met or there is a measured decline in PTWL populations or the extent or quality of PTWL habitat. Table 2–6 identifies relevant triggers for each habitat parameter and appropriate corrective actions to be implemented.

Additionally, a review of the PTWL Habitat Management Plan would be required if significant new ecological information is documented in the area relevant to the plan. In particular, if the breeding status or foraging behaviour of threatened species known to breed in the west Belconnen area, such

as the Superb Parrot or Little Eagle, changes in the area relevant to the plan, alteration of offset monitoring or management may be required to protect such species.

Table 2–6. PTWL habitat and population offset compliance (triggers / responses)

Habitat parameter	Trigger	Response / Action
Extent of medium – high quality habitat	20% reduction in extent of medium – high quality habitat in sampled areas. A lower threshold (i.e. 10%) is likely to fall within the range influenced by inter-annual climatic variability.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018)
Weed prevalence in medium – high quality habitat	20% increase in weed cover in sampled areas of medium – high quality habitat. A lower threshold (i.e. 10%) is likely to fall within the range influenced by inter-annual climatic variability.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018). Development of specific weed control measures for PTWL habitat zone.
Extent of habitat improved or created	5 yearly targets for PTWL habitat improvement or creation not met.	• Review PTWL habitat improvement and creation schedule
Floristic condition of habitat improvement or creation zones	Floristic condition of habitat improvement or creation zones declines by 20% following activities.	• Review of PTWL habitat improvement and creation measures in consultation with ACT Government Parks and Conservation Service
Occupancy of habitat improved or created	Failure to detect PTWL in habitat creation or improvement zones within 5 years of works.	• Review of PTWL habitat improvement and creation measures in consultation with ACT Government Parks and Conservation Service
Population condition	Consistent decline of >30% in PTWL detection in sampled areas of the PTWL habitat with continued declining trend recorded over at least two sampling periods. To be measured against detection rates recorded during the initial two years of monitoring.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018) • Review of proposed habitat improvement measures
Biomass management	Qualitative identification of areas of very high biomass.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018).

3. Box-Gum Woodland Management Plan

3.1. Background

To be considered part of the EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (box-gum woodland) critically endangered ecological community, remnant areas must:

- Have a predominantly native understorey where at least 50% of the perennial vegetation cover in the ground layer is made up of native species; and
- Be 0.1 ha or greater, and contains an understorey with at least 12 native understorey species other than grasses, and at least one listed important species; or
- Be 2 ha or greater and has an average of 20 or more mature trees per hectare or displays evidence of natural regeneration of mature trees. Mature trees are defined as those with a height of at least 130 cm and circumference of 125 cm. Regeneration must consist of naturally occurring juveniles of dominant overstorey species with a height of 130 cm above ground and circumference of at least 15 cm (Australian Government 2006).

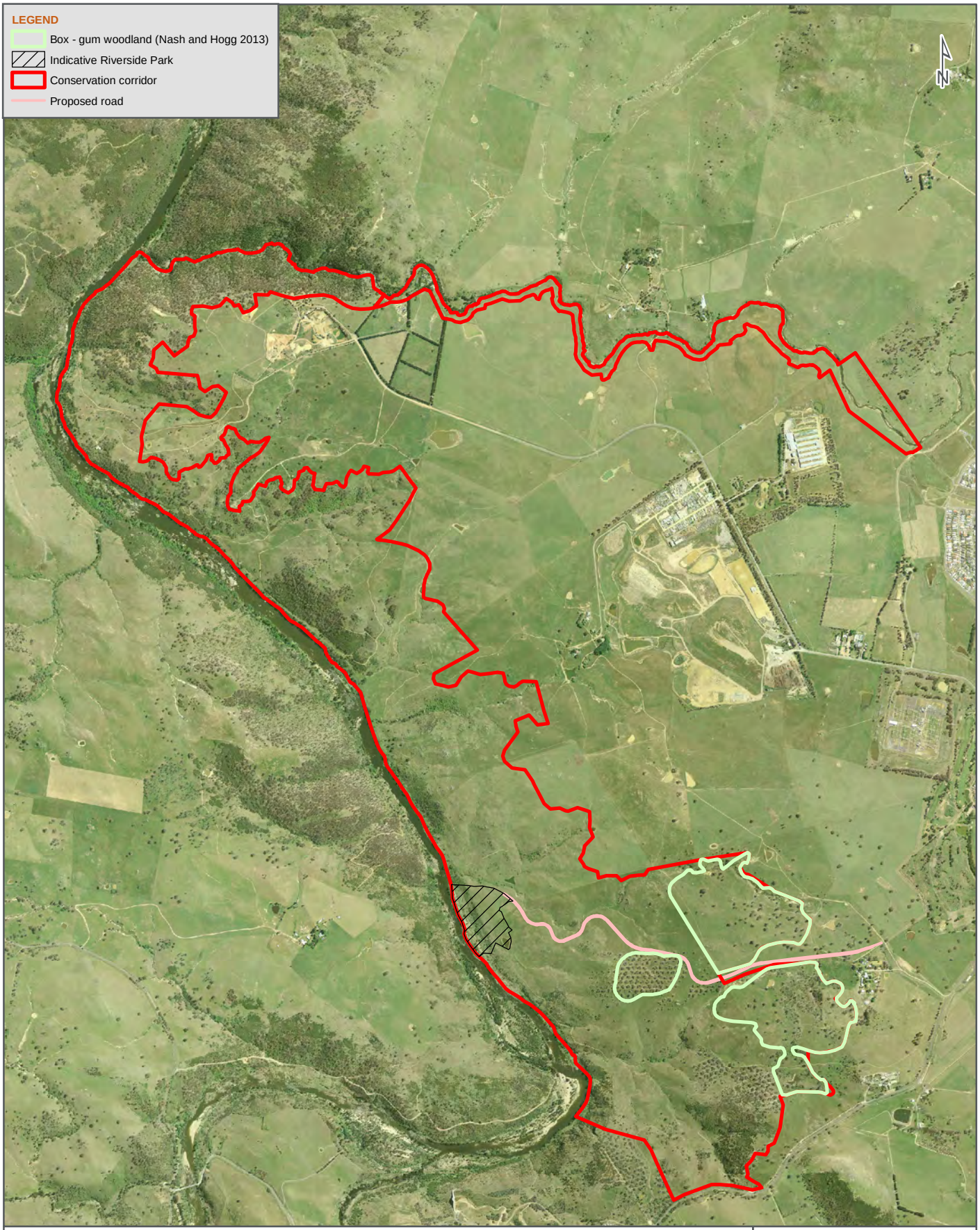
The ecological community can occur either as woodland or derived native grassland (i.e. grassy woodland where the tree overstorey has been removed). It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs (where shrub cover comprises less than 30% cover), and a dominance or prior dominance of White Box (*Eucalyptus albens*) and/or Yellow Box (*E. melliodora*) and/or Blakely's Red Gum (*E. blakelyi*) trees. In the woodland state, tree cover is generally discontinuous and of medium height with canopies that are clearly separated.

Advice on the description and status of box-gum woodland is available in the relevant policy statement under the EPBC Act (Australian Government 2006) and the ACT Government Action Plan (ACT Government 2004).

3.2. Corridor Context

The Corridor contains three remnant patches totalling 68.2 ha of White Box-Yellow Box-Blakely's Red Gum Woodlands and Derived Native Grasslands (referred to as 'box-gum woodland' in this Management Plan), which meets the criteria for categorisation as this endangered ecological community under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. Box-gum woodland is also protected as endangered under NSW and ACT legislation. These areas are in the south of the ACT portion of the Corridor near the Strathnairn Arts Centre (Figure 4).

Remnant patches of box-gum woodland in the Corridor in the south of the ACT portion of the Corridor are protected in accordance with the Molonglo Strategic Assessment NES Plan (ACT Government 2011). No areas of woodland protected under the Molonglo Strategic Assessment can be developed. The box-gum woodland in the Corridor is in a modified condition with an absence of the tree layer in many places.



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COORDINATE SYSTEM GDA 1994 MGA Zone 55

FIG NO. 4

FIGURE TITLE **Distribution of listed woodland within the Corridor (Nash and Hogg 2013).**

PROJECT NO. 3002638

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY N.Crook

SOURCES Riverview

SMEC
Member of the Surbana Jurong Group

Location: X:\Projects\3002638 Ginninderry Offset Managment Plan\GIS\MXD\OMP\Figure 4 Distribution of listed woodland within the WBCC (Nash and Hogg 2013).mxd

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3.3. Offset Requirements

The existing identified box-gum woodland in the Corridor must be maintained under the Molonglo Strategic Assessment (Section 4.1), and under the Ginninderry Strategic Assessment box-gum woodland must be both maintained (Program Report Action 12) and enhanced (Program Report Action 13).

Impacts on the 3.8 ha in the Drake Brockman Drive woodland patch are being offset by enhanced management of box-gum woodland in the Corridor to achieve biodiversity outcomes over and above the maintenance requirements of the Molonglo NES Report. Restoration of the box-gum woodland in the Corridor will enhance condition improve and expand important habitat for native fauna such as birds, bats, ground dwelling and arboreal mammals, and invertebrates.

3.4. Maintenance

The GCCMP (TRC Tourism Pty Ltd 2018) addresses maintenance of biodiversity values in the Ginninderry Conservation Corridor. This includes management actions to maintain the condition of box-gum woodland, including management of weeds, pest animals, human use and biomass.

3.5. Restoration Opportunities

Improvement of the natural values of box-gum woodland areas requires the implementation of restoration management measures. Restoration principles to be followed would be assisting natural regeneration, establishing corridors between existing woodland fragments, creating islands of habitat structure and enhanced groundcover diversity, and introducing habitat features that are currently absent or sparse within the woodland area. Restoration opportunities for box-gum woodland include, but are not limited to:

- Promoting natural regeneration of woodland trees (e.g. assisted natural regeneration)
- Targeted planting of woodland trees and shrubs
- Improving ground-cover diversity through planting forbs and grasses
- Placing woody debris
- Stabilising erosion
- Erecting vertical structures to create bird and bat habitat.

