

Appendix I Great Eastern Highway Bypass Interchanges Project: Offset Management Plan



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Great Eastern Highway Bypass Interchanges Offset Management Plan



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Table of Contents

1. Executive Summary	4
2. Introduction	5
3. Description of Offsets Package.....	6
4. Management Framework.....	9
4.1 Objectives of Plan	9
4.2 Specific Outcomes.....	9
4.3 Responsibilities and Governance	10
5. Specific Management Actions	12
5.1 Restricting Entry into the Offset Sites	15
5.2 Avoidance of Habitat Clearing or Disturbance.....	15
5.3 Fire Management.....	15
5.4 Weed Management.....	16
5.5 Dieback Management	18
6. Risk and Risk Management	20
7. Monitoring	22
7.1 Habitat Quality Monitoring	22
7.2 Photo-point Monitoring	22
7.3 Performance Indicators and Completion Criteria	22
8. Evaluation, Reporting and Contingency Management	24
9. References.....	25
Appendix 1 - Revegetation Plan for Offset 4 Neaves Road.....	26

List of Tables

Table 1 Banksia Woodland TEC Habitat Quality Scores for the Proposed Action and Offset Sites.....	6
Table 2 Black Cockatoo Foraging Habitat Quality Score for the Offset Sites	6
Table 3 Summary of Offsets	8
Table 4 Future Value “with offset” and “without offset”	10
Table 5 Offset Management Action in Line with Recovery Plan/Conservation Advice	13
Table 6 Dominant Introduced Species in Offset Areas.....	16
Table 7 Environmental Weed Control Options.....	17
Table 8 Environmental Weed Control Methods	17
Table 9 Summary of Weed Control Methods	18
Table 10 Dieback Management Actions.....	19
Table 11 Risk Matrix used for Assessment of Risk of Threatening Processes	20
Table 12 Risk Assessment of Threatening Processes on Offset Areas	21
Table 13 Completion Criteria for Offset Management Outcomes	22
Table 14 Reporting Schedule	24

1. Executive Summary

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct a grade separated interchange at the intersection between Roe Highway and Great Eastern Highway Bypass (GEHB) and duplicate the Roe Highway Helena River bridge. The Proposed Action will take place in the City of Swan, Shire of Kalamunda and Shire of Mundaring Local Government Areas (LGA), approximately 15 km east of the Perth Central Business District and approximately 5 km east of Guildford.

These upgrades will improve road user safety and enhance transport efficiency through a significant economic corridor. The Proposed Action will also improve long-term access to and from Perth's International and Domestic airports.

The Proposed Action was formally referred to the then Department of Agriculture, Water and Environment (DAWE) in September 2020 (EPBC Act referral 2020/8784) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to potential impacts on Matters of National Environmental Significance (MNES). DAWE advised in October 2020 that the Proposed Action is a Controlled Action that would be assessed by Preliminary Documentation.

At the time of referral, the Proposed Action was predicted to impact the EPBC-listed *Shrublands and Woodlands of the Eastern Swan Coastal Plain* TEC (SCP20c) (Endangered), which is listed under the *Western Australian Biodiversity Conservation Act 2016* (BC Act) as Critically Endangered.

Following the referral of EPBC 2020/8784, the Proposed Action was redesigned to avoid and reduce impacts on TECs, Threatened Black Cockatoo species and the Threatened flora species *Conospermum undulatum*. This avoided the entire patch of *Shrublands and Woodlands of the Eastern Swan Coastal Plain* TEC, avoided all but one individual *C. undulatum* and reduced the number of potential Black Cockatoo breeding trees within the Development Envelope (DE).

The MNES with potential to be significantly impacted by the Proposed Action include:

- Clearing of 14.94 ha of Banksia Woodlands of the Swan Coastal Plain (BWSCP) TEC.
- Clearing up to 33.48 ha of high quality Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC) foraging habitat.
- Clearing up to 33.48 ha of low quality foraging habitat for Baudin's Cockatoo.
- Clearing up to 162 suitable Breast Height Diameter (DBH) trees, none with suitable hollows.

The actual impact on MNES is expected to be less than the amounts listed above. Opportunities will be continually investigated to further minimise disturbance to BWSCP TEC and Black Cockatoo habitat throughout the design and construction phases.

Main Roads has a strong track record of both developing and implementing best practice in environmental management and implementation of management measures. The measures proposed have been successfully implemented on other projects that have been subject to EPBC conditions and management measures.

Substantial effort has been undertaken to avoid and minimise the Proposal's impact on MNES. To counterbalance the significant residual impacts to BWSCP TEC and Black Cockatoo habitat that haven't been avoided, Main Roads intends to implement an Environmental Offset Strategy and Offset Management Plan.

The offset strategy and plan incorporate both direct and indirect offsets to address the residual impacts on BWSCP TEC and Black Cockatoo habitat. Direct offset will form 90% of the offset requirement for Black Cockatoos, with the remaining 10% being indirectly offset through a contribution to Black Cockatoo research. The assessment of offset sites has identified that threatening processes such as grazing, dieback infestation and weed invasion have the potential to impact vegetation condition and affect conservation gain.

The objective of this Offset Management Plan is to describe the management actions that will be undertaken to achieve the net environmental gain.

2. Introduction

In April 2020, the Western Australian Government announced a series of transport construction commitments to address some of Perth's congested intersections and roads. These commitments included \$180 million to build the Roe Highway – Great Eastern Highway Bypass (GEHB) Interchange.

Roe Highway is a major arterial highway that links the southeast corridor with the northeast and northwest corridors of the Perth Metropolitan Area. Roe Highway services the Hazelmere and Forrestfield industrial areas, and is a strategic freight, tourist and inter town route. The Roe Highway and GEHB intersection is one of the last remaining signalised intersections on Roe Highway.

Approximately 60,000 vehicles pass through the Roe Highway and GEHB intersection each day, with heavy vehicles making up to 14% of this figure. The current layout of Roe Highway at GEHB consists of four lanes (two in each direction) with a signalised intersection. In the past five years, 155 crashes have occurred at the intersection, with four requiring hospitalisations (Main Roads, 2020).

Main Roads is proposing to upgrade Roe Highway, comprising:

- The construction of a grade separation at the intersection of Roe Highway and GEHB – Roe Highway Straight Line Kilometre (SLK) 37.54.
- The upgrade of Roe Highway between Adelaide Street, Hazelmere and Clayton Street, Bellevue, including a duplication of the bridge over the Helena River.
- The construction of approximately 4km Principle Shared Path along the length of Roe Highway from Kalamunda Road to 300m north of Clayton Street.
- Drainage works, electrical works and other associated road works.

The construction of a grade separated interchange at Roe Highway and GEHB will improve road user safety and enhance transport efficiency through a significant economic corridor. The Proposed Action will also improve long-term access to and from Perth's International and Domestic airports.

The Proposed Action was formally referred to DAWE in September 2020 (EPBC Act referral 2020/8784) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to potential impacts on MNES. DAWE advised in October 2020 that the Proposed Action is a Controlled Action and required assessment via preliminary documentation, and approval under the Act.

This Offset Management Plan has been developed to facilitate the implementation of the Offset Strategy. The plan provides guidance for implementation of the offsets identified within the Offset Strategy through management of key threatening processes associated with the offset sites. The Management Plan entails management actions, performance indicators, completion criteria and monitoring to ensure that the offset sites are achieving conservation outcome.

3. Description of Offsets Package

The residual impact of the Proposed Action comprises clearing of 14.94 ha Banksia Woodland TEC and 33.48 ha of Carnaby's Cockatoo, FRTBC and Baudin's Cockatoo foraging habitat. One offset site was identified to counterbalance the significant residual impacts of the Proposed Action to Banksia Woodland TEC and the five Black Cockatoo species. The offset strategy comprises land acquisition, rehabilitation of Main Road managed land for conservation purposes and research funding. Direct offset through land acquisition and protecting Main Roads' managed land for conservation forms 100% of the offset requirement for impacts to Banksia Woodland of the Swan Coastal Plain TEC, and with rehabilitation forms 100% of the offset requirement for impacts to Carnaby's and Baudin's Cockatoo species and 90% of offset requirement for FRTBC. Indirect offset through research forms 10% of the offset requirement for impacts to FRTBC.

Main Roads has provided funding for the acquisition of four suitable land packages, which will be transferred to the conservation estate under the management of DBCA. These four offset sites will be owned and managed by DBCA as freehold land or reserves. A Memorandum of Understanding (MOU) will be enacted for each of the land packages acquired as offset. The MoU commits Main Roads' funding to assist DBCA to undertake 'on-ground' management activities for 20 years. Offset 2 at Neaves Rd. is owned and managed by Main Roads.

Main Roads has secured five offset sites with a total area of 422.45 ha to counterbalance the significant residual impact on MNES and to satisfy both Commonwealth and State environmental offset requirements. Of the five offset sites, offset site 1 at Cowalla is designated to offset Banksia Woodland TEC, three sites for Baudin's Cockatoo, four sites for FRTBC and five for Carnaby's Cockatoo as shown in Table 1 and Table 2.

Table 1 Banksia Woodland TEC Habitat Quality Scores for the Proposed Action and Offset Sites

Offset	Location	Site Condition (out of 150)	Site Context (out of 100)	Habitat Quality Score (out of 10)
Impact (Proposed Action)	Hazelmere, Intersect of Great Eastern Highway Bypass Interchange and Roe Highway	105	45	6
Offset 1	Durigen Road, Cowalla	120	70	8

Table 2 Black Cockatoo Foraging Habitat Quality Score for the Offset Sites

Offset no.	Offset Site	Black Cockatoo Species	Vegetation Condition (0-7)	Site Proximity (0-3)	Start Quality Score
1	Cowalla	Carnaby's	4	2	6
2	Neaves	Carnaby's	2	2	4
		FRTBC	3	3	6
3	Boallia	Carnaby's	6	3	9
		Baudin's	6	3	9
		FRTBC	6	3	9
4	Crossman	Carnaby's	5	3	8
		Baudin's	4	3	7
		FRTBC	4	3	7
5	Hoffman	Carnaby's	6	0	6
		Baudin's	5	3	8
		FRTBC	6	3	9

To ensure that the offset sites offset at least 100% of the residual impact, calculation for equivalency was done using the EPBC's offset calculator guided by the Offsets Assessment Guide and in accordance with the EBPC Act Environmental Offsets Policy. The information in Table 1 and Table 2, which is derived from the results of biological surveys and the HQS tool, were used to provide inputs into the EPBC Offset Assessment Guide Calculator. The calculator was used to determine the quantum of impact to be offset and the percent of impact that could be offset by each proposed offset site, for each of the MNES under consideration.

Based on the results of these analysis, the total quantum of Impact to be offset for 14.94 ha Banksia Woodland TEC with habitat quality score of 6 was assessed as 8.96 ha. The total quantum of impact for Black Cockatoo foraging habitat with quality ranging from 3-6 is assessed as 10.04 ha for Baudin's Cockatoo and 20.09 ha for Carnaby's Cockatoo and FRTBC, respectively. A summary of offset sites, that will be managed by this Offset Management Plan (GCA 2023), with the offset values for each MNES as outlined in Table 3.

Table 3 Summary of Offsets

Offset Site	MNES Values Confirmed	Offsetting of Residual Impacts to MNES				Total Area
		Banksia Woodland TEC <i>14.94 ha x quality 8</i>	Baudin's Cockatoo <i>33.48 ha x quality 3</i>	Carnaby's Cockatoo <i>33.48 ha x quality 6</i>	FRTBC <i>33.48 ha x quality 6</i>	
Offset 1 Cowalla	Surveyed (FVC, 2022)	163 ha, 100.27% of impact offset	Nil. Outside modelled distribution	163 ha 44.74% of impact offset	Nil. Outside modelled distribution	163 ha
Offset 2 Neaves Road	Inferred (AECOM 2020; Coffey, 2014)	Nil. No TEC present	Nil. Outside modelled distribution	29.29 ha 19.41% of impact offset	29.29 ha 14.29% of impact offset	29.29 ha
Offset 3 Boallia	BC habitat surveyed (SW Environmental, 2022)	Nil. No confirmed TEC present	62.16 ha 34.13% of impact offset	62.16 ha 17.06% of impact offset	62.16 ha 20.81% of impact offset	62.16 ha
Offset 4 Crossman	BC habitat surveyed (AECOM, 2023)	Nil. No TEC present	91 ha 49.96% of impact offset	91 ha 24.98% of impact offset	91 ha 30.47% of impact offset	91 ha
Offset 5 Hoffman	BC habitat surveyed (AECOM, 2023)	Nil. No TEC present	63 ha 34.59% of impact offset	80 ha 21.96% of impact offset	74 ha 24.78% of impact offset	80 ha
Offset 6 Research		Nil. No research offsets	0 ha, 0%, research offset not required	0 ha, 0%, research offset not required	0 ha, 10% of impact offset	
Total impact of offsets to MNES		163 ha, 100.27% of impact	216.16 ha, 118.67% of impact	425.45 ha, 128.16% of impact	256.45 ha, 100.35% of impact	422.45 ha

4. Management Framework

4.1 Objectives of Plan

Pockets of remnant vegetation are subject to key threats from clearing, fire, weed invasion, *Phytophthora* dieback infestation and grazing by herbivores such as goats, rabbits and kangaroos. Acquiring land as an offset and management by DBCA will provide protection to the area's biodiversity value by averting future loss or degradation and enhancing the viability of the protected matter. The Offset Management Plan (OMP) details the management activities that will be undertaken at the offset sites to achieve conservation gain through protection and improvement of condition and environmental values for Banksia Woodland TEC and the three threatened Black Cockatoo species habitat. The OMP also outlines the monitoring program and risk management at the offset sites. Time until ecological benefit has been assessed as 20 years except for rehabilitation of Offset 4 at Neaves Road, for which 10 years has been estimated to achieve the conservation objective. The main management action involves the following:

- Prevent grazing to improve native flora species richness and diversity, improve species recruitment and to manage understory vegetation composition.
- Strategically manage fire to reduce the risk of fire that can pose significant impact on the MNES.
- Reduce overdominance of understory composition by non-native species through control of invasive weed species.
- Prevent the spread of dieback that will deteriorate the value of MNES.

These actions are anticipated to achieve the following conservation outcomes:

- Improved vegetation condition of Banksia Woodland TEC.
- Improved foraging habitat for Carnaby's, Baudin's and FRTBC.

Apart from protecting the ecological values, the OMP will also help manage risk of Banksia Woodland TEC and Black Cockatoo foraging habitat degradation and help implement adaptive management through continual evaluation and revision of the management actions as and when additional information becomes available for the MNES.

4.2 Specific Outcomes

The EPBC Act offset calculator has been used to determine the offset value to ascertain that an environmental value equivalent to that of the residual impact will be offset. The inputs to determine the value of an offset includes the habitat quality score of baseline impact and offset derived from vegetation condition and context for the MNES using DCCEEW's habitat quality scoring tool. The Banksia Woodland TEC in the Proposed Action area was assessed to have a habitat quality score of 6. The habitat quality score for Carnaby's Cockatoo and FRTBC was assessed as 6 and a score of 3 was suggested for Baudin's Cockatoo. The future value of the habitat with offset is considered as the specific outcomes to be achieved with implementation of the management actions.

The future value without offset is the habitat value that the area is likely to have when it continues to be exposed to threatening processes in the absence of the offset. As per the EPBC Act Environment Offset Policy, an offset area will have to deliver a conservation outcome that improves or maintains the viability of the MNES in a pre-project status and that the final habitat quality score of the offset site must be equal or greater than the habitat quality score of the impact area. The future value with offset and without offset for the MNES for each of the offset site is as provided in Table 4. Each of the scores are supported by biological surveys carried out for each of the offset site and through existing literature. The detailed scoring methodology and rationale behind each score is detailed out in Appendix 3 of the Offset Strategy (GCA 2023).

Table 4 Future Value “with offset” and “without offset”

Attribute	Offset 1	Offset 2	Offset 3	Offset 4	Offset 5	Offset 6	Offset 7
Banksia Woodland TEC							
Future value without offset	7	5	5				
Future value with offset	8	6	6				
Baudin's Cockatoo							
Future value without offset		3	3		8	7	8
Future value with offset		4	4		9	8	9
Carnaby's Cockatoo							
Future value without offset	6	6	6	4	8	8	6
Future value with offset	7	7	7	7	9	9	7
FRTBC							
Future value without offset		6	6	6	8	7	9
Future value with offset		7	7	8	9	8	10

4.3 Responsibilities and Governance

Main Roads is responsible for the implementation of the offsets and this offset plan. For the properties acquired for incorporation into the Conservation Estate, this will be achieved by funding DBCA to manage the properties. The management of these offset areas will be governed by MoU's signed by DBCA and Main Roads that extend for a 20 year period. At the end of the 20 year period and provided the completion criteria outlined in section 7.3 has been met, the ongoing management of these sites will be undertaken by DBCA as part of their regular conservation estate management program. The sites under Main Roads management will continue to be managed by Main Roads once the completion criteria have been achieved.

4.4 Threats to offset area values

1.1.1 Kangaroo overgrazing and weed invasion.

Recent studies have demonstrated that kangaroos can have a significant impact on conservation areas, especially through overgrazing. Prevention of grazing damage from overabundant kangaroos is specified as a priority management action in the Banksia Woodland TEC Approved Conservation Advice (TSSC, 2016). In 2023, Main Roads prepared a literature review that considered the key ecological impacts of overgrazing by kangaroos on terrestrial biodiversity, in particular ecological communities and fauna habitat, and the conservation benefits of kangaroo exclusion fencing to these communities (Main Roads Western Australia, 2023). The review drew on numerous studies, including seven that specifically included assessment of the effect of exclusion plots or exclusion fencing. All seven studies showed that kangaroo overgrazing resulted in deleterious effects on the conservation areas being assessed and that exclusion of kangaroos from these areas via fencing enabled recovery of the vegetation cover and thus biomass, as well as species richness and vegetation structural complexity (Main Roads Western Australia, 2023a). The dominant threatening process identified by both DBCA (DBCA, 2010, 2018) and Biota (2021) in the Banksia vegetation was overgrazing by kangaroos. The second of the two key threatening process identified by DBCA in their 2018 assessment and also by Biota in their 2021 report, was invasion by annual weeds. This threat was noted as being linked to kangaroo overgrazing impacts, meaning that where overgrazing impacts were more prevalent, invasion by exotic species was also more prevalent and that in these areas, exotics were present at higher densities. An assessment of these reports shows that during the period 2010 to 2021, the Banksia vegetation within the Bunbury Outer Ring Road “Ducane” Offset Area decreased in condition from ‘Pristine to Excellent’ across its entirety to a combination of ‘Very good’ and ‘Good with some Degraded’ condition. This is a significant loss of vegetation quality and habitat value in a relatively short period of time.

Grazing evidence has been recorded across the offset sites. Kangaroo grazing has been identified as threat to vegetation within offset site 1 and 3. At offset 4 at Crossman and offset 5 at Hoffman, grazing by feral goats is predominant.

1.1.2 Unauthorised vehicle access.

Unauthorised vehicle access to Offset Sites 3, 4 and 5 is not effectively limited due to a lack of effective gates and barriers and these sites are subject to disturbances due to unauthorised access. At offset site 3, native vegetation is subject to clearing for an access track. At offset sites 4 and offset 5, disturbance of the vegetation from tracks, rubbish and logging potentially through illegal access were observed (AECOM 2023). Access control will be used to prevent a range of detrimental impacts to bushland caused by unauthorised vehicle access.

1.1.3 Introduced pest animals.

Evidence of European wild rabbit and red fox were recorded within offset 2 at Neaves Road. The flora and fauna surveys at offset 4 and offset 5 recorded evidences of introduced pest species such as *Sus scrofa* (Feral Pig), through ground disturbance, and dens of *Vulpes vulpes* (European Red Fox) was recorded. Additionally, evidence suggests the presence of *Capra hircus* (Feral goat) at Hoffman (AECOM 2023).

1.1.4 Fire.

The risk of wildfire is a potential threat for offset sites 1, 3, 4 and 5. Fire has been identified as a threatening process across the entirety of offset site 1 with previous fire recorded 5-10 years prior. At Crossman, while there is no evidence of recent fire, evidence suggests the last fire occurred over 10 years ago. Approximately one-third of the survey area at offset 5 has been recorded as burnt in a hot fire 5-10 years ago. Wildfire has the potential to significantly reduce the fauna habitat extent and value and degrade the Banksia Woodland TEC vegetation. This is particularly the case if overgrazing by kangaroos occurs during the post-fire recovery period.