Restoration programmes may apply a combination of any of the above methods, as appropriate to the site requirements and conditions. Specific restoration activities are not prescribed here, but should be undertaken in conjunction with a prescribed work plan identifying the restoration opportunity, proposed restoration measures, maps of restoration works, ongoing maintenance requirements and any site-specific proposed monitoring. Performance measures to be used to assess the success of the management and restoration program are outlined in Section 3.8.4.

3.5.1. Promotion of Natural Regeneration

Assisted natural regeneration comprises creating conditions favourable for the natural regenerative processes of woodland (NSW Government undated). Assisted natural regeneration applies the following principles:

- Prioritise works in areas with existing native groundcover
- Areas supported should be proportional to the capacity for ongoing maintenance
- Minimise disturbance.

Appropriate assisted natural regeneration measures are context specific and should be developed on a site by site basis, consistent with NSW Government (undated).

Example assisted natural regeneration problems and responses are presented in Table 3–1. Assisted natural regeneration measures, which may be applied at the site include, but are not limited to these measures.

Table 3–1. Applicable assisted natural regeneration measures (NSW Government undated)

Problem	Assisted Natural Regeneration Response
Livestock, macropod or feral animal grazing.	• Fence the area or use tree guards around natural regeneration where practical. • Reduce or strategically manage grazing. • Control feral herbivores in woodland areas.
Competition from weeds, including pasture species.	• Remove weeds in a targeted measured way, consistent with ongoing management capacity, and manage causes.
Soil compaction caused by trampling from stock, feral herbivores or vehicles, or recreational use.	• Manage the causes to prevent further damage. • Provide habitat for soil fauna (e.g. allow leaf litter and fallen timber to accumulate), plant pioneer species such as wattles. • Lightly rake or scarify — even rip in severe cases (but only if there are no weed sources nearby).
Lack of fire to trigger germination.	• Use prescribed burning, smoke or smoke water treatment.
Lack of disturbance to trigger germination.	• Lightly rake or scarify — rip in severe cases (but only if there are no weed sources nearby).
Loss of soil fauna (e.g. fungi, bacteria, worms and other invertebrates).	• Provide habitat for soil fauna (e.g. allow leaf litter and fallen timber to accumulate). • Reintroduce soil fauna by translocating small quantities of topsoil and leaf litter from nearby healthy areas.
Elevated nutrient levels from fertiliser, animal faeces, or enriched runoff.	• Prevent further nutrient enrichment, remove weeds and wait to see if natural regeneration occurs over time.
Exposure to the elements (e.g. persistent strong winds, frosts, sunlight).	• Plant a buffer on the windward side of a remnant bush patch, plant pioneer species to protect natural recruitment.
Excess shading from exotic species.	• Remove or thin exotic trees and shrubs.
Density induced dieback of native regeneration.	• Thin dense copses of native regeneration.

3.5.2. Tree and Shrub Planting

Tree and shrub planting may be undertaken to assist revegetation of extensive open areas in the woodland management zone. Such plantings support native groundcover or mixed native and exotic pasture, particularly through the creation or improvement of habitat corridors, and / or the establishment of habitat '*islands',* which can improve habitat for woodland birds and provide a seed source for future natural revegetation. To maintain an appropriate woodland mosaic, large scale planting of woodland trees and shrubs is not recommended.

Tree and shrub planting may be used effectively with other maintenance and restoration measures to achieve objectives such as suppressing long term weed infestations, reducing the risk of wind-blown weed dispersal, or stabilising and revegetating riparian corridors vulnerable to erosion.

Species selection should be consistent with locally occurring species present in the box-gum grassy woodlands. Only tree species present in the woodland management zone should be planted. A diverse suite of shrub species, naturally occurring in grassy woodlands, should be planted, increasing diversity by adding species likely to have formerly occurred in woodland at the site.

Planted trees and shrubs should be sourced from local provenance, with preference given to using seed collected from on site or within 5 km of the site.

3.5.3. Groundcover Diversity Enhancement

Agricultural management of the woodland area has caused the loss of forb diversity. The grassy ecosystem diversity typically remains low following the removal of agriculture (Fensham *et. al.* 2016). Seed availability and resource availability are critical in determining the recovery of forb diversity in grassy woodland communities (Johnson *et al.* 2017). Resource availability is largely driven by vegetation structure, litter and competition with exotic species. Elevated soil nutrient levels are also an important factor, as they influence competition with exotic species (Gibson-Roy, Moore and Delpratt 2010; Gibson-Roy and Delpratt 2015). The focus of measures to enhance forb diversity in grassy woodland should focus on (Johnson *et. al*. in press):

- Increasing seed availability
- Reducing resource competition
- Reducing litter
- Reducing elevated soil nutrient levels (where appropriate).

A site-specific work plan should be prepared for all groundcover diversity enhancement works, specifying methods to be used, areas to be restored, and maintenance and monitoring requirements. Work plans would include final species lists, seed quantities and / or planting densities. Grassland restoration work plans should be developed in consultation with the ACT Parks and Conservation Service so that proposed restoration measures are consistent with restoration measures being applied and tested in the ACT.

Groundcover diversity enhancement may be undertaken by a range of methods. Groundcover diversity enhancement is not recommended for the large-scale treatment of areas, but should be undertaken to expand or improve areas with existing native groundcover, and / or in '*islands*' which can function as future seed sources and focal points for future enhancement.

Groundcover diversity enhancement should be informed by current best practice at the time of works and may include tubestock planting or direct seeding with diverse native grass and forb species, combined with appropriate site preparation measures. Site preparation techniques which may be appropriate include, but are not limited, to management of biomass, soil fertility and exotic seed banks through manual weed removal, herbicide application or the scalping and removal of topsoil.

Selection of areas for groundcover diversity enhancement, and the selection of appropriate restoration measures should consider the site-specific objectives, for example, whether the objective is to enhance forb diversity in an area with existing native or degraded native vegetation, or whether it is to create a patch of native vegetation in areas which are highly disturbed and dominated by exotic species. Opportunistic groundcover restoration in areas where clearance of topsoil is likely to occur (i.e. at the edge of trail development areas and adjacent to Riverside Park) may be an effective approach to increasing groundcover diversity enhancement without disturbing established areas of native vegetation supporting high native forb or grass diversity. Highly invasive techniques, e.g. herbicide application or scalping, should not be applied in areas where significant diversity or habitat values are

already present, and, in areas supporting degraded native groundcover, should only be applied following appropriate assessment and planning.

Direct seeding should use a diverse native grassland seed mix, with the objective of including a minimum of 45 species across a diversity of functional groups (i.e. C3 grasses, C4 grasses, legumes, non-grass monocots and herbs). Unless otherwise justified in the work plan, the final list should comply with species selection guidance provided in Appendix A. Where tubestock would be used for plantings, native grass and forb species associated with box- gum woodland should be selected, including but not limited to *Themeda triandra*, *Poa sieberiana, Austrostipa scabra, Chrysocephalum apiculatum* and *Leptorhynchos squamata*.

Sourcing of seed for direct seeding or tubestock cultivation should consider guidance in Delpratt and Gibson-Roy (2015). Conditions for seed sourcing are:

- Seed must be locally sourced from the same bioregion, unless otherwise agreed with ACT Parks and Conservation Service
- Seed must be collected from a range of source populations and over the entire season (where feasible)

3.5.4. Woody Debris Placement

Woody debris has numerous roles in woodland habitats. Large woody debris can create microhabitat for vertebrate and invertebrate fauna, assist in improving soil condition through water retention and addition of organic matter, improve habitat structure, and create shelter and foraging habitat for woodland birds and mammals. Woody debris may also protect regenerating woodland trees and shrubs from exposure and grazing.

Woody debris over 300 mm in diameter and 3 – 6 m long, derived from native vegetation cleared in the Ginninderry development area, may be placed in the woodland management zone. Woody debris placement in the box-gum woodland management area should be planned and implemented according to a work plan. The following guidelines should be followed:

- The total density should be between 20 tonnes and 40 tonnes of woody debris per area
- Place timber flat on the ground approximately 1 m apart
- Do not pile timber on top of each other
- Place timber both under trees and out in the open.

Additional considerations for log placement are:

- Avoid placing within 20 m of the conservation corridor boundary
- Avoid placing on rocky outcrops
- Do not place on known threatened species sites
- Do not place on rare plant populations
- Do not place on heritage sites
- Do not place on research plots (unless specifically required)
- Maintain clearances from infrastructure where required.

Woody debris between 75 mm in diameter and 300 mm in diameter, and mulch derived from native vegetation cleared on site, may also be placed in the woodland area where litter and /or mulch is specified, as required for soil stabilisation purposes as per Section 3.5.5.

3.5.5. Stabilising Erosion

Erosion and soil loss is a key threat to woodland ecosystems and is an identified threat in the woodland management zone (RJPL 2017). Appropriate actions to stabilise erosion are likely to be site-specific; however, appropriate management measures are likely to include a combination of the following:

- Trapping sediment flows on site through sediment fencing, sediment matting, weed-free straw, locally sourced native mulch, or polymer coatings
- Recontouring the soil surface to reduce water flow intensity, and to trap seeds and leaf litter
- Using woody debris and native litter to slow water flows, and trap seeds and leaf litter
- Erosion control measures are most effective if applied in combination with targeted plantings of trees, shrubs and native grasses, which will assist in stabilising areas vulnerable to erosion.

3.5.6. Erection of Vertical Structures

Research at Barrer Hill in the ACT has demonstrated that erecting artificial structures, designed to improve habitat availability and diversity for threatened woodland birds and bats are extensively used by such species (D. La Roux, pers. comm.).

Vertical structures, which may provide habitat for woodland birds and bats, may be installed at locations where mature woodland trees are absent. These may be strategically placed to improve connectivity and are recommended to be established in association with other restoration works, which improve habitat structure such as woody debris placement, and tree and shrub plantings.

Examples of vertical structures may include relocated hollow bearing stags, but may also include vertical structures such as poles or concrete features upon which artificial habitat features can be mounted or integrated. Artificial habitat features suitable for use on vertical structures include but are not limited to nesting boxes, bat boxes and artificial bark.