1.1.5 Phytophthora dieback.

According to the information from the biological survey for offset site 1, the area within the offset boundary is dieback free (Focused Vision 2022). However, numerous sites around the offset site have been assessed as potentially dieback infested. At offset 3, the northern corner comprising approximately 39% of the offset site is assessed as dieback infested and the remaining site is uninfested protectable.

5. Specific Management Actions

The specific management outcome and offset objectives will be realised by implementing specific on-ground management actions for each MNES, which will include fencing, weed management and dieback hygiene to prevent grazing, minimise weed invasion and spread of dieback. These management actions are specific to the seven offset areas and are based on the MNES that require offsetting. It is envisaged that the vegetation condition will be improved with implementation of these management actions as described below and supported by existing literature review at Appendix 4 of the Offset Strategy (GCA 2023). The management actions are considered in line with the Commonwealth's conservation advice and recovery plans as summarised in Table 5.

The implementation of management measures described in the following sections will result in habitat quality improvement for Banksia Woodland TEC and Black Cockatoos leading to an increased habitat quality score of one (1) from the present value. The improvement in habitat quality will be attributed to the following:

- Increased native species recruitment by reducing competition from non-native species, exclusion of herbivore grazing that reduces the effect of trampling and over-grazing and prescribed burning to abate the effects of uncontrolled fires.
- Increased foliage cover and species recruitment.
- Increased native species richness and diversity.
- Increased organic litter cover with the growing ground biomass of tree species over time and the application of the appropriate fire regime.

Table 5 Offset Management Action in Line with Recovery Plan/Conservation Advice

MNES	Relevant Conservation Advice or Recovery Plan	Main Threats	Recommended Action	OMP proposed actions
Banksia Woodland TEC	Conservation Advice	<ul style="list-style-type: none"> Land Clearing and fragmentation Ground water drawdown Altered fire regime Plant Pathogens Invasive flora and fauna 	<ul style="list-style-type: none"> Preventing vegetation clearance and direct habitat damage; Prevent further clearance, fragmentation or detrimental modification of remnants of the ecological community and of surrounding native vegetation; Avoid the requirement for offsetting, by avoiding and mitigating impacts to the ecological community first. Prevent weed invasion by minimising any soil disturbance. Retain habitat features for fauna. Prior to removal of any trees, or use of heavy machinery that may also damage the understorey, ensure comprehensive flora and fauna surveys have identified threatened species on site and their potential shelter and nesting sites. Control runoff to prevent movement of weed material into natural areas. Prevent further introduction of feral animals. Monitor for <i>Phytophthora cinnamomi</i> and other plant pathogens to minimise the risk of new infestations in areas that are not yet infested. Use appropriate hygiene to minimise the introduction or spread of weeds and diseases at susceptible sites. Manage groundwater extraction by monitoring changes to levels of groundwater over the long-term. Identify and implement appropriate fire management regimes. 	<ul style="list-style-type: none"> Restrict access and avoid habitat clearing and disturbance. Prevent grazing. Weed management. Dieback hygiene Fire regime management
Carnaby's Cockatoo	Department of Parks and Wildlife 2013, Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) Recovery Plan, Department of Parks and Wildlife, Perth, Western Australia	<ul style="list-style-type: none"> Loss of breeding habitat through clearing or degradation Nest hollow shortages Clearing, fragmentation and degradation of foraging and night roosting habitats. Illegal shooting Climate change Illegal capture 	<ul style="list-style-type: none"> Protect and manage breeding habitat and associated feeding habitat. Protect and manage non-breeding habitat. Undertake regular monitoring. Conduct research to inform management. Manage other impacts. Engage with the broader community. Undertake information and communication activities. 	<ul style="list-style-type: none"> Restrict access and avoid habitat clearing and disturbance. Prevent grazing. Weed management. Dieback hygiene Fire regime management

MNES	Relevant Conservation Advice or Recovery Plan	Main Threats	Recommended Action	OMP proposed actions
Baudin's Cockatoo	TSSC 2018b Conservation Advice <i>Calyptorhynchus baudinii</i> Baudin's Cockatoo	<ul style="list-style-type: none"> Habitat loss from land clearing activities due to agriculture, forestry and mining Nest hollow shortages Fire events Competition with native and invasive species (eg European Honey bees) Illegal shooting by orchardists Phytopathogens Climate change 	<ul style="list-style-type: none"> Limiting the amount of illegal shooting. Increasing number of nest hollows through limiting loss of mature trees. Develop and implement a policy for the identification of old-growth forest areas for retention and protection of existing hollow-bearing trees and future habitat trees that may develop hollows in the next 50-100 years. Undertake habitat restoration by revegetating suitable area with key tree species. Manage fire regime. Develop and implement control program for reduction of feral European honeybees. Implement management actions to reduce spread of phytopathogens, manage and contain infested areas and protect non-infested areas. 	<ul style="list-style-type: none"> Restrict access and avoid habitat clearing and disturbance Prevent grazing Weed management Dieback hygiene Fire regime management
FRTBC	DEWA 2009 Conservation Advice <i>Calyptorhynchus banksii naso</i> Forest Red-tailed Black Cockatoo	<ul style="list-style-type: none"> Habitat loss from land clearing and fire Nest hollow shortages Competition with other species Injury or death from invasive species (European Honeybees) Illegal shooting 	<ul style="list-style-type: none"> Determine and implement measures to reduce effect of the Proposed Action on habitat loss. Determine and implement measures to manage forest for the conservation of the species. Develop and implement management plan for the control and reduction of feral European Honeybees 	<ul style="list-style-type: none"> Restrict access and avoid habitat clearing and disturbance Prevent grazing and avoidance of habitat clearing Weed management Dieback hygiene Fire regime management

The specific management actions for Banksia Woodland TEC and foraging habitat for Black Cockatoo species offsets are as discussed in the following sub-sections.

5.1 Restricting Entry into the Offset Sites

Offset sites 1, 3, 4 and 5 will be managed by DBCA after acquisition under the MoU signed between the two parties. The MoU will also address funding of management activities. Access restriction into the offset areas will be implemented to prevent unauthorised entry that will threaten the offset area in terms of distribution of invasive weeds and spread of dieback. Fencing, and the maintenance of the fence, for each property will be undertaken in consultation with DBCA. Main Roads will install fencing at offset site 2 at Neaves Rd.

Restriction of access will also prevent unauthorised firewood collection and damage to vegetation through trampling.

The following proposed actions will be implemented:

- Access to the offset area will be controlled through installation of fences. Fencing will be erected within 24 months of the MOUs being enacted for sites being managed by DBCA and within 24 months of the action commencing for Main Roads managed sites. The specification of fences will depend on the size, location and topography of each offset site. Fencing helps manage threats to the offset site from unauthorised human access, unauthorised vehicle entry, herbivore grazing and grazing by domestic stock.
- Clear signage will be posted at all the potential access points of the offset area so that people are made aware that the area is protected. Signage will be posted as soon as practicable after the land is secured as offset.
- Access to vehicles will also be regulated such that only authorised vehicle and personnel enter the area.
- Movement of authorised vehicles will be restricted to designated tracks and limited speed as advised by DBCA within the offset area.

5.2 Avoidance of Habitat Clearing or Disturbance

As the area will support MNES and be managed by Main Roads/DBCA, any activity within the area will require referral under the EPBC Act and WA EP Act. Further, the following actions will be undertaken to ensure that the habitat is protected from clearing and disturbance:

- Except for vegetation clearing required for fencing, establishing or maintaining fire breaks and for safety purposes, no clearing will be permitted without the relevant approvals.
- Pest animals such as rabbits, foxes and feral pigs are a serious threat to loss of biodiversity through degradation of native vegetation species in the offset area. Pest management will be carried out using range of best practices in accordance with the National Pest Smart Guidelines (Invasive Animals Cooperative Research Centre, 2016) issued by the Department of Primary Industries and Regional Development (DPIRD) and governed by the Biosecurity and Agriculture Management Act (BAM Act).
- Grazing by kangaroos is prevalent in Offset 1 and Offset 3 and by pigs and rabbits at Offset 4 and Offset 5. Grazing by these herbivores will be limited by fencing the offset area to promote species recruitment.

5.3 Fire Management

Bushfire poses a serious risk to biodiversity values, communities, critical infrastructure, and cultural and heritage values. Fire management will aim to reduce the incidence of uncontrolled fires, both planned and unplanned, and discourage broadscale burning for agricultural purposes around the offset areas. Fire management will be carried out in accordance with the DBCA's Corporate Policy Statement 19- Fire Management (DPaW, 2015), which includes the following measures:

- Fire detection and reporting system in fire risk areas and high value areas.
- Responding to bushfire depending on the scale and values at risk.
- Control of fire in line with relevant legislation including the Fire State Hazard Plan (Statement Emergency Management Committee, 2022).
- Ensure effective access for fire fighters and firefighting equipment during emergency.
- Ensuring that the fire management strategies consider environmental values.

- Conduct bushfire mitigation measures.
- Collaborate with other agencies to develop approaches towards mitigation of bushfire risks.
- Ensure prescribed burning to achieve land management objectives, ecosystem health maintenance, regeneration and protection of native forest and reduce bushfire related risk in accordance with the Corporate Policy Statement 88-Prescribed Burning (DPaW 2015).

Prescribed burning, when undertaken, will be under the guidance and recommendation of biodiversity experts and burning plan to ensure that burns are established in such a way that it will provide for safer fire suppression and to allow a better opportunity for fire suppression success during the time of uncontrolled wildfire. Prescribed burns shall be planned as per the DBCA's code of practice for fire management, prescribed fire manual and relevant standard operating procedures (DEC 2008) and in line with respective regional fire management plan. The prescribed burning plan would include an assessment of fuel load at each offset site to indicate fuel hazard that would be useful to determine the risk of unplanned fires to the MNES and to inform fire management strategies.

5.4 Weed Management

Significant disturbance of areas through activities such as land clearing or over grazing can lead to invasion of the area by non-native plant species (weeds). These species adversely modify natural processes leading to change in the vegetation composition and structure by excluding native species through disruption of native species recruitment and degradation of ecosystem condition and functionality. Some of the weed species observed across the seven offset areas are as listed in Table 6. The ability of these species to out compete native plants for resources threatens the survival of the MNES. Control of weed species is critical to restore diversity, composition, and structure of the vegetation communities across the offset areas. The aim of weed control is to incorporate control methods including fencing and treatments to keep un-infested areas clear of weeds and control the spread of existing weed infestations.

Table 6 Dominant Introduced Species in Offset Areas

Dominant Weed Species In the Offset Areas	
<i>Aira caryophyllea</i>	<i>Gladiolus caryophyllaceus</i>
<i>Aira cupaniana</i>	<i>Gladiolus sp.</i>
<i>Arctotheca calendula</i>	<i>Hypochaeris glabra</i>
<i>Avena fatua</i>	<i>Hypochaeris radicata</i>
<i>Bellardia trixago</i>	<i>Lysimachia arvensis</i>
<i>Brachypodium distachyon</i>	<i>Pentameris airoides subsp. airoides</i>
<i>Brassica barrelieri subsp. oxyrrhina</i>	<i>Pentameris pallida</i>
<i>Briza maxima</i>	<i>Romulea rosea</i>
<i>Briza minor</i>	<i>Silene gallica var. gallica</i>
<i>Bromus hordeaceus</i>	<i>Sonchus oleraceus</i>
<i>Disa bracteata</i>	<i>Trifolium dubium</i>
<i>Ehrharta calycina</i>	<i>Trifolium sp</i>
<i>Ehrharta longiflora</i>	<i>Ursinia anthemoides</i>
<i>Eragrostis curvula</i>	<i>Vulpia bromoides</i>
<i>Erigeron bonariensis</i>	<i>Vulpia myuros</i>
<i>Erodium botrys</i>	<i>Wahlenbergia capensis</i>

In addition to the weed information from the biological survey reports, comprehensive surveys of the offset sites will be undertaken and mapped in the early phase of land acquisition to determine the distribution and abundance of weed species. A register of weed species will be developed and maintained for each offset site and updated with periodic inspection. The register will include details of distribution of each species, abundance, relevant biological information, history of control method applied and record of their relative success.

Weed management will be undertaken in line with the Environmental Weed Strategy for Western Australia (CALM, 1999), which involves an integrated approach comprising various control option such as weed led control, cause led control, site led control, resources led control and threatened species and communities led control in order to maximise nature conservation outcome. The various options are summarised in the Table 7.

Table 7 Environmental Weed Control Options

Sl.no.	Control Options	Description
1	Weed led control	Aims to prevent introduction, establishment, survival, reproduction, and dispersal of an environmental weed before causing adverse impact on the ecosystem.
1.1	Preventing weed introduction	<ul style="list-style-type: none"> • Good hygiene practice • Regulation to ensure buffer between native vegetation and roadsides, requirement to cover materials while transporting, sale of potential weed species. • Education on garden waste disposal
1.2	Early detection and eradication	<ul style="list-style-type: none"> • Identification of small local priority population • Assess whether control is possible. • Applying control methods
2	Site led control	Aims to identify and prioritise areas that require weed control or those in good condition, which can be improved, based on biodiversity value.
3	Threatened species and threatened communities led control	Aims to control weed at sites identified with priority placed on the protection of threatened species and threatened communities.
4	Human resource led control	<p>Aims to control weeds using various methods depending on whether the control is undertaken by volunteers or professionals.</p> <p>Recommends volunteers to target small populations of visible weeds that can be removed manually or through chemical methods and professionals to be used for methods that require spraying or machinery.</p>
5	Cause led control	Aims to reduce, control, or eliminate the factors that cause disturbance to the ecosystem leading to proliferation of environmental weeds.

Environmental weeds can be controlled through an approach that uses various indirect and direct control methods employed in combination or alone. The control methods are listed below in Table 8. Using the appropriate weed control method and technique, a reduction in weed cover is expected to be observed within 5-7 years of management. Weeds will be monitored at each land acquisition offset site (site 1, 5, 6 and 7) within three years of the enactment of the offset site MOUs, and every 3 years thereafter for 20 years or until the completion criteria is achieved. Weed monitoring will be undertaken at offset sites 2 and 3 within three years of the commencement of the action, and every 3 years thereafter for 20 years or until the completion criteria is achieved.

Weed control measures will be applied throughout the 20 years of the offset when weed cover is considered to negatively impact natural regeneration. Table 8 Environmental Weed Control Methods

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> • chemical control (herbicide) • biological control • manual control 	<ul style="list-style-type: none"> • land management to control ecosystem degradation

The above listed control methods are described in detail in Table 9.

Table 9 Summary of Weed Control Methods

Control Method	Description
Chemical control	<p>The control method uses herbicide and it is considered to be the most cost-effective method. It is generally used in conjunction with other control methods.</p> <p>The use of these chemicals will be in line with approved label that provides instruction on safe use and storage, Material Safety Data Sheet (MSDS) and appropriate safety standard. Only Australian Pesticide and Veterinary Medicine Authority (APVMA) registered herbicide will be used in accordance with the direction/instruction on the label.</p> <p>The use of chemicals in the offset area will be undertaken only by licensed professionals suitably qualified to identify native plants. Selection of herbicide type and most appropriate technique for herbicide application will be undertaken depending on the site conditions, target weed and constraints.</p> <p>Weather conditions will be taken into account during the application of the chemicals. Wind direction and speed will be assessed in the spraying zone to prevent chances of spray drift.</p>
Biological control	<p>It is a long term weed control technique and generally environmentally friendly. It involves deterioration of health of weeds using insects or pathogens.</p> <p>Require substantial investment and substantial testing before releasing the biological agent to ensure it does not become pest themselves.</p> <p>The use of biological control will be in accordance with the revised guideline for the introduction of exotic biological control agents for the control of weeds and plant pests and any other protocols under the Department of Agriculture, Fisheries and Forestry and DCCEEW.</p>
Manual control	<p>Involves physically removing the weed species by unearthing the root system in its entirety. It is most effective for small infestations and suitable for situations where disturbance to an individual threatened species must be avoided.</p> <p>Weeds can also be slashed to prevent seed production prior to flowering.</p>
Land Management	<p>The incidence and impacts of weeds can be reduced by good land management. Management strategies include:</p> <ul style="list-style-type: none"> • Maintenance of ground cover. • Installing fences to reduce grazing. • Implementation of weed hygiene. • Early weed identification.

Species specific weed control measures will be detailed in the weed control program that will be developed for each offset site. The weed control program will include, but not limited to, specific control measures, procedures, location, and timing of management activities. Weed management will also be consistent with the DBCA's Corporate Policy Statement 14-Weed Management (DBCA, 2022), standard operating procedures, plans and guidelines. In addition to the weed treatment methods, weed hygiene practices will be implemented which will include:

- The requirement of all the vehicles and machinery entering the offset sites to undergo thorough wash down and inspection for any vegetation trapped on the undercarriage.
- No vehicles or machineries will be all allowed to enter the offset sites during the wet conditions to reduce the risk of weed introduction.

5.5 Dieback Management

Phytophthora dieback is identified as a key threatening process to MNES by a causing decline in vegetation health, sometimes leading to death of the vegetation. The offset area 1 at Cowalla has been assessed as dieback free, and the northern corner of offset 3 is mapped as dieback infected. The dieback status of offset site 2, 4 and 5 is unknown, dieback surveys will be undertaken at these sites prior to the commencement of the action. Dieback management at each offset site will be in consistent with the objective of DCCEEW's Threat Abatement Plan (DEE, 2014) for disease in natural ecosystems caused by *Phytophthora cinnamomi* as presented in Table 10 and in accordance with DBCA's Phytophthora Dieback Management Manual (DBCA, 2020).

Table 10 Dieback Management Actions

Threat Abatement Plan's Objective	Recommended Actions	Proposed Management Actions
Identify and prioritise protection of threatened species and ecological communities	<ul style="list-style-type: none"> Identify and prioritise species and ecological communities at risk Identify and map areas at risk of infection Improve and maintain monitoring program 	<ul style="list-style-type: none"> Strengthen information on dieback presence on each offset site and accordingly mapped. Dieback protectable area within the offset site and its surround will be identified and mapped. Fencing of offset area to exclude area from pests, herbivores, human and vehicle entry. Dieback management will be undertaken along with weed and fire management. Signage will be posted at the entrance and at the access points that provides information about the area and indicate that the area is prohibited from entry. Dieback protection areas will be designated and clean on entry signage posted. Machinery and vehicle hygiene inspection checklist will be maintained for each offset site as per the format prescribed by DBCA.
Reduce the spread and mitigate the impacts of dieback	<ul style="list-style-type: none"> Assess the feasibility of phosphite registration and implement application Implement risk mitigation, eradication and containment Integration of dieback management with other natural resource management system Promote the use of guidelines 	
Inform and engage the community through promotion of information on the impact of dieback	<ul style="list-style-type: none"> Develop and implement national communication strategy for awareness on dieback and promote measures to prevent the spread of the disease. Education and training Adopt signage and alert system to guide visitors and land managers. 	
Encourage research on dieback and its management	<ul style="list-style-type: none"> Undertake review of literature on Phytophthora biology or new research. Screening of priority species for susceptibility towards dieback. 	

In addition to the proposed management actions described above, the following dieback hygiene practices will also be carried out to prevent the risk of dieback spread or introduction:

- All vehicles and machinery entering the offset sites to undergo thorough wash down and inspection for any vegetation trapped on the undercarriage.
- Restrict the entrance of vehicles and machinery into the offset area during wet conditions to reduce the risk of spread of the pathogen.

Further, dieback management will also be in accordance with management of *Phytophthora cinnamomi* for Biodiversity Conservation in Australia-National Best Practice Guideline (O'Gara et al., 2005) and DPaW's Corporate Policy Statement No.3-Management of Phytophthora disease (DPaW, 2015).