3.6. Box - Gum Woodland Management Zone

The Box - Gum Woodland Management Zone is shown in Figure 5 and comprises the following areas:

- A 20 m buffer around box-gum woodland in the Corridor
- All confirmed box-gum woodland in the Corridor, as per Nash and Hogg (2013)
- Restoration areas identified as formerly supporting box-gum woodland (RJPL 2017) providing substantial benefits through improved woodland connectivity and expansion.

3.6.1. Buffer Area

The 20 m buffer around box-gum woodland in the Corridor has been defined to guide avoidance of adverse impacts on woodland during infrastructure planning in and adjacent to the Corridor. The buffer zone includes areas outside the Corridor boundary, but immediately adjacent to woodland in the Corridor.

Works undertaken in the buffer should be assessed to determine whether any adverse impacts on box-gum woodland may occur, to identify measures required to manage (e.g. avoid and mitigate) potential adverse impacts and to specify any restoration required to offset residual impacts. Unless otherwise specified, no specific restoration or management works are required within the buffer area.

The total area of the buffer zone is 14.0 ha.

3.6.2. Confirmed Box-gum Woodland

All areas mapped by Nash and Hogg (2013), as meeting Commonwealth criteria for classification, as the critically endangered White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, are included in the Box-Gum Woodland Management Zone. These comprise a total area of 70.7 ha, reported in the program report as 68.2 ha, due to the exclusion of 2.5 ha of box-gum woodland on 'Straithnairn' that is excluded from the boundary of the Program Report (A T Adams Consulting 2017).

All works proposed in these areas should be assessed to determine whether any adverse impacts on box-gum woodland may occur, to identify measures required to avoid and mitigate potential adverse impacts and to specify any restoration required to offset residual impacts. Box-gum woodland restoration activities may be undertaken in these areas.

3.6.3. Restoration Areas

An additional 34.3 ha of degraded grasslands, identified as formerly supporting degraded box-gum woodland, regenerating woodland or woodland plantings not identified as meeting *EPBC Act* criteria for inclusion in the critically endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community at the time of assessment by Nash and Hogg (2013), have been included in the box-gum woodland management area.

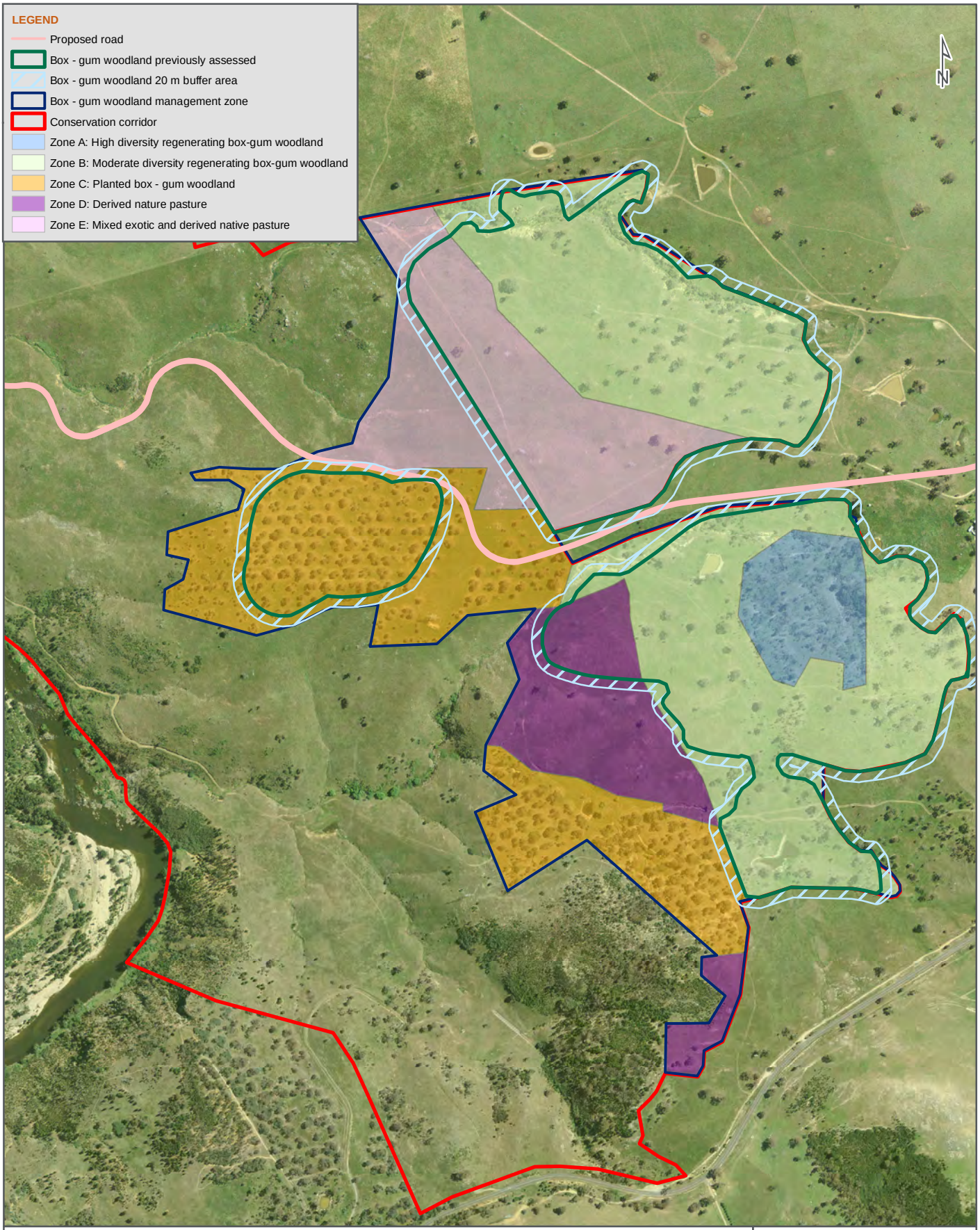
Restoration of these areas creates the opportunity to increase the extent of box-gum woodland meeting criteria for inclusion in the Commonwealth-listed endangered ecological community above and beyond that identified in the Commonwealth approval. Through increasing patch size, restoration of these areas would increase the connectivity and resilience of the box-gum woodland areas identified by Nash and Hogg (2013), and hence contribute to the requirement to enhance the value of existing box-gum woodland areas.

3.6.4. Zoning

To assist in planning management activities, the woodland management zone (excluding the buffer zone) has been divided into the following five zones, consistent with RJPL (2017), based on assessed condition:

- Zone A: High diversity regenerating woodland
- Zone B: Moderate diversity regenerating box-gum woodland
- Zone C: Planted box-gum woodland
- Zone D: Derived native pasture
- Zone E: Mixed exotic and derived native pasture.

The entire extent of the identified zones need not be subject to habitat creation or habitat improvement works. Rather these are the areas where habitat creation and improvement should be targeted. The location of specific restoration works in these areas would be subject to case-specific work plans.



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COORDINATE SYSTEM GDA 1994 MGA Zone 55

FIG NO. 5

FIGURE TITLE **Box - gum Woodland Management Zone.**

PROJECT NO. 3002638

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY N.Crook

SOURCES Riverview

SMEC
Member of the Surbana Jurong Group

Location: X:\Projects\3002638 Ginninderry Offset Managment Plan\GIS\MXD\OMP\Figure 5 BGW Boundary and management zones.mxd

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3.7. Box-Gum Woodland Management Actions

Management actions are presented in Table 3–2. Annual work plans must be developed to guide specific box-gum woodland restoration works in the applicable period, including, at a minimum, restoration methods, work locations and monitoring requirements. Research and woodland restoration activities being undertaken in nearby areas, including the Corridor, should inform management actions in each reporting period. Unless specifically excluded in the work plan, specific work plans would be developed for restoration actions prior to works commencing. Where restoration activities are routine and involve minimal disturbance (e.g. woody debris placement), these may be undertaken without a specific work plan if sufficient detail is provided in the work plan.

Table 3–2. Box-gum woodland management actions

Activity	Class	Description	Zone	Estimated timeframe for completion
Annual works plan	Planning	Develop work plan identifying restoration methods, work locations and specific monitoring requirements. Detailed description requirements and processes for individual restoration works will be implemented, including site plans and measures to minimise impacts on MNES.	All	Prior to restoration works commencing - reviewed annually
Forb enhancement in exotic pasture	Restoration	Restore diverse native groundcover in areas dominated by exotic perennial groundcover. This would comprise topsoil removal and seeding with diverse native grassland mix.	B, D, E	20 years
Revegetation in derived native pastures	Restoration	Planting woodland trees and shrubs in derived native pastures to expand the woodland extent, and to enhance and build upon natural regeneration.	B (Restricted) D E	20 years
Assisted regeneration	Restoration	Natural regeneration of indigenous trees and shrubs will be promoted in the box-gum woodland areas through exclusion fencing and targeted weed control.	A, B	20 years
Woody debris	Restoration	Placement of woody debris to create focal points for the restoration of woodland diversity [Identify maximum placement densities].	B, C, D, E	20 years
Installation of vertical structures	Restoration	Installation of vertical structures e.g. poles and stags incorporating habitat features to benefit woodland birds, mammals and invertebrates.	C, D, E	20 years

Activity	Class	Description	Zone	Estimated timeframe for completion
Stabilisation of erosion and riparian areas	Restoration	Stabilisation of watercourses in woodland areas, including through establishment of native groundcover and active revegetation measures.	A, B	20 years
Invasive animals	Maintenance (Additional)	Control of invasive bird species, particularly breeding populations of Starlings and Indian Mynas.	All	20 years
Research	Monitoring	Conduct research on the effectiveness of management and restoration activities.	All, as required	Ongoing

3.8. Box-Gum Woodland Monitoring Plan

3.8.1. Monitoring Requirements

The monitoring requirements specified in the Program Report (Section 5.1) are presented in Table 3–3. A suitably qualified ecologist must conduct the monitoring. A monitoring protocol has been developed for the Corridor (Sharp 2015) and baseline data was collected in 2015 (RJPL 2017).