6. Risk and Risk Management

Risk analysis was undertaken to assess the risk to achieving the specific outcomes described in section 4.2 posed by the currently identified threats such as grazing, uncontrolled fire, weed invasion and dieback. Measures will be implemented to minimise the associated risks as described in Section 5. DBCA's phytophthora dieback risk assessment and management plan form at Appendix 1 of the *Phytophthora Dieback Management Manual* (DBCA, 2020) provides a risk rating for dieback under different moisture conditions. The same matrix has been used for the risk assessment for other threatening processes. The risk matrix is provided in Table 11. The presence of dieback surrounding the offsets 1, and 3 are mapped according to the biological survey reports. The status of dieback presence at offset 2 is unknown and does not occur within DBCA's disease risk area. Similarly, offset 4 and offset 5 are not mapped within the forest disease risk area, however, the nearest disease risk area is located 18 km west. A high risk of dieback infection has been suggested, attributing to the offset sites being 'likely' to be infected by dieback, due to the presence of dieback in the surrounding area and potential spread by human and animals. The infection will have significant consequences due to the following:

- The dieback has potential to infest all protectable area in the offset areas.
- The impact is predicted to be high due to the presence of several susceptible species and infection may result in loss of the species' populations.
- The disease poses a risk on Banksia Woodland TEC, foraging habitat of Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC species.

Table 11 Risk Matrix used for Assessment of Risk of Threatening Processes

LIKELIHOOD	CONSEQUENCE				
	Insignificant	Minor	Intermediate	Significant	Severe
Very likely	Low	Moderate	High	High	High
Likely	Low	Moderate	Moderate	High	High
Possible	Low	Low	Moderate	High	High
Unlikely	Low	Low	Low	Moderate	Moderate
Very unlikely	Low	Low	Low	Low	Low

Source: DBCA

The risk rating has been carried out based on the likelihood of occurrence of the risk at the offset area and the extent of consequence it might lead to in the instances of risk occurrence. The result for risk assessment is as tabulated in Table 12.

Table 12 Risk Assessment of Threatening Processes on Offset Areas

Threatening Process	Potential Impact on the Offset Area	Inherent Risk Rating			Management Measures	Residual Risk Rating		
		L	C	Risk		L	C	Risk
Grazing	<ul style="list-style-type: none"> Loss of understory vegetation Loss of native vegetation through feeding and trampling Inhibit species recruitment Reduce species richness and diversity Alter species composition 	Likely	Significant	High	Section 5.2	Unlikely	Minor	Low
Clearing	<ul style="list-style-type: none"> Loss of native vegetation Loss of habitat for threatened Black Cockatoo species 	Unlikely	Significant	Moderate	Section 5.2	Very Unlikely	Significant	Low
Fire	<ul style="list-style-type: none"> Loss of native vegetation Loss of habitat for threatened Black Cockatoo species Loss of fauna 	Likely	Severe	High	Section 5.3	Unlikely	Severe	Low
Weed	<ul style="list-style-type: none"> Alter species composition Competition with native species for resources Reduce species richness, diversity and percentage cover 	Likely	Significant	High	Section 5.4	Unlikely	Minor	Low
Dieback	<ul style="list-style-type: none"> Decline of vegetation health that will lead to loss of breeding and foraging habitat for Black Cockatoos Alter vegetation structure Alter foliage cover Loss of food resources 	Likely	Significant	High	Section 5.5	Unlikely	Significant	Moderate

7. Monitoring

The overarching objectives of the monitoring program are to evaluate performance of the OMP against the performance indicators and completion criteria and accordingly to assist with the development and implementation of corrective actions if the criteria are not achieved. This allows evaluation and update of the OMP to include additional management actions as required.

7.1 Habitat Quality Monitoring

Baseline flora and vegetation surveys have been undertaken at offset sites 1, 3, 4 and 5, and a portion of offset site 2. Targeted Black Cockatoo surveys have been undertaken at offset sites 1, 3, 4 and 5. Detailed flora and vegetation surveys will be required upon implementation of this plan at offset sites, 4 and 5 and the remainder of 2 to establish a baseline and monitoring quadrats.

Habitat Quality assessments will be undertaken using the same quadrats as the baseline survey to enable statistical analysis of change over time at each quadrat. There is a 70% confidence that ecological benefit will be achieved at every site within 20 years, except for offset 2, where the ecological benefit for the rehabilitation is expected to be reached within ten years.

An assessment will be undertaken at each land acquisition offset site (site 1, 3, 4 and 5) within three years of the enactment of the offset site MOUs, and every 3 years thereafter for 20 years or until the completion criteria is achieved.

Habitat Quality Assessments will be undertaken annually at offset 2 for a period of ten years.

Habitat quality assessment will be carried out for both the BWSCP TEC and foraging habitat for three Black Cockatoo species using DCCEEW's habitat quality scoring tool (HQS). The tool allocates habitat quality scores based on the following three indicators:

- Site condition: assessment of vegetation condition and structure in comparison to the benchmark.
- Site context: assessment of the offset area in relation to surrounding environment.
- Species habitat index: the ability of the offset site to support the species.

This OMP will be reviewed after each monitoring event to determine what amendments to management actions are required, if any, to ensure progress towards the nominated completion criteria.

7.2 Photo-point Monitoring

Photo monitoring will be undertaken at designated locations. These will be aligned with photo-points used for the baseline assessment where possible. Photo monitoring will be used to provide a visual record of changing site conditions over time. Each photograph will have location, date and time at which it was recorded. The photo-point monitoring will be undertaken during the habitat quality assessments.

7.3 Performance Indicators and Completion Criteria

The following performance indicators will be assessed during each habitat quality assessment to assess the performance of the OMP against the completion criteria outlined in Table 13

Table 13 Completion Criteria for Offset Management Outcomes

Performance Indicator	Completion Criteria
Vegetation Condition	No decline in vegetation condition (Keighery 1994) compared to baseline
Weed Cover	Weed cover does not negatively impact natural regeneration or revegetation
Species Richness	No decline in species richness compared to baseline
Foliage Cover	Increase in foliage cover compared to baseline. Offset 1: minimum foliage cover of greater than 30% for Carnaby's Cockatoos foraging species. Offset 2: minimum foliage cover of 26% post revegetation.

Performance Indicator	Completion Criteria
	Offset 3: minimum foliage cover of greater than 40%. Offset 4: minimum foliage cover of greater than 40% of species suitable for Carnaby's and greater than 30% for Baudin's and FRTBC. Offset 5: minimum foliage cover of greater than 50% for Carnaby's and FRTBC and greater than 40% for Baudin's Cockatoo.
Presence of Dieback	No introduction of dieback into "Protectable Areas" as identified in the baseline surveys

The completion criteria for offset site 2 will be as per the Neaves Road Revegetation Plan (**Appendix 1**).

8. Evaluation, Reporting and Contingency Management

Management actions will be evaluated against the performance indicators to assess effectiveness towards achieving the completion criteria, by assessing the change in vegetation condition and structure relative to the baseline. This will enable management actions to be strengthened and identify corrective actions to achieve the required outcomes.

Progress against the objectives of this OMP will be reported in accordance with the schedule outlined in Table 14.

Table 14 Reporting Schedule

Reports	Reporting Period	Responsibility
Annual compliance report in accordance with the EPBC Act Annual Compliance Report Guideline.	Annually	Main Roads
Evaluation report assessing the effectiveness of management actions comprising the monitoring reports, management actions and investigations and corrective actions, if taken.	Every 3 years	
Habitat quality assessment report for both BWSCP TEC and respective Black Cockatoo species.	As per section 7.1	
Internal review outlining the effectiveness of the OMP in achieving the conservation outcomes and suggesting additional management measures, if required.	Every 5 years	

Where monitoring results indicate that management actions are not working, contingency measures will be triggered. Contingency measures will include corrective actions guided by expert opinion and will result in necessary revisions of the management measures and monitoring program. The revisions will be documented in accordance with Main Roads document control procedure. The corrective actions would include:

- Increase in monitoring frequency.
- Further survey works to better understand the factors that are influencing the unanticipated changes in the environment.
- Change in approach to weed control.
- Change in weed treatment application technique.

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Appendix 1 - Revegetation Plan for Offset 4 Neaves Road



Greater Connect
ALLIANCE

Great Eastern Highway Bypass Interchanges Neaves Road Revegetation Plan



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Client Main Roads Western Australia

Document Owner Environment

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Table of Contents

Abbreviations	5
1. Introduction	6
1.1 Background.....	6
1.2 Environmental Approvals and Conditions	6
1.3 Documentation	6
1.4 Objectives	6
2. Site Description	7
2.1 Site Location and Size	7
2.2 Land Tenure	7
2.3 Existing and Previous Land Uses	7
2.4 Climate	7
2.5 Landform and Soils	7
2.6 Dieback Status	7
2.7 Vegetation.....	7
2.8 Fauna	8
2.9 Weeds	8
3. Objectives, General Strategy and Completion Criteria	10
3.1 General Objectives.....	10
3.2 General Revegetation Strategy	10
3.3 Completion Targets.....	11
3.4 Reference Site.....	11
4. Management Strategy Concept	12
4.1 Zone 1 – Partial Revegetation.....	12
4.2 Zone 2 – Full Revegetation	12
4.3 Zone 3 – Wetland Protection (Weed Control Only)	12
5. Implementation Methodology	13
5.1 Weed Management.....	13
5.2 Surface Preparation	13
5.3 Species Selection.....	13
5.4 Seedling Propagation.....	13
5.5 Seedling Planting	14
5.6 Plant Protection – Fences and Tree Guards.....	14
5.7 Scheduling	14
6. Monitoring, Maintenance and Contingencies	15
6.1 Monitoring	15
6.2 Site Maintenance Activities.....	16
6.3 Contingency Actions	16
6.4 Reporting	16
6.5 Handover and Vesting	17
7. References	18
Appendix 1 – Location Map	19
Appendix 2 – Revegetation Map	20
Appendix 3 – Tubestock List	21
Appendix 4 – Indicative Revegetation Schedule	22

List of Figures (in Text and Appendices)

Figure A 1 Design for Monitoring Quadrats..... 15

Appendix 1 Figure 1 Offset Site Location for Lot 156 Neaves Road, Bullsbrook..... 19

Appendix 2 Figure 2 Revegetation Plan for Lot 156 Neaves Road, Bullsbrook..... 20

List of Tables (in Text and Appendices)

Table 1 Weed Species List..... 8

Table 2 Completion Targets and Criteria..... 11

Appendix 3 Table 3 Tubestock Species and Allocations 21

Appendix 4 Table 4 Indicative Revegetation Schedule..... 22

Abbreviations

Abbreviation	Details
CCW	Conservation Category Wetland
DPIRD	Department of Primary Industry and Regional Development
FRTBC	Forest Red-tailed Black Cockatoo
GCA	Greater Connect Alliance
GEHBI	Great Eastern Highway Bypass Interchange
MRWA	Main Roads Western Australia
NIASA	Nursery Industry Accreditation Scheme of Australia

1. Introduction

1.1 Background

The Greater Connect Alliance (GCA) was commissioned by Main Roads Western Australia (MRWA) to prepare a revegetation plan for the Neaves Road offset site. The site forms part of the offset proposal prepared for the Great Eastern Highway Bypass Interchanges (GEHBI) project, which includes the upgrade of two major interchanges at Roe Highway and Abernethy Road in Perth's Eastern Metropolitan Region. This plan details the extent of revegetation activities to be undertaken, as well as the scheduling required for achieving successful outcomes in the short and long terms.