Table 3–3. Box-gum woodland monitoring requirements

Outcome	Action	Baseline	Frequency
Ongoing monitoring of impact on woodland. Monitoring will be consistent with box-gum woodland monitoring in offset reserves across the ACT.	Field research to be conducted to assess change in the extent and quality of box-gum woodland habitat.	Adopt field data recorded by Nash and Hogg 2013, as baseline data.	Every two years from date of endorsement. Ability to review monitoring period if impacts have stabilised

3.8.2. Baseline Data

Independent sets of baseline data for the monitoring of box-gum woodland condition have been recorded in 2012 by (Nash and Hogg 2013) and in 2015 (RJPL 2017).

Data collected by Nash and Hogg (2013) comprises 20 x 20 m floristic diversity plots and independent transects. Sampling and plot structure are inconsistent with monitoring plots for offset reserves elsewhere in the ACT; however, floristic diversity recorded in the plots is likely to be comparable with data collected as part of the monitoring protocol for the conservation corridor (Sharp 2015).

RJPL (2017) collected data in plots and for the identified management units according to the monitoring protocol for the conservation corridor (Sharp 2015), and data is consistent with that collected for woodland monitoring in other offset reserves across the ACT.

Details of existing plot locations in the box-gum woodland management zone are presented in Appendix A.

3.8.3. Monitoring Approach

Floristic diversity and structure

Monitoring of box-gum woodland floristic diversity and structure throughout the woodland management zone would be undertaken in the manner specified by the monitoring protocol for the conservation corridor (Sharp 2015). Monitoring would be undertaken in the first year, third year and every five years unless otherwise determined by a review of monitoring requirements.

At a minimum, sampling should be conducted at the plots at which baseline assessments have been undertaken (Nash and Hogg 2013; RJPL 2015), identified in Appendix A. The initial monitoring event must include a review of the 18 existing plots and assessment of whether these plots can be rationalised, or whether additional plots are required to gain a representative and informative sample across the site and meet the sampling intensity recommended in the monitoring protocol (Sharp 2015).

Extent of woodland and woodland habitat features

A detailed mapping exercise should be undertaken in the first year following endorsement and every five years subsequently to capture the following information:

- Extent of woodland meeting EPBC Act criteria for inclusion in the box-gum woodland critically endangered ecological community
- Location and extent of restoration works including improvements in connectivity
- Location and extent of threats, including but not limited to:
- Erosion
- Weed infestation
- Dieback
- Grazing by native or invasive animals.

Restoration monitoring

Restoration works should be subject to specific monitoring requirements outlined in the relevant work plan. Monitoring of restoration works must consider the following principles:

- Be targeted at measuring the woodland components impacted
- Be undertaken every two years from date of endorsement
- Duration of monitoring should be determined taking into consideration the features being restored.

Monitoring reports must include a summary of woodland restoration works undertaken in the monitoring period, including information on the type of restoration works undertaken and the location of restoration works and the utilisation of vertical structures by invasive birds.

3.8.4. Performance Measures

The following performance measures would be used to assess the success of the management and restoration program:

- Increase in floristic diversity and cover of vegetation structural elements
- Maintain or increase the extent of woodland that meets the EPBC listing criteria
- No increase in the cover of weed species
- Increased presence and / or cover of additional habitat features such as woody debris and vertical habitat features
- Reduced incidence of invasive and over-abundant animals.

Triggers and corrective actions based on these measures are presented in Section 3.9.

3.8.5. Performance Targets

Table 3–4. Box-gum woodland conservation targets

Habitat parameter	Target
Extent of vegetation meeting criteria for Commonwealth listed box-gum woodland in the management zone	15% increase in extent of medium – high quality habitat in sampled areas
Weed prevalence in box-gum woodland areas	30% reduction in weed cover in sampled areas
Average floristic condition of box-gum woodland independent of restoration sites	20% increase in average floristic condition (native forb and grass cover or species diversity) of restoration areas
Presence of additional habitat features	20% increase in woody debris cover

3.8.6. Monitoring Schedule

The monitoring schedule for assessing box-gum woodland is presented in Table 3–5. The program report specifies that monitoring would be undertaken every two years following the date of endorsement. The monitoring schedule may be reviewed after the second monitoring period if impacts have stabilised.

Table 3–5. Box-gum woodland monitoring program

Year	Task	Monitoring approach
In the first year following endorsement and every five years subsequently.	Mapping extent of box-gum woodland, habitat features, and threats.	Mapping using methods consistent with those used in other woodland offset reserves in the ACT. Apply Commonwealth criteria to determine the extent of box-gum woodland.
First year following endorsement, the third year and every five years subsequently.	Monitoring changes in the floristic condition and structure.	Plot-based monitoring consistent with standard woodland monitoring protocols in the ACT, as outlined in Sharp (2015). Monitoring of at least 18 plots for which baseline data is available.
First year following works, the third year and every five years subsequently. Monitoring duration to consider the features being restored.	Monitoring changes in the condition of specific features in restoration areas.	Plot-based assessment as outlined in work plans.

3.9. Triggers and Corrective Actions

Corrective actions would be implemented if, as determined by the monitoring program, offset requirements are not met or there is a measured decline in the quality of the box-gum woodland. Table 3–6 identifies relevant triggers for each habitat parameter and appropriate corrective actions to be implemented.

Additionally, a review of the Woodland Management Plan would be required if significant new ecological information is documented in the area relevant to the plan. In particular, if the breeding status or foraging behaviour of threatened species known to breed in the west Belconnen area, such as the Superb Parrot or Little Eagle, changes in the area relevant to the plan, alteration of offset monitoring or management may be required to protect such species.

Table 3–6. Box-gum woodland condition compliance (triggers and responses)

Habitat parameter	Trigger	Response / Action
Extent of vegetation meeting criteria for Commonwealth listed box-gum woodland in the management zone.	20% reduction in extent of box-gum woodland habitat in the management zone.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018).
Weed prevalence in box-gum woodland areas.	20% increase in weed cover in sampled areas of box-gum woodland relative to the baseline.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018). • Development of specific weed control measures for the woodland management zone.
Average floristic condition of box-gum woodland independent of restoration sites.	Decrease of more than 20% in average floristic condition of sampled areas (excluding groundcover diversity enhancement plots) of box-gum woodland relative to the baseline for two or more consecutive sampling years.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018). • Review of box-gum woodland restoration measures in consultation with ACT Government Parks and Conservation Service.
Floristic condition in restoration areas.	No increase (i.e. <5%) in floristic condition at groundcover restoration plots following restoration relative to the baseline for two or more consecutive sampling years.	• Review of box-gum woodland restoration measures in consultation with ACT Government Parks and Conservation Service.
Presence of additional habitat features.	No increase in the cover of woody debris in sampled areas of box-gum woodland relative to the baseline after 5 years.	• Review of box-gum woodland restoration measures in consultation with ACT Government Parks and Conservation Service.
Invasive bird species.	More than 30% vertical structures occupied by invasive native or exotic bird species.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018). • Review of pest animal management measures.
Biomass management.	Qualitative identification of areas of very high biomass.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018).

4. Natural Temperate Grassland Management Plan

4.1. Background

The EPBC listed Natural Temperate Grassland of the South Eastern Highlands (NTG-SEH) ecological community is a natural temperate grassland dominated by native perennial tussock grasses with a diversity of grass-like and herbaceous species, including forbs or wildflowers. The key defining characteristics of NTG-SEH are:

- Occurrence within the ACT's temperate zone where tree growth is climatically limited (elevation up to approximately 1200 m)
- Treeless or contains up to 10% projective cover of trees, shrubs or sedges
- Dominated by native grasses and/or native forbs (more than 50% total vegetative cover, excluding introduced annuals)
- A diversity of native forbs present, or if disturbed, having components of the indigenous native species (including both existing plants and reproductive propagules in the soil e.g. soil seed banks) sufficient to re-establish the characteristic native groundcover (Environment ACT 2005).

To be considered part of the EPBC Act listed Natural Temperate Grassland of the South Eastern Highlands Critically Endangered ecological community, patches must meet condition thresholds in Table 4–1 below.

Table 4–1 Condition thresholds for EPBC Natural Temperate Grassland of the South Eastern Highlands (Commonwealth of Australia 2016)

Condition threshold category	Scenarios	
Moderate to High	A	B
	1. The patch is characterised by at least 50% foliage cover of the ground of *Themeda triandra*. OR 2. The patch is characterised by at least 50% foliage cover of the ground of *Poa labillardierei*, generally in flats and drainage lines where this vegetation type naturally occurs. OR 3. The patch is characterised by at least 50% foliage cover of the ground of *Carex bichenoviana*, or at least 50 tussocks for every 100 m^2.	1. The percentage cover of native vascular plants (including annual and perennial species) in the patch is greater than the percentage cover of perennial exotic species. AND (in sampling plots of 0.04 ha): 2. During favourable sampling times: a. At least 8 non-grass native species OR b. At least 2 indicator species OR c. A floristic value score (FVS5) of at least 5 OR 3. During other sampling times: a. At least 4 non-grass native species OR

Condition threshold category	Scenarios	
		b. At least 1 indicator species OR c. A floristic value score (FVS5) of at least 3
High to Very High	1. The percentage cover of native vascular plants (including annual and perennial species) in the patch is greater than the percentage cover of perennial exotic species AND (In sampling plots of 0.04 ha): 2. At any time of the year: a. At least 12 non-grass 3 native species OR b. At least 3 indicator species OR c. A floristic value score (FVS5) of at least 6.5	
Excellent	• Be considered 'benchmark' or 'reference' sites, which approximate the condition and state of patches of the ecological community prior to European settlement • Have a low cover of weeds • Contain exceptional native plant diversity or rare species, which may be indicated by a relatively high floristic values score for that region.	