1.2 Environmental Approvals and Conditions

Both State and Commonwealth legislation require a series of offsets to be implemented to mitigate the residual environmental impacts for the project. Offset proposals have been prepared and submitted that detail how GCA intends to meet the offset requirements (GCA 2022; GCA 2022a). As part of the offset proposal, GCA is proposing to revegetate and restore 29.6 hectares (ha) for the Neaves Road offset site.

1.3 Documentation

The report is based on information and findings from the following documentation:

- Draft EPBC Offset Strategy (GCA, 2022) – prepared for the GEHBI Project.
- CPS 94481 Offset Proposal (GCA, 2022a) – prepared for the GEHBI Project.
- Rutland Road Ecological Surveys (AECOM Australia Pty Ltd, 2020).
- Perth-Darwin National Highway (Swan Valley Section), Public Environmental Review (Coffey, 2015).

1.4 Objectives

The objectives of this plan are to:

1. Provide an action plan by quantifying material requirements and detailing strategies for the rehabilitation works.
2. Capitalise on existing features of the site.
3. Minimise further impacts to existing vegetation.
4. Improve the aesthetics and conservation values of the site.
5. Ensure that rehabilitation measures will be successful in both the short and long terms.

By achieving these objectives, GCA aims to enhance the existing Black Cockatoo Foraging Habitat and Conservation Category Wetland (CCW) ecological values of the Neaves Road site.

2. Site Description

2.1 Site Location and Size

The site is approximately 35 km north of the Perth CBD and 25 km north of the Project proposal (**Appendix 1 Figure 1 Offset Site Location for Lot 156 Neaves Road, Bullsbrook**). The site is 29.6 ha in size and is bordered by Neaves Road to the south and Tonkin Highway to the west (GCA, 2022a). The site is intersected by one Bush Forever site - Site 100.

2.2 Land Tenure

The site is defined as Lot 156 on Plan P056488, Bullsbrook, City of Swan (GCA, 2022a).

2.3 Existing and Previous Land Uses

The site consists of mixed land-use agricultural and residential with patches of remnant and revegetated vegetation. Native vegetation is most prominent in the centre and south-west corner of the site, with revegetated vegetation occurring mostly in the north-east corner. A strip of cleared vegetation is visible along the northern boundary (Coffey, 2015).

2.4 Climate

Climate data was obtained from the Pearce Royal Australian Air Force Base (weather station number 009053), located approximately 4.6km south-east of the site. Climate for the area is described as Mediterranean, with warm, dry summers and cool wet winters. Summer occurs from December to February with mean maximum temperatures ranging from 30.6°C to 33.3°C and mean minimum temperatures ranging from 14.6°C to 17.6°C. Winter occurs from June to August with mean maximum temperatures ranging from 17.9°C to 19.0°C and mean minimum temperature ranging from 8.2°C to 9.3°C. Mean annual rainfall in the area is 655.6 mm (Bureau of Meteorology, 2023).

2.5 Landform and Soils

The site is located within the Yanga System, which is often characterised by poorly drained plains with pale sands (DPIRD-027). The site is described as pale sands overlying siliceous / humic pans, bog iron and clay. It has sandy rises on a flat to gently sloping plain with occasional low dunes and drainage depressions. The soils in the area are yellowish brown duplex and poorly structured clay soils often with pans underlying (DPIRD-064).

2.6 Dieback Status

Dieback (*Phytophthora cinnamomi* or other *Phytophthora* species) is an introduced plant pathogen that occurs throughout the southwest of Western Australia. The pathogen travels through soil-water and attacks the roots of many native plant species.

The dieback status of the site is currently unknown, although according to the Forest Disease Risk Areas DBCA dataset (DBCA-024), *Phytophthora* occurrence does not extend to the site. Given the uncertainty of dieback occurrence in the area, precautionary dieback hygiene practices should be implemented during revegetation works.

2.7 Vegetation

The site is located within the Yanga vegetation complex of the Swan Coastal Plain. According to the Flora and Vegetation Assessment for Perth-Darwin National Highway (Swan Valley Section), the site is comprised of six vegetation units (listed in order of area coverage – greatest to least):

1. **Revegetated *Corymbia* sparse mid woodland (R)** – *Corymbia calophylla*, *Eucalyptus camaldulensis* and *Eucalyptus todtiana* low woodland over *Calothamnus quadrifidus* and *Banksia nivea* sparse mid shrubland over *Bromus diandrus* and *Ehrharta calycina* sparse mid grassland over *Ursinia anthemoides* and *Hypochaeris glabra* sparse low herbland (Revegetation site)
2. ***Corymbia* sparse mid woodland (CcEr³)** – Open paddocks with remnant *Corymbia calophylla* and *Eucalyptus rudis* subsp. *rudis* over pasture species (introduced) dominated by *Cenchrus clandestinus*
3. ***Melaleuca* open low woodland (MpMr)** – *Melaleuca preissiana* and *Melaleuca raphiophylla* low (open) woodland over *Zantedeschia aethiopica* and *Typha orientalis* open mid herbland.

4. **Cleared (CI)** – Cleared areas, consisting of paddocks, infrastructure corridors (i.e. Roads and Highways), and building envelopes (i.e. residential housing, industry etc.)
5. ***Eucalyptus* sparse mid Woodland Creek line/floodplain (Er⁵)** – *Eucalyptus rudis* subsp. *rudis* sparse mid woodland over *Melaleuca preissiana* and *Melaleuca raphiophylla* low woodland over **Zantedeschia aethiopica* and **Rorippa nasturtium-aquaticum* open mid herbland
6. ***Melaleuca* open low woodland (MP⁷)** – *Melaleuca preissiana* sparse to open low woodland over **Zantedeschia aethiopica* sparse tall herbland over **Cenchrus clandestinus* and **Holcus lanatus* sparse mid grassland (Coffey, 2015).

The site has been historically cleared, particularly in the north-east corner and northern border of the site. Most of the remnant vegetation extents (CcEr³, MpMr, Er⁵, MP⁷) occur within the centre and south-west corner of the site. Native vegetation was mapped as ranging from Degraded-Completely Degraded to Good-Degraded condition.

Further assessment and a detailed description of vegetation will be provided on approval.

2.8 Fauna

The wetland fauna habitat comprises *Melaleuca* open low woodland, providing high quality foraging habitat for Carnaby's Cockatoo and moderate quality for the Forest Red-tailed Black Cockatoo (FRTBC). The modified habitat provides low quality habitat for Carnaby's Cockatoo and comprises sparse mid woodland (Marri) and paddocks with Marri (GCA, 2022a). A survey conducted by AECOM in 2020 observed six Carnaby's Cockatoo flying over the area and foraging evidence (chewed Marri nuts) (AECOM, 2020).

2.9 Weeds

A significant portion of the site is weedy, as is evident from the vegetation assessment undertaken by Coffey (2015). The understory of all vegetation units (exempting cleared areas) is dominated by introduced flora. Weeds are likely to be most prominent in the north-east corner marked as revegetated.

The south-east corner of the site was extensively surveyed via three quadrats (Site 3, 4, and 5) by AECOM in 2020. The three quadrats intercept the four most dominant vegetation units (R, CcEr³, MpMr, CI), therefore representing a vast majority of the vegetation composition for the site. Coffey's 2014 survey covers the remaining two vegetation units, with the *Eucalyptus* sparse mid Woodland Creek line (Er⁵) occurring exclusively within the offset site, and the *Melaleuca* open low woodland (MP⁷) recorded in only one other location slightly north of the offset site. Only one additional weed (*Cenchrus clandestinus*) was identified for the two remaining vegetation units assessed by Coffey. Weeds recorded across the offset site are included in **Table 1**.

Table 1 Weed Species List

Species	Common Name
<i>Arctotheca calendula</i>	Cape dandelion
<i>Briza maxima</i>	Greater quaking-grass
<i>Bromus</i> sp.	-
<i>Cenchrus clandestinus</i>	Kikuyu grass
<i>Cynodon dactylon</i>	Bermuda grass
<i>Dittrichia</i> sp.	-
<i>Holcus lanatus</i>	Yorkshire fog
<i>Hypochaeris radicata</i>	Flatweed
<i>Lysimachia arvensis</i>	Scarlet pimpernel
<i>Phytolacca octandra</i>	Inkweed
<i>Ranunculus muricatus</i>	Spinyfruit buttercup

Species	Common Name
<i>Rorippa nasturtium-aquaticum</i>	Watercress
<i>Rubus ulmifolius</i>	Elmleaf blackberry
<i>Rumex acetosella</i>	Red sorrel
<i>Sonchus oleraceus</i>	Common sowthistle
<i>Zantedeschia aethiopica</i> *	Calla lily

* Represents weed of national significance (likely to be most problematic towards revegetation efforts)

3. Objectives, General Strategy and Completion Criteria

For the purpose of this plan, a total of 29.6 hectares has been identified for revegetation and / or weed management efforts (GCA, 2022a). There are two primary objectives for the revegetation and land management of the site:

1. Protect and enhance existing Black Cockatoo Foraging Habitat.
2. Conserve and enhance the CCW and associated vegetation.

To maximise the likelihood of achieving the above objectives, three management zones have been established based on the existing quality and vegetation composition of the offset site, with differing strategies adopted for each:

- Zone 1 – Partial revegetation.
- Zone 2 – Full revegetation.
- Zone 3 – Wetland protection/weed control (**Appendix 2 Figure 2 Revegetation Plan for Lot 156 Neaves Road, Bullsbrook**).

The general objectives and strategy for the management areas are detailed below, although the strategies will be adaptable and based on learnings from on-going revegetation works across the site. Variations to the management strategies will be agreed with the EPA prior to implementation.