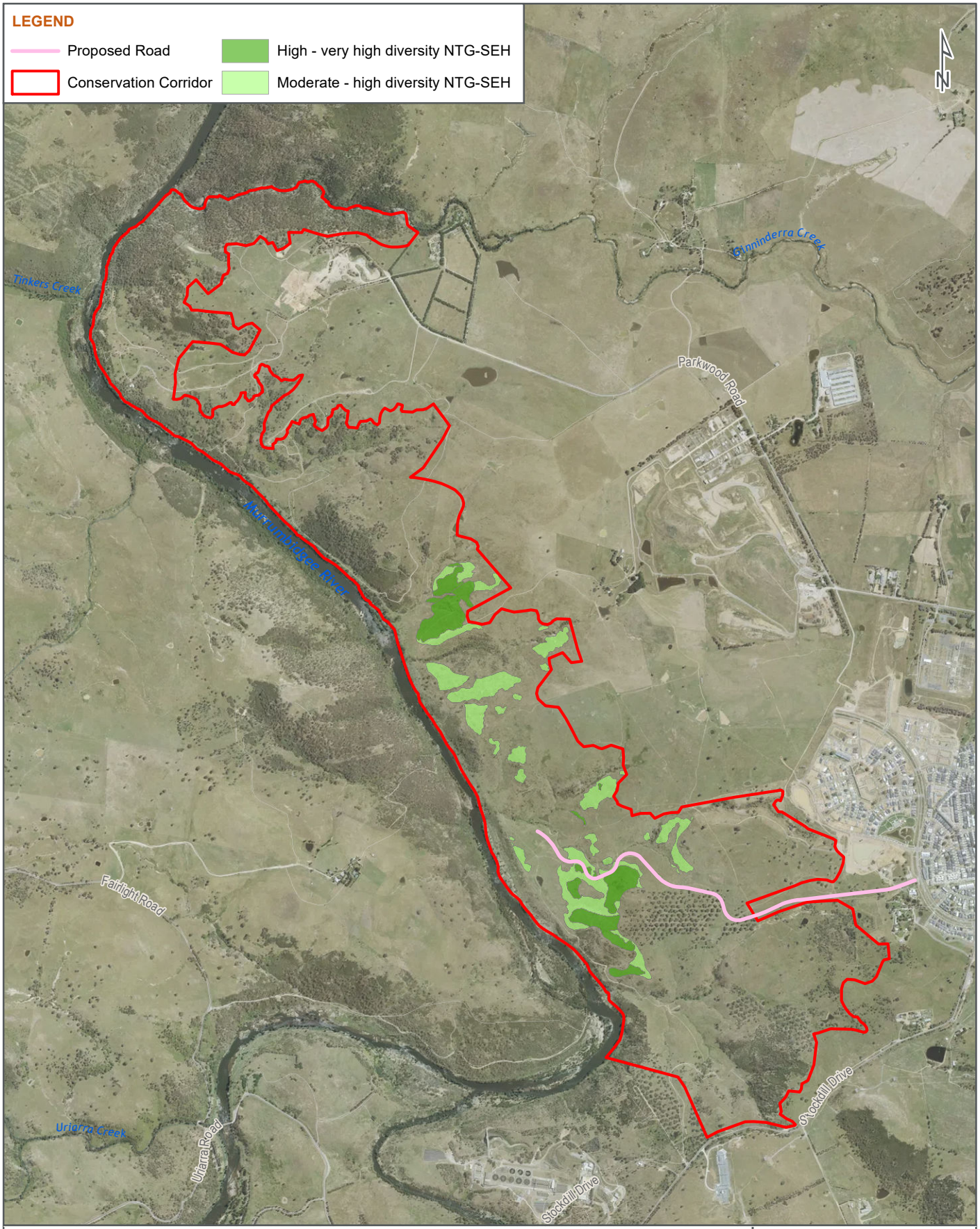
Key diagnostic criteria for NTG-SEH are described in the relevant EPBC Act Approved Conservation Advice (Threatened Species Scientific Committee 2016).

4.2. Corridor Context

In total, 44.47 ha of grassland in the Ginninderry project area meets the EPBC criteria for NTG-SEH. Natural temperate grassland is also listed as endangered under ACT legislation the *Nature Conservation Act 2014* (NC Act). All 44.47 ha occurs within the Corridor on rocky slopes or knolls, and of this, 86.7% aligns closely with moderate to high quality PTWL habitat. NTG-SEH within the Corridor was divided into zones of 'High to very high diversity' and 'Moderate to high diversity' (Figure 6).

The highest quality patches of NTG-SEH were located on steep north-facing slopes where historic land uses have been the least intensive. Patches of moderate quality NTG-SEH have experienced greater disturbance and as a result displayed a lower floristic diversity. The remaining grassland areas have experienced intensive disturbance from historic land-uses as well as ongoing impacts from plant and animal pest species. Due to this, these areas were described as supporting native pasture or exotic pasture and did not meet the EPBC criteria for NTG-SEH (Figure 6).

The grasslands contain substantial areas dominated by noxious weed and exotic pasture and agricultural weed species, which pose a threat to the EPBC and ACT NC grassland values of the Corridor. Appropriate diligent and systematic management is required to control these species and to conserve and enhance the values of the Corridor. A Weed Management Plan has been prepared for the Ginninderry Conservation Corridor (Ginninderry Conservation Trust 2021).



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COORDINATE SYSTEM GDA 1994 MGA Zone 55

FIG NO. 6

FIGURE TITLE Distribution of Natural Temperate Grassland of the South Eastern Highlands (NTG-SEH) within the Corridor (Capital Ecology 2020)

PROJECT NO. 30018032

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY FA13847

SOURCES Roadnet MDS 2020, MetroMap Imagery © Aerometrex Pty Ltd, Capital Ecology 2020

SMEC
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4.3. Offset Requirements

The 44.47 hectares of NTG-SEH within the Ginninderry project area is protected within the Corridor, therefore future stages of suburb development will not have any direct impacts to NTG-SEH in the Corridor. However, other works that are undertaken within the Corridor and indirect impacts from urban development do have the potential to impact NTG-SEH.

4.4. Maintenance

The GCCMP (TRC Tourism Pty Ltd 2018) addresses maintenance of biodiversity values in the Ginninderry Conservation Corridor. This includes management actions to manage weeds, pest animals, human use and biomass.

4.5. Restoration Opportunities

Improving native biodiversity and ecosystem function of NTG-SEH areas requires the implementation of restoration management measures. NTG-SEH have generally experienced severe loss of biodiversity and disruption to its natural processes, therefore the goals for restoration have shifted from complete restoration to a pre-European state. The aim is now to improve vegetation structure and plant composition of grasslands, improve fauna habitat, manage and control exotic species, and enhance native biodiversity.

Restoration opportunities for NTG-SEH include, but are not limited to:

- Weed control
- Improving fauna habitat elements
- Threatened species translocation
- Managing herbage mass and grazing levels
- Planting native forbs amongst tussock grasses.

Performance measures to be used to assess the success of the management and restoration program are outlined in Section 4.8.4.

4.5.1. Weed Control

Native grasslands, including high quality NTG-SEH, generally contain a component of exotic grass and other weed species. The abundance of these exotic grasses is identified as a key contributor to degradation of habitat for the majority of plant and animal species that depend on native grassland communities. Some exotic grasses can also provide habitat for threatened species, so management decisions are required to consider how best to conserve threatened species and also prevent further degradation of native grassland. A Weed Management Plan has been prepared for the Ginninderry Conservation Corridor (Ginninderry Conservation Trust 2021).

The most invasive weed species of NTG-SEH identified by Capital Ecology (2020) in the Ginninderry project area are African Lovegrass (*Eragrostis curvula*) and St John's Wort (*Hypericum perforatum*). Other pest species identified were Paspalum (*Paspalum dilatatum*), Blackberry (*Rubus fruticosus*), Paterson's Curse (*Echium plantagineum*), Skelton Weed (*Chondrilla juncea*), Great Mullein (Verbascum Thapsus) and Saffron Thistle (*Carthamus lanatus*).

According to the *ACT native grassland conservation strategy and action plans* (ACT Government 2017b), the ACT Weeds Strategy 2009-2019 (ACT Government 2009) should guide management where:

- Exotic grasses do not comprise significant habitat for threatened grassland species
- A patch of exotic grass cannot be practically contained and poses high risk of spread into high quality native grassland

- Exotic grasses comprise significant habitat for threatened species and can practically and feasibly be converted back to native grassland habitat. This would require additional actions to restore native grasses.

The *ACT native grassland conservation strategy and action plans* also state that for exotic grasses that comprise significant habitat for threatened species but cannot be converted to native grassland habitat, it may be practically feasible to contain the spread or there may be a low or acceptable risk of spread into native grassland. In this case, management can include controlling the spread and managing exotic grass as part of the broader habitat for the threatened species (ACT Government 2017b).

4.5.2. Improving Habitat Elements

Fauna are an essential part of grassland habitats and are crucial to its functioning, such as through pollination, seed dispersal, nutrient recycling, and maintaining soil condition. Improving habitat elements that support fauna communities is an important aspect of enhancing ecosystem function and adding ecological value to the surrounding landscape, particularly for sites that are already in moderate condition.

The following guidelines should be followed:

- Prioritise sites that connect high quality remnants to facilitate fauna movement, areas that would increase habitat size for threatened species, and degraded patches within or sites adjacent to high quality grassland can facilitate shifting sites to a higher quality state
- Identify and maintain the physical structure of grasslands and enhance where needed to provide a diversity of habitat for the fauna community. These include soil cracks and holes, rocks where they naturally occur, wet areas and watercourses, specific micro-habitats for particular species such as basking sites for reptiles, and plant litter

Appropriate use of natural or artificial structures such as rocks or roof tiles can in some circumstances assist in providing additional habitat where they have previously been lost, or improve habitat connectivity, such as for the PTWL. Monitoring their use is important to make sure they are not supporting introduced species (Antos and Williams 2015). The Ginninderry Conservation Corridor Ecological Monitoring Framework (hereafter: the 'Monitoring Framework') outlines the proposed monitoring schedule for PTWL artificial habitat (Umwelt 2021).

Trees and shrubs that are naturally present scattered within a grassland community can provide important habitat, which should be maintained and managed. Exotic and non-local trees, however, should not be planted and should be removed or replaced by a locally occurring tree, unless it holds heritage value (Eddy 2002).

4.5.3. Threatened Species Translocation

For some threatened species, more intensive ex-situ management options are required to prevent their extinction in the wild and in general should only be resorted to when in-situ actions have failed, and when the survival of the species depends on it. Experimental translocations have been undertaken for several threatened grassland plant and animal species to understand their reintroduction requirements.

The guidelines for safeguarding populations by translocation of individuals are as follows:

- Translocations of threatened animals should only be carried out in exceptional circumstances, including:
    - Survival depends on these actions
    - Critical research for the species' survival cannot be undertaken in the wild

    - Important ecological information can be gained through experimental translocation of individuals that would otherwise die due to urban infrastructure development.
- The Conservator of Flora and Fauna must approve any proposal for the translocation of threatened a species
- Translocations should follow current best practice, such as the 'IUCN Guidelines for Reintroductions and other Conservation Translocations' (IUCN/SSC 2013).

4.5.4. Managing Herbage Mass and Grazing Levels

Management of herbage mass and the space among grass tussocks is one of the fundamental principles of grassland conservation and maintenance of grassland biodiversity (Wong and Morgan 2007; Morgan 2015). This is due to the essential role of native grasses and forbs providing habitat and resources for grassland animals and maintaining the structure and function of healthy native grassland ecosystems. The Ginninderry Conservation Trust is managing herbage mass and grazing levels in-line with the Section 303 licence requirements.

General guidelines for managing herbage mass and structure are (ACT Government 2017b):

- Aim to maintain grassland with intermediate levels of herbage mass, even during productive years, which promotes a grass structure suitable for different grassland species, including threatened species. This will usually have:
    - Well-defined tussocks mostly ranging between 5-20 cm in height
    - Inter-tussock spaces composed of shorter grasses, forbs, and some bare ground
- Avoid removing most of the herbage mass or maintaining grasslands with high herbage mass
- Aim to maintain a heterogenous, patchy grassland sward structure (i.e. patches of longer, dense grass mixed with patches of shorter, more open sward) to provide a range of habitat niches
- Manage herbage mass through the manipulation of grazing regimes (including native and introduced grazers), fire regimes, and mowing or slashing
- Kangaroo grazing is the preferred method to manage grass biomass, with grazing by stock used when kangaroo grazing is unable to maintain the desired grass herbage mass and structure. Currently stock grazing is the primary biomass management tool in the Corridor as it is listed on the Biodiversity Offset Plan (BOP) as a grazed site
- When using fire, aim to create a patchy mosaic of burnt and unburnt areas that are tens of metres across. Low quality habitat may require broader scale burns to improve overall habitat quality. Seasonal conditions, rainfall, and topography need to be considered to minimise impacts to threatened species and risk of weed establishment and erosion, and to promote establishment of native perennial grasses
- Past management practices at a site should be adopted initially to guide herbage mass management (Morgan 2015) as different practices may have different outcomes depending on the management history of the site (eg. frequently versus rarely burned sites)
- Consider the climatic conditions when planning management strategies, as herbage mass and inter-tussock space can vary seasonally due to moisture availability.

4.5.5. Planting Native Forbs amongst Tussock Grasses

A key component in native grassland restoration is establishing a healthy and moderately dense native grassy sward. In some circumstances it may be appropriate to re-introduce native forbs at the same time or before the native grassy sward (Gibson-Roy and Delpratt 2015). Where native seed banks are lacking, restoration of a grassland may depend on reintroducing propagules by planting or direct seeding (Morgan 2015). Where native grassy swards are already present, inter-tussock spaces must be

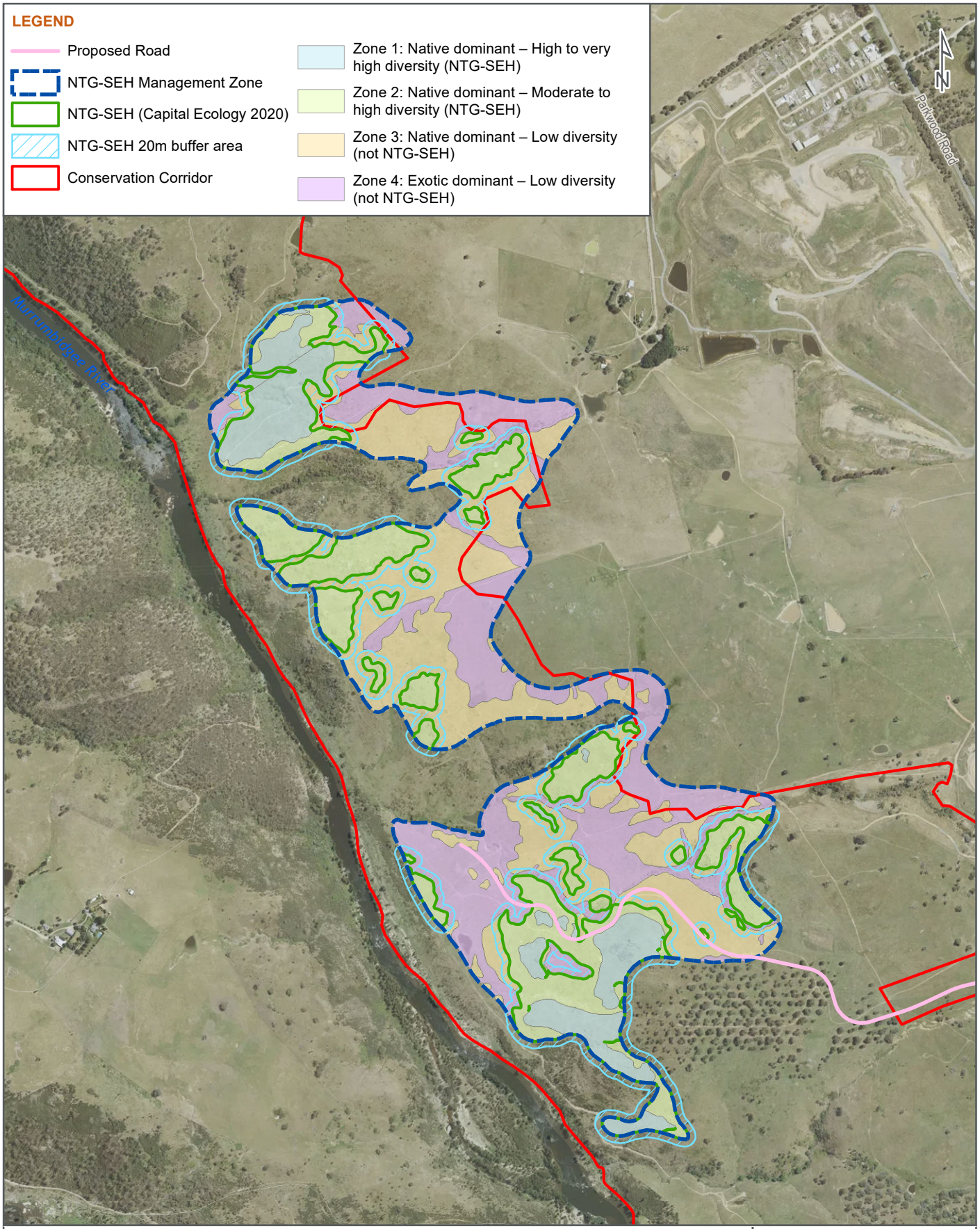
created prior to planting or seeding with forbs. Ongoing maintenance is required to ensure that native grasses or weeds do not close these gaps (Gibson-Roy and Delpratt 2015).

Large amounts of native seed are required for large-scale restoration. Currently, the best practice for sourcing seed for restoration of grassland include consideration of genetics and provenance, seed viability, methods for collection, methods for seed production, harvesting, processing, and storage.

4.6. NTG-SEH Management Zone

The NTG-SEH Management Zone is shown in Figure 7 and comprises the following areas:

- A 20 metre buffer around NTG-SEH in the Corridor
- All confirmed NTG-SEH in the Corridor, as per Capital Ecology (2020)
- Restoration areas identified as Tablelands Dry Tussock Grassland that does not meet the EPBC criteria for NTG-SEH, which also lies within the estimated maximum 1750 extent of natural grasslands.



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COORDINATE SYSTEM GDA 1994 MGA Zone 55

FIG NO. 7

FIGURE TITLE Natural Temperate Grassland of the South Eastern Highlands (NTG-SEH) Management Zone

PROJECT NO. 30018032

PROJECT TITLE Ginninderry Offset Management Plan

CREATED BY FA13847

SOURCES Capital Ecology 2020, MetroMap Imagery © Aerometrex Pty Ltd, Roadnet MDS 2020

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4.6.1. Buffer Area

The 20 metre buffer around NTG-SEH in the Corridor has been defined to guide avoidance of adverse impacts on woodland during infrastructure planning in and adjacent to the Corridor. The buffer zone includes areas outside the Corridor boundary, but immediately adjacent to NTG-SEH in the Corridor.

Works undertaken in the buffer should be assessed to determine whether any adverse impacts on NTG-SEH may occur, to identify measures required to manage (e.g. avoid and mitigate) potential adverse impacts and to specify any restoration required to offset residual impacts. Unless otherwise specified, no specific restoration or management works are required within the buffer area.

The total area of the buffer zone is 22.1 hectares.

4.6.2. Confirmed NTG-SEH

All areas mapped by Capital Ecology (2020) as meeting the Commonwealth criteria for classification of critically endangered NTG-SEH are included in the NTG-SEH Management Zone. These comprise a total area of 44.47 ha.

All works proposed in these areas should be assessed to determine whether any adverse impacts on NTG-SEH may occur, to identify measures required to avoid and mitigate potential adverse impacts and to specify any restoration required to offset residual impacts. NTG-SEH restoration activities may be undertaken in these areas.

4.6.3. Restoration Areas

An additional 86.87 hectares of PCT-ACT01 Tablelands Dry Tussock Grassland that does not meet the EPBC criteria for inclusion in the critically endangered NTG-SEH ecological community at the time of assessment by Capital Ecology is included in the NTG-SEH management area.

Restoration of these areas creates the opportunity to increase the extent of natural temperate grassland meeting the criteria for inclusion in the Commonwealth-listed endangered ecological community above and beyond that identified in the Commonwealth approval. Through increasing patch size, restoration of these areas would increase the connectivity and resilience of the NTG-SEH areas identified by Capital Ecology (2020), and hence contribute to the requirement to enhance the value of existing NTG-SEH areas.