3.1 General Objectives

The objectives for the revegetation of Black Cockatoo Foraging Habitat and CCW include:

- Retention and management of existing native vegetation.
- Management of problematic weed species.
- Revegetation of bare and degraded areas to increase plant density and species richness.
- Re-establish key plant species found within the Yanga vegetation complex.

3.2 General Revegetation Strategy

The general strategy for revegetation will consist of the following works:

- Site Preparation (Year 1):
 - Weed control up to four times in 12 months in advance of revegetation activities, depending on weeds present and severity of infestations (most likely timing: mid-winter, mid-spring, early summer, late autumn)
 - Scalping for the most degraded areas of the site will occur to remove the top 5 – 10 cm of soil, containing the highest concentrations of weed seeds and surface biomass. Scalping is to occur in late summer or autumn following pre-treatment of weeds and allowing for the weed biomass to break down prior to removal
 - Ripping to a depth of 0.5 m to break up the subsoil to improve water infiltration and plant root development. Ripping is to occur during late summer / early autumn (dry conditions) during the year of revegetation
 - Installation of a 1.8 m tall protection fence and rabbit-proof skirt (buried to a depth of 30 cm) to prevent destructive grazers such as kangaroos and rabbits from entering the revegetation areas.
- Initial Revegetation Works (Year 2):
 - Pre-revegetation weed control in autumn / winter
 - Tubestock installation during winter, factoring in existing plant densities and completion targets for each zone.
- Maintenance (Years 3 – 5):
 - Monitoring and maintenance to ensure the completion criteria are achieved at the end of the maintenance period (three years from the anniversary of installation practical completion). This will include weed control up to four times per year, infill planting and fence maintenance as required.

Section 4 provides details where zones have additional requirements, or only some of the techniques detailed in the General Revegetation Strategy are to be used.

3.3 Completion Targets

Table 2 shows the completion targets for the site. All zones will be formally assessed each spring and autumn following the initial revegetation works. All monitoring reports will capture data for comparing progress with completion targets, and maintenance activities will be undertaken in response to these assessments. When assessing completion targets for plant densities and species richness, existing plants and seedlings observed from natural germination will be included in these assessments.

Table 2 Completion Targets and Criteria

Target	Completion Criteria
To rehabilitate and manage 29.6 ha of predominantly degraded Yanga vegetation complex.	<p>Rehabilitation of 29.6 ha of Yanga vegetation complex completed. After five years, the offset site will meet the following rehabilitation completion criteria:</p> <ul style="list-style-type: none"> • Average species richness > 9 native species per 100m² • Foliage cover of native species across the rehabilitated site is at least 100% of the foliage cover at the reference site (26%)*. • Weed coverage is a maximum of 15% across the rehabilitated site. • The revegetated site contains no declared weeds or WONS. • Number of active rills deeper than 150 mm is no more than 5 per hectare.

*Foliage cover % for reference site taken from Coffey Environments Australia (2015a).

3.4 Reference Site

The completion targets were established using a nearby reference site (SVB089) located south of the revegetation site. The reference site was chosen due to its proximity and similarity to the Yanga complex, and consists of vegetation association Er6, which is described as:

“*Eucalyptus rudis* subsp. *rudis* sparse mid woodland over *Melaleuca raphiophylla* sparse low woodland over **Lolium rigidum*, **Ehrharta longiflora* and **Cenchrus clandestinus* low grassland (*Eucalyptus* sparse mid woodland)” (Coffey, 2015a, p49).

The reference site contains a relatively intact overstory, although the understory consists of a mix of grassy and herbaceous weeds. Considering this, the completion criteria was set to exceed the reference site species richness by 300% (at least nine species / 100m²), and to establish at least 100% of the foliage cover by the end of the maintenance period. For the purposes of this report, the foliage cover of 26% has been taken from the reference site sampling data (Coffey Environments Australia, 2015a).

4. Management Strategy Concept

A Management strategy has been developed for each revegetation zone. Refer to the attached Revegetation Map (**Appendix 2 Figure 2 Revegetation Plan for Lot 156 Neaves Road, Bullsbrook**) for an overview of revegetation zones. A 1.8 m tall fence and rabbit-proof skirt (buried to a depth of 30 cm) will be installed around the entire offset site encapsulating all zones.

4.1 Zone 1 – Partial Revegetation

Zone 1 – Partial Revegetation accounts for 19.01 ha of the offset site and is comprised of one large patch located in north-east half of the site (16.76 ha) and a small patch in the south-west corner (2.25 ha). The zone is entirely revegetated or remnant *Corymbia* sparse mid woodland, with a *Corymbia calophylla* and *Eucalyptus rudis* subsp. *rudis* dominated canopy. The understory is comprised of a variety of grasses and herbaceous weeds including **Bromus diandrus* and **Ehrharta calycina*.

Works in Zone 1 will involve targeted weed control to allow natural regeneration of native species within the existing canopy, as well as infill planting of bare areas to increase the overall plant density and species richness. The site will then be ripped prior to tubestock planting in winter.

Works will be undertaken as follows:

1. One year of herbicide application targeting seasonal weeds.
2. Installation of a 1.8 m pest control fence and targeted rabbit control (if required).
3. Ripping to a depth of 0.5 m to reduce compaction and break up the subsoil.
4. Installation of tubestock to bare areas at 1 plant / 2 m².
5. Targeted spot spraying of weeds for the duration of the maintenance period.
6. Infill planting as necessary.

4.2 Zone 2 – Full Revegetation

Full revegetation is planned for completely degraded and cleared areas that are predominantly found in the north-west corner of the site characterised by open paddocks. The area is 5.04 ha with very few trees scattered across the Zone. The few trees that are present are mostly *Corymbia calophylla* and *Eucalyptus rudis* subsp. *rudis* over introduced pasture species dominated by **Cenchrus clandestinus*.

Works will initially involve broadscale herbicide applications to reduce the weed load. Scalping of the site will occur to remove the top 5 – 10 cm of soil, containing the highest concentrations of weed seeds and surface biomass. The site will then be ripped prior to tubestock planting in winter.

Works will be undertaken as follows:

1. One year of herbicide application targeting seasonal weeds.
2. Installation of a 1.8 m pest control fence and targeted rabbit control (if required).
3. Scalping to remove the top 5 – 10 cm of soil to remove weeds and weed seeds.
4. Ripping to a depth of 0.5 m to reduce compaction and break up the subsoil.
5. Installation of tubestock to bare areas at 1 plant / 2 m².
6. Targeted spot spraying of weeds for the duration of the maintenance period.
7. Infill planting as necessary.

4.3 Zone 3 – Wetland Protection (Weed Control Only)

Zone 3 is 5.24 ha and mostly comprised of *Melaleuca* open low woodland (MpMr), containing a canopy dominated by *Melaleuca preissiana* and *Melaleuca raphiophylla*. The area was assessed by Coffey (2015) as good to degraded condition, with degraded locations mostly impacted by understory weeds including **Zantedeschia aethiopica* and **Typha orientalis*.

As the wetland has a relatively well-established canopy of *Melaleuca*, the works will be primarily focused on targeted spot spraying of weeds to promote understory native growth for the duration of the management period.

5. Implementation Methodology

5.1 Weed Management

Herbicide application will take place during the key weed growth periods of autumn, winter, spring, and summer. Herbicides will be selected for the target species, considering the surrounding environment and the constraints this may present. Amongst remnant native vegetation, selective herbicides (i.e. grass or broadleaf-specific) will be favoured over general knockdown herbicides to keep off-target damage to a minimum. In the wetland areas, only herbicides considered safe for use in these environments will be applied (e.g. RoundUp Biactive).

Herbicide spraying technicians will:

- be appropriately qualified and licensed in herbicide application
- have demonstrated experience in the ability to identify, and distinguish between, native and weed species
- be familiar with the most appropriate control measures, timing, herbicides, and application rates for the target species.

5.2 Surface Preparation

For revegetation to have the greatest likelihood of success, the soil surface must be adequately prepared to promote natural recruitment and ensure that seedling survival and development rates are maximised. Ripping will be undertaken in all appropriate areas to increase water infiltration and alleviate compaction issues created by past stock and vehicle movements. Scalping will also be undertaken for Zone 2 to remove weeds and weed seeds and optimise native seedling survival.

5.2.1 Scalping

Scalping involves complete removal of the surface soil to a depth of approximately 5 – 10 cm. This technique results in removal of weed biomass and any weed seeds that exist in the surface layer of topsoil and can be an effective method of weed control where a significant weed-seed load occurs. Scalping is usually undertaken using a front-end loader or grader, depending on the size of the revegetation site.

Material removed from revegetation areas is either taken off site and disposed of, buried on site to a depth where weed seeds are unlikely to germinate, or mounded into windrows on the revegetation site. The windrows are then sprayed to manage re-emerging weeds. The most appropriate option will be selected at the time, taking into consideration all constraints presented by the site.

5.2.2 Ripping

The purpose of ripping is to alleviate soil compaction and promote plant root development. Ripping is undertaken by using tines attached to a tractor or other larger earthmoving equipment. The soil is ripped to a depth of approximately 0.5 m, and in lines approximately 1 m apart and perpendicular to the fall of the slope. Ripping is undertaken during late summer or early autumn for sites with heavier soils, or late autumn / early winter for sandy soils. Ripping for heavier soils should occur when they are dry so that the profile is 'fractured', whereas sandy soils should be damp before ripping.

5.3 Species Selection

Species selection has been compiled based on remnant native vegetation in the area, past biological surveys of the offset site, and comparative areas of Yanga complex bushland with high quality native vegetation (Coffey, 2015; AECOM, 2020). The tubestock list has been attached with this document (**Appendix 3 Table 3 Tubestock Species and Allocations**).

The occurrence of dieback on site may affect the selection of species for revegetation sites. Should dieback be found to occur, the use of susceptible species, such as those in the Proteaceae family, may be limited or omitted completely.

5.4 Seedling Propagation

Seedlings will be sourced from local provenance where possible and propagated either in forestry tubes (50 mm x 50 mm x 125 mm) or deep cells (34 mm x 34 mm x 90 mm). These pots produce seedlings of good root ball size and transfer well from the pot to final environment.

Plant orders will be ideally placed in spring the year before planting to ensure sufficient seedlings are available (subject to seed availability and species propagation timing). Seedlings will be grown by nurseries that are accredited by the Nursery Industry Accreditation Scheme of Australia (NIASA) which will increase the quality of supplied material.

5.5 Seedling Planting

Planting of seedlings will commence after the season's first major rains occur (typically May / June) when the soil is sufficiently wet to plant without the need for additional watering. All planting work should be completed before the end of the wet season to take maximum advantage of the seasonal rainfall.

5.6 Plant Protection – Fences and Tree Guards

Fencing will be implemented to control access to the site and mitigate the spread of weeds, dieback, invasive species, and destructive grazing in alignment with the offset proposal (GCA, 2022). Tree guards will be used if grazing within the site is suspected to remain a problem after the fence installation.

5.6.1 Fencing and Firebreaks

Fences will be 1.8 m tall and made of either chainmesh or ring lock, supported by solid steel posts for corners and star pickets along each edge. A rabbit-proof skirting will be installed along the bottom of the fence using 40 mm rabbit netting which extends a minimum of 30 cm above the ground and is buried to a depth of 30 cm below ground. In some areas, burying the rabbit skirt may be impractical due to the hard soil and / or tree roots; in this case the skirt will be bent into an L shape and pinned to the ground surface. At least two access gates (with rabbit skirt) large enough to allow a vehicle to enter for weed control will be installed.

Firebreaks will be installed to three metres width along the internal and external perimeters of protection fencing. Firebreaks should be annually maintained to keep the tracks free of any vegetation and debris. They will also be used to provide maintenance access.

5.6.2 Tree Guard Specifications

If required, tree guards will be constructed of corflute and installed using a single hardwood stake driven into the ground. Tree guards are typically left on the plant until the end of the first summer after planting.

5.7 Scheduling

An indicative schedule of works is provided in **Appendix 4 Table 4 Indicative Revegetation Schedule**. The timing for works will ultimately be dependent on seasonal variations, site access constraints and weed germination timings.

6. Monitoring, Maintenance and Contingencies

To ensure the project is successful in the long-term, monitoring will be undertaken at the site. At the end of the maintenance period, assuming all targets have been achieved, the revegetation works will be deemed as complete.

6.1 Monitoring

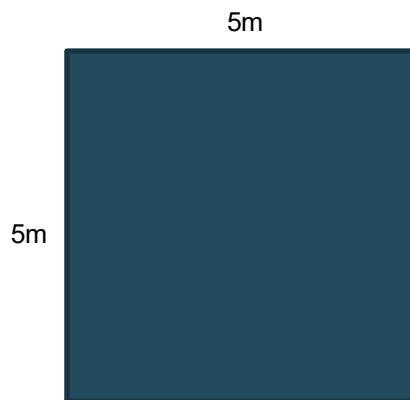
Revegetation progress will be formally monitored during autumn and spring of each year. The purpose of the formal monitoring is to assess the progress of revegetation against the completion criteria, and to initiate remedial action if required.

The first formal monitoring assessment will evaluate seedling transplant survival and provide initial indications as to the likelihood of longer-term revegetation success. The second assessment determines survival rates over the first summer period, and whether there has been any natural recruitment from existing native species.

The results of each formal monitoring assessment will be compared against previous data and the completion targets to determine growth and mortality rates and provide a quantitative measure of progress. Informal assessments will also be undertaken between formal monitoring events to visually monitor progress, and to identify and counter any emerging issues. Timing of the assessments will be adjusted to the appropriate stages of plant growth, which are influenced by annual weather conditions.

6.1.1 Monitoring Plot Establishment

One 5m x 5m monitoring plot will be established per hectare or part thereof in each revegetation zone for formal monitoring. Each location will be permanently marked with galvanised fence droppers and recorded with a GPS. For each quadrat a fixed photograph reference point will also be marked. The placement of plots will be as per a stratified random sampling design, where plots are located randomly but differences in topography, soils and other edaphic factors taken into consideration (**Figure A 1**).



Blue square = monitoring of new seedlings from germination

Figure A 1 Design for Monitoring Quadrats

6.1.2 Monitoring Methodology

Within each quadrat the following observations and records will be made:

1. Native stem count.
2. Identification of native species present.
3. Native foliage cover.
4. Identification of predominant weed species.
5. Weed foliage cover.
6. Erosion and site stability.
7. All other general factors that may be impeding or contributing to progress (e.g., evidence of grazing).

Analysis is a comparison of average monitoring parameters against the defined completion target. Data will either be 'meeting' or 'not meeting' the target for the given parameter. As further monitoring data is collected, a time series can be plotted to show the changes in given parameters.

These will assist with determining the likelihood of meeting the completion targets (e.g., if time series data indicate a trend of a given parameter increasing or decreasing).

6.2 Site Maintenance Activities

Maintenance of the revegetation sites will continue after the initial seedling planting program is completed. Maintenance of the revegetation sites may include:

- Weed control.
- Access control.
- Infill planting of tubestock.
- Tree guard removal (if installed).
- Fence maintenance.
- Pest management.
- Rubbish removal.
- Control of any other factors likely to influence the outcome.

It is anticipated that weed control will be required up to four times per year (spring, summer, autumn and winter). The extent of the control requirements (i.e. target species, area treated, etc.) will be determined through the monitoring program.

Infill planting will be carried out during winter periods as necessary (**Appendix 3 Table 3 Tubestock Species and Allocations**). The quantities required for infill planting will be calculated through monitoring each year to ensure the management zones remain on track to meet completion targets. Infill planting numbers will be determined by comparing actual plant densities to the required plant densities and installing the necessary number of plants to maximise the likelihood of meeting the completion targets in the longer term. Similarly, if species richness is not meeting completion targets, infill planting will concentrate on increasing species richness.

Where tree guards are used, maintenance is essential to ensure the guards do not collapse and impede plant development. Tree guards will be maintained regularly until their removal, generally either the end of the first summer, or until the plant growth becomes restricted by the guard.

Fence maintenance and rubbish removal will be carried out as required and can be undertaken at any time of the year.

6.3 Contingency Actions

The following contingency actions will be adopted if revegetation works are not tracking towards the completion targets within the specified timeframes:

- Evaluate the cause of revegetation failure/issues.
- Determine the appropriate corrective actions.
- Potential corrective actions may include:
 - Changes to species lists
 - Altered weed control scheduling
 - Altered herbicides or weed management techniques
 - Pest management.

6.4 Reporting

Reports are to be prepared after each monitoring event and following all activities (including maintenance). Reporting requirements include:

- Works summary, for example:
 - Number of seedlings installed
 - Weed control events undertaken
 - Other works
- Current status of the site against completion targets.
- Summary of data presented in tables or graphs.
- Photographs from fixed monitoring points.
- Current weed status of the site against completion targets for weed cover and priority / woody species.
- Recommendations for maintenance work required over next 12 months.

Maintenance activities are to be recorded as maintenance items are completed. Communication of maintenance activities should be limited to a summary of the works undertaken, the materials used and the location of the works. For example, tubestock installation should include a species list and quantities, site preparation undertaken (e.g., ripping), and reference to the revegetation zone that was planted.

6.5 Handover and Vesting

The site is currently owned by MRWA and was acquired as part of an earlier project (Northlink WA). Main Roads will retain ownership and management responsibility of the land for the course of the revegetation program.

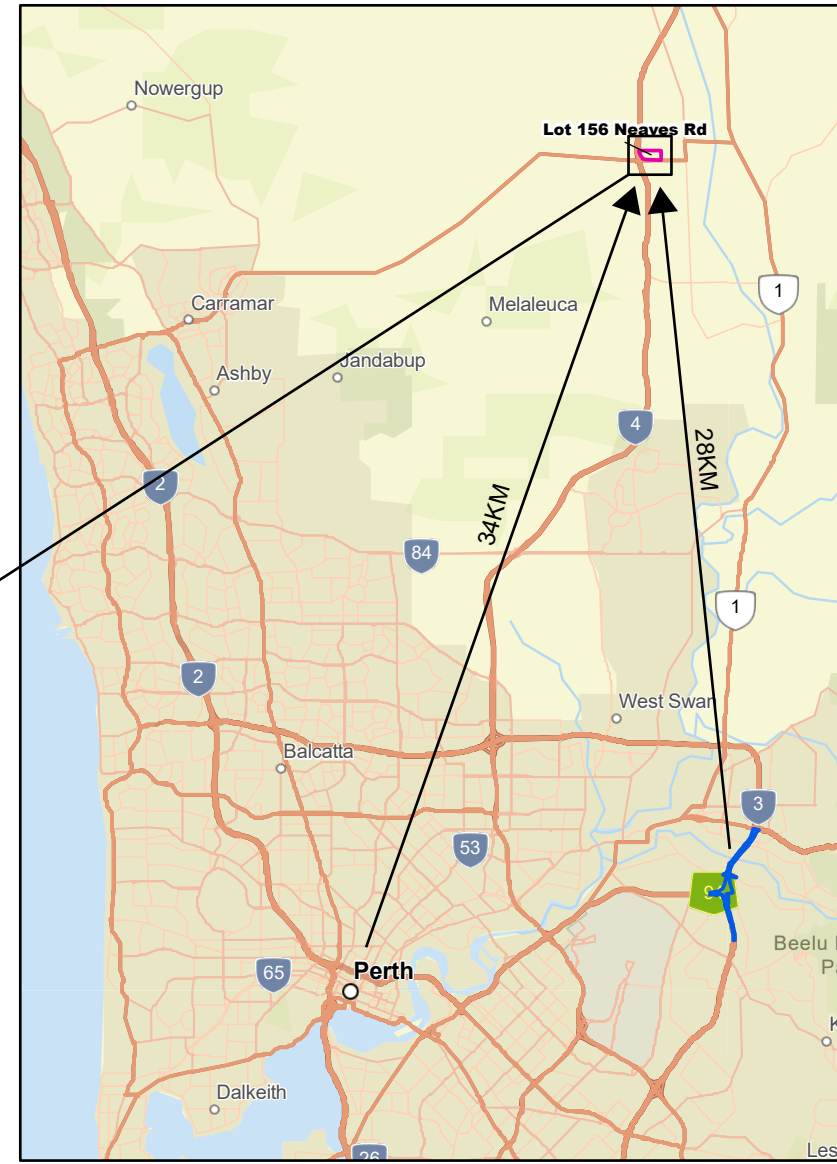