4.6.4. Zoning

To assist in planning management activities, the NTG-SEH management zone (excluding the buffer zone) has been divided into the following four zones (Capital Ecology 2020), based on assessed condition:

- Zone 1: Native dominant – High to very high diversity (meeting the EPBC Act criteria for NTG-SEH in 'high to very high condition')
- Zone 2: Native dominant – Moderate to high diversity (meeting the EPBC Act criteria for NTG-SEH in 'moderate to high condition')
- Zone 3: Native dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH)
- Zone 4: Exotic dominant – Low diversity (not meeting the EPBC Act criteria for NTG-SEH).

The entire extent of the identified zones need not be subject to habitat creation or habitat improvement works. Rather these are the areas where habitat creation and improvement should be targeted. The locations of specific restoration works in these areas would be subject to case-specific work plans.

4.7. NTG-SEH Management Actions

Management actions for NTG-SEH are presented in *Table* 4–2. Different prioritisation of management activities would apply to each of the identified zones. A five-yearly review of the Ginninderry Conservation Corridor Plan of Management and annual reporting to the ACT Conservator of Flora and Fauna on MNES outcomes is required under the EPBC Act.

Table 4–2. Corridor-wide and NTG-SEH management actions

Activity	Reference	Description	Zone	Priority
Ecological restoration and biodiversity management	Action NTG1 and NTG2, Section 4.1.1 and 5.1.2 of the Ginninderry Conservation Corridor 2018-2023 Interim Management Plan (Plan of Management)	Restoration of natural ecosystems through soil stabilisation, control of pest and weeds, natural vegetation regeneration, vegetation planting, creating fauna habitat, reintroduce previously existing flora and fauna species, and special protective measures for certain species.	All	1
Weed management	Action NTG2, Section 4.1.2 of the Plan of Management	Targeted weed control prioritised for the most invasive weeds with high potential for spread - African Lovegrass (*Eragrostis curvula*) and St John's Wort (*Hypericum perforatum*).	All	1 and ongoing
Pest animal management	Action NTG2, Section 4.1.3 and 5.1.2 of the Plan of Management	Control of exotic animal species seen within the Corridor or in nearby areas, including European rabbits (*Oryctolagus cuniculus*), feral goats (*Capra hircus*), wild deer (*Cervus* spp. and *Dama dama*), feral pigs (*Sus scrofa*), European Red Foxes (*Vulpes vulpes*) and feral cats (*Felis catus*).	All	1 and ongoing
Fire management	Action NTG2, Section 4.1.4 of the Plan of Management	Implement appropriate fire regimes, particularly in sites with high productivity.	All	1 and ongoing
Grazing	Action NTG2, Section 4.1.5 of the Plan of Management	Implement appropriate controlled grazing regimes using livestock or kangaroos, particularly in sites with high productivity, to manage weed spread and reduce biomass to reduce bushfire risk.	All	1 and ongoing

Activity	Reference	Description	Zone	Priority
Conservation connectivity	Action NTG2, Section 4.1.9 and of the Plan of Management.	Ecological restoration and biodiversity management to maintain and enhance physical habitat linkages between NTG-SEH habitat areas in the Corridor and nearby areas.	All	1 and ongoing
Initial Corridor infrastructure	Action NTG3, Section 5.1.2 of the Plan of Management	Locate and design management trails, recreation trails, vehicle roads and other infrastructure to avoid or minimise impacts on NTG-SEH: • Use existing roads and tracks where possible, and rehabilitate closed tracks • Vehicle and bush fire control tracks maximum width 6 m (other trails 2.5 m).	All	1 and ongoing
Community and visitor education	Action NTG4, Section 5.1.2 of the Plan of Management	Prepare and distribute information for the community and visitors to educate them on presence, extent and management measures for NTG-SEH.	All	2 and ongoing
Targeted surveys	Action NTG5, Section 5.1.2 of the Plan of Management	Undertake targeted surveys in NTG-SEH areas for Striped Legless Lizards *(Delma impar)*.	All	2 and ongoing

4.8. NTG-SEH Monitoring Plan

4.8.1. Monitoring Requirements

The monitoring requirements specified in the Ginninderry Conservation Corridor Management Plan and the Monitoring Framework (Umwelt 2021) are presented in Table 4–3. A suitably qualified ecologist must conduct the monitoring.

Table 4–3. NTG-SEH monitoring requirements (adapted from Umwelt 2021)

Outcome	Action	Baseline	Frequency
Ongoing monitoring of the condition and impacts on the natural temperate grassland. Future monitoring of the extent of natural temperate grassland should be completed in accordance with the requirements of the ACT Government natural temperate grasslands monitoring guidelines (ACT Government 2015b)	Establishment of ongoing monitoring programs to assess the condition of the grasslands, in reference to the baseline condition previously surveyed.	Adopt field data recorded by Capital Ecology 2020, as baseline data.	Monitoring would be undertaken in the first year (2021), third year (2023), fifth year (2025) and every five years unless otherwise determined by a review of monitoring requirements.

4.8.2. Baseline Data

Baseline data for monitoring extent and condition of grassland vegetation and NTG-SEH was recorded by Capital Ecology in 2020.

Vegetation mapping was carried out using a four-step method developed by Capital Ecology to map PCT boundaries, map vegetation zone boundaries, record floristic composition and structure data, and map areas of determined NTG-SEH. Data was collected using 20 x 20 m floristic diversity plots (as per Rehwinkel 2015) and 50 m step-point transects at each plot to record structural characteristics every 1 m.

Data collection was also based on ACT Government (2015b) monitoring guidelines for natural temperate grasslands. Details of the plot locations in in the NTG-SEH management zone are presented in Appendix A.

4.8.3. Monitoring Approach

The Ecological Monitoring Framework (Umwelt 2021) documents the monitoring program for NTG-SEH and informs the following sections.

Extent of NTG-SEH

Monitoring the extent of NTG-SEH would be undertaken in accordance with the natural temperate grasslands monitoring guidelines (ACT Government 2015b) and associated baseline mapping and monitoring surveys undertaken throughout ACT Offset Reserves (Capital Ecology 2018b). The maximum extent of NTG-SEH assessment should be the estimated pre 1750 extent of natural temperate grassland in the Ginninderry Conservation Corridor estimated by Capital Ecology (2020).

Monitoring would be undertaken in the first year, third year, fifth year and every five years unless otherwise determined by a review of monitoring requirements.

Monitoring of NTG-SEH extent should be conducted through:

- Confirmation of PCT
- Vegetation zone definition and mapping
- Critically Endangered ecological community determination
- Threat mapping.

A detailed mapping exercise should be undertaken in the third and fifth years following endorsement and every five years subsequently to capture the following information:

- Extent of grassland meeting EPBC Act criteria for inclusion in the NTG-SEH critically endangered ecological community
- Location of habitat features
- Location and extent of threats, including but not limited to:
    - Erosion
    - Weed infestation
    - Excessive biomass
    - Significant grazing by native or invasive animals.

Floristic diversity and structure

Monitoring of NTG-SEH floristic diversity and structure throughout the NTG-SEH management zone would be undertaken in the manner according to the Environmental Offsets Ecological Condition Monitoring Methods (ACT Government 2020). Monitoring would be undertaken in the first year, third year, fifth year and every five years unless otherwise determined by a review of monitoring requirements.

Ongoing monitored is required to be conducted at the 17 plots at which baseline assessments have been undertaken (RJPL 2015; Capital Ecology 2020), identified in Appendix A. Two candidate plots have also been proposed in NSW (RJPL 2015; Capital Ecology 2020). Nine plots are co-located with PTWL monitoring plots, therefore floristic monitoring of natural temperate grassland should be completed concurrently with habitat quality assessments for PTWL.

Restoration monitoring

Restoration works should be subject to specific monitoring requirements outlined in the relevant work plan. Monitoring of restoration works must consider the following principles:

- Be targeted at measuring the NTG-SEH components impacted
- Be undertaken in the third and fifth years following endorsement and every five years subsequently
- Duration of monitoring should be determined taking into consideration the features being restored.

Priority sites for monitoring include:

- Sites with threatened species present
- Sites where kangaroo populations are being managed
- Sites where specific management actions are being trialled and carried out.

Monitoring reports must include a summary of NTG-SEH restoration works undertaken in the monitoring period, including information on the type of restoration works undertaken and the location of restoration works.

4.8.4. Performance Measures

The following performance measures would be used to assess the success of the management and restoration program:

- Increase in floristic diversity
- Maintain or increase the extent of NTG-SEH that meets the EPBC listing criteria
- No increase in the cover of weed species
- Reduced incidence of invasive and over-abundant animals.

Triggers and corrective actions based on these measures are presented in Section 4.9.

4.8.5. Performance Targets

Table 4–4 NTG-SEH conservation targets

Habitat parameter	Target
Extent of vegetation meeting criteria for Commonwealth listed NTG-SEH in the management zone	15% increase in extent of medium – high quality habitat in sampled areas
Weed prevalence in NTG-SEH areas	30% reduction in weed cover in sampled areas
Average floristic condition of NTG-SEH independent of restoration sites	20% increase in average floristic condition (native forb and grass cover or species diversity) of restoration areas

4.8.6. Monitoring Schedule

The Monitoring Framework (Umwelt 2021) outlines the monitoring schedule for assessing NTG-SEH and is presented in Table 4–5.

Table 4–5 NTG-SEH monitoring schedule (adapted from Umwelt 2021)

Year	Season	Task
2020 (completed)	Autumn	• Extent of natural temperate grassland, habitat features, and threats mapped. • Floristic condition and structure monitoring completed at new baseline plots, and additional locations as required. • Capital Ecology (2020) baseline plots marked
2021	Spring	• Monitoring changes in the floristic condition and structure. • Mark additional plots.
2023	Spring	• Mapping extent of natural temperate grassland, habitat features, and threats. • Monitoring changes in the condition of specific features in restoration areas. • Assessment of change against and thresholds • Mapping extent of natural temperate grassland, habitat features, and threats. • Monitoring changes in the condition of specific features in restoration areas. • Monitoring changes in the floristic condition and structure. • Assessment of change against and thresholds

Year	Season	Task
2025	Spring	• Mapping extent of natural temperate grassland, habitat features, and threats. • Monitoring changes in the condition of specific features in restoration areas. • Monitoring changes in the floristic condition and structure. • Assessment of change against and thresholds
2030 Ongoing every five years subject to review every 10 years commencing at 10 years.	Spring	• Mapping extent of natural temperate grassland, habitat features, and threats. • Monitoring changes in the condition of specific features in restoration areas. • Monitoring changes in the floristic condition and structure. • Assessment of change against and thresholds
2030, 2040	N/A	• Review of monitoring framework and monitoring methods. • Consultation with stakeholders regarding ongoing monitoring requirements

4.9. Triggers and Corrective Actions

Corrective actions would be implemented if, as determined by the monitoring program, offset requirements are not met or there is a measured decline in the quality of the NTG-SEH. Table 4–6 identifies relevant triggers for each habitat parameter and appropriate corrective actions to be implemented.

Additionally, a review of the Management Plan would be required if significant new ecological information is documented in the area relevant to the plan.

Table 4–6. NTG-SEH condition compliance (triggers and responses) (adapted from Umwelt 2021)

Habitat parameter	Trigger	Response / Action
Extent of vegetation meeting criteria for Commonwealth listed natural temperate grassland in the Ginninderry Conservation Corridor.	10% reduction in combined extent of Zones 01.1 and 01.2	• Review in monitoring report reasons for reduction in extent (i.e. management activities, disturbance, degradation or seasonal conditions) • Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018) • Consult with ACT PCS
Invasive weeds density (plants per ha) [Chilean needlegrass, African lovegrass, serrated tussock, saffron thistle, St John's wort]	Increase of 10% relative to the baseline or Benchmark (<50) exceeded after 10 years of management.	• Review of annual management response to weeds to ensure response is appropriate in scale and nature • Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018) • Development of targeted weed control measures for natural temperate grassland areas.

Habitat parameter	Trigger	Response / Action
Proportion native groundcover	>30% increase in cover of either annual or perennial exotic grasses relative to baseline plots.	• Review of annual management response to weeds to ensure response is appropriate in scale and nature • Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018) • Consideration or review of targeted weed control measures for natural temperate grassland areas.
Average floristic condition of natural temperate grassland independent of restoration areas. Floristic Value Score based calculated according to Rehwinkel (2015)	Zones 01.1 and 01.2 are less than benchmark for more than two years running, unless explained by seasonal conditions. Zones 01.3: After 10 years of management have no positive trend towards benchmark.	• Review in monitoring report reason for reduction in condition (i.e. management activities, disturbance, degradation or seasonal conditions) • Review of management measures specified in the GCCMP (TRC Tourism, 2018).
Biomass	Thatch cover consistently outside benchmark values for three or more sequential monitoring periods.	• Review of management measures specified in the GCCMP (TRC Tourism Pty Ltd 2018) • Review of annual biomass management response measures.

5. Regulatory Reporting and Auditing

Formal reporting and auditing requirements are outlined in the Commonwealth Approval and the Program Report (s 7). In addition to the requirements outlined in the Program Report, the following information should be included in annual reports detailing implementation of measures to protect, maintain and restore PTWL habitat, NTG-SEH and box-gum woodland within the conservation Corridor:

- Approved activities resulting in disturbance or loss of PTWL habitat
- Breaches of conditions resulting in disturbance or loss of PTWL habitat, NTG-SEH or box-gum woodland
- A summary of restoration actions undertaken
- Results of regular monitoring (if applicable)
- Results of site-specific monitoring of restoration works (if applicable).
- Adaptive management actions.

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Appendix A Established Plot Locations

Table A1: Box-gum Woodland plot locations

Plot name	Source	Plot type	Vegetation community	Projection	Easting	Northing	Baseline Survey date
Pa04	RJPL 2015	As per Sharp 2015	Exotic pasture	GDA94 55	680428	6099636	13/11/2014
Pa06	RJPL 2015	As per Sharp 2015	Depauperate native pasture	GDA94 55	680711	6099025	11/11/2014
Pa07	RJPL 2015	As per Sharp 2015	Depauperate native pasture	GDA94 55	680848	6098414	28/10/2014
Pl01	RJPL 2015	As per Sharp 2015	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680872	6098696	28/10/2014
Pl02	RJPL 2015	As per Sharp 2015	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680153	6099352	11/11/2014
W01	RJPL 2015	As per Sharp 2015	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	681300	6099186	11/11/2014
W03	RJPL 2015	As per Sharp 2015	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680835	6099757	13/11/2014
W04	RJPL 2015	As per Sharp 2015	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	681063	6098990	11/11/2014
W05	RJPL 2015	As per Sharp 2015	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680764	6099940	13/11/2014
W06	RJPL 2015	As per Sharp 2015	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	681151	6099184	11/11/2014
Wet1	RJPL 2015	As per Sharp 2015	Tableland Riparian Fringing Wetlands	GDA94 55	680692	6098869	11/11/2014
Q1	Nash and Hogg 2013	20 x 20 m floristic quadrat	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680581	6099984	October 2012
Q2	Nash and Hogg 2013	20 x 20 m floristic quadrat	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	681143	6099226	October 2012
Q3	Nash and Hogg 2013	20 x 20 m floristic quadrat	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680864	6099170	October 2012
Q4	Nash and Hogg 2013	20 x 20 m floristic quadrat	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680955	6098959	October 2012
Q5	Nash and Hogg 2013	20 x 20 m floristic quadrat	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	681039	6098868	October 2012
Q6	Nash and Hogg 2013	20 x 20 m floristic quadrat	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680743	6099718	October 2012
Q7	Nash and Hogg 2013	20 x 20 m floristic quadrat	Yellow Box - Red Gum Tableland Grassy Woodland	GDA94 55	680625	6099848	October 2012

Table A2: NTG-SEH plot locations

Monitoring	Plot name	Source	Plot type	Vegetation community	Projection	Easting	Northing	Baseline Survey date
Yes	G01	RJPL 2015	As per Sharpe 2015	Natural Temperate Grassland: Rocky Natural Grassland	GDA94 55	679304	6100135	13/11/2014
Yes	G02	RJPL 2015	As per Sharpe 2015	Natural Temperate Grassland: Rocky Natural Grassland	GDA94 55	678915	6100702	13/11/2014
Candidate (NSW)	G07	RJPL 2015	As per Sharpe 2015	Natural Temperate Grassland: Rocky Natural Grassland in a mosaic with Red Stringybark - Scribbly Gum Tableland Forest: secondary grassland	GDA94 55	678501	6101905	13/11/2014
Yes	Gi_01.1.1	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	678838	6101044	24-25 March 2020
Yes	Gi_01.1.2	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679561	6099538	24-25 March 2020

Monitoring	Plot name	Source	Plot type	Vegetation community	Projection	Easting	Northing	Baseline Survey date
Yes	Gi_01.1.3	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679680	6099342	24-25 March 2020
Yes	Gi_01.1.4	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679873	6099628	24-25 March 2020
Yes	Gi_01.2.1	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679279	6099729	24-25 March 2020
Yes	Gi_01.2.2	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679736	6099434	24-25 March 2020
Yes	Gi_01.2.3	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679764	6100064	24-25 March 2020
Candidate (NSW)	Gi_01.2.4	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	678983	6101336	24-25 March 2020
Yes	Gi_01.3.1	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	680058	6099628	24-25 March 2020
Yes	Gi_01.3.2	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands	GDA94 55	679183	6101068	24-25 March 2020

Monitoring	Plot name	Source	Plot type	Vegetation community	Projection	Easting	Northing	Baseline Survey date
				Dry Tussock Grassland				
Yes	Gi_01.3.3	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679337	6100671	24-25 March 2020
Yes	Gi_01.3.4	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679474	6099582	24-25 March 2020
Yes	Gi_01.4.1	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679147	6101142	24-25 March 2020
Yes	Gi_01.4.2	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679402	6100478	24-25 March 2020
Yes	Gi_01.4.3	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679255	6099838	24-25 March 2020
Yes	Gi_01.4.4	Capital Ecology 2020	As per Rehwinkel 2015 and ACT Government 2015b	PCT-ACT01 Tablelands Dry Tussock Grassland	GDA94 55	679784	6099911	24-25 March 2020

Appendix B Diverse Grassland Seed Mix Guidance

Where possible, native seed mix for groundcover diversity enhancement should include the following species, which have been selected based on results from Johnson et al (i*n press)*, a pilot scalp trial at the Barrer BGW restoration site (MRR) and Greening Australia's *Grassy Groundcover Research Project* results.

Appendix Table 1. Native grasses and forbs to be included in diverse native grassland seed mix.

C3 Grasses	C4 Grasses	Broad-leaved herbs	Non-grass monocots	Legumes
Austrostipa bigeniculata	*Bothriochloa macra*	*Calotis lappulacea*	*Arthropodium fimbriatum*	*Glycine clandestina*
Austrostipa scabra	*Cymbopogon refractus*	*Chrysocephalum apiculatum*	*Arthropodium minus*	*Glycine tabacina*
Rytidosperma caespitosum	*Sorghum leiocladum*	*Chrysocephalum semipapposum*	*Bulbine bulbosa*	
Rytidosperma carphoides	*Themeda triandra*	*Craspedia variabilis*	*Luzula densiflora*	
Poa sieberiana		*Leucochrysum albicans*		
Rytidosperma laeve		*Linum marginale*		
		Plantago varia		
		Vittadinia muelleri		
		Rutidosis leptorrhynchoides		
		Xerochrysum viscosum		

Appendix Table 2. Rare forbs and sub-shrub species to be included where available or easily sourced.

Forbs	Legumes
Dianella longifolia	*Cullen tenax*
Gonocarpus elatus	*Swainsona monticola*
Gratiola pumila	
Lepidium pseudotasmanicum	
Limosella australis	
Lotus australis	
Polygala japonica	
Stuartina hamata	
Stylidium despectum	
Thesium australe	

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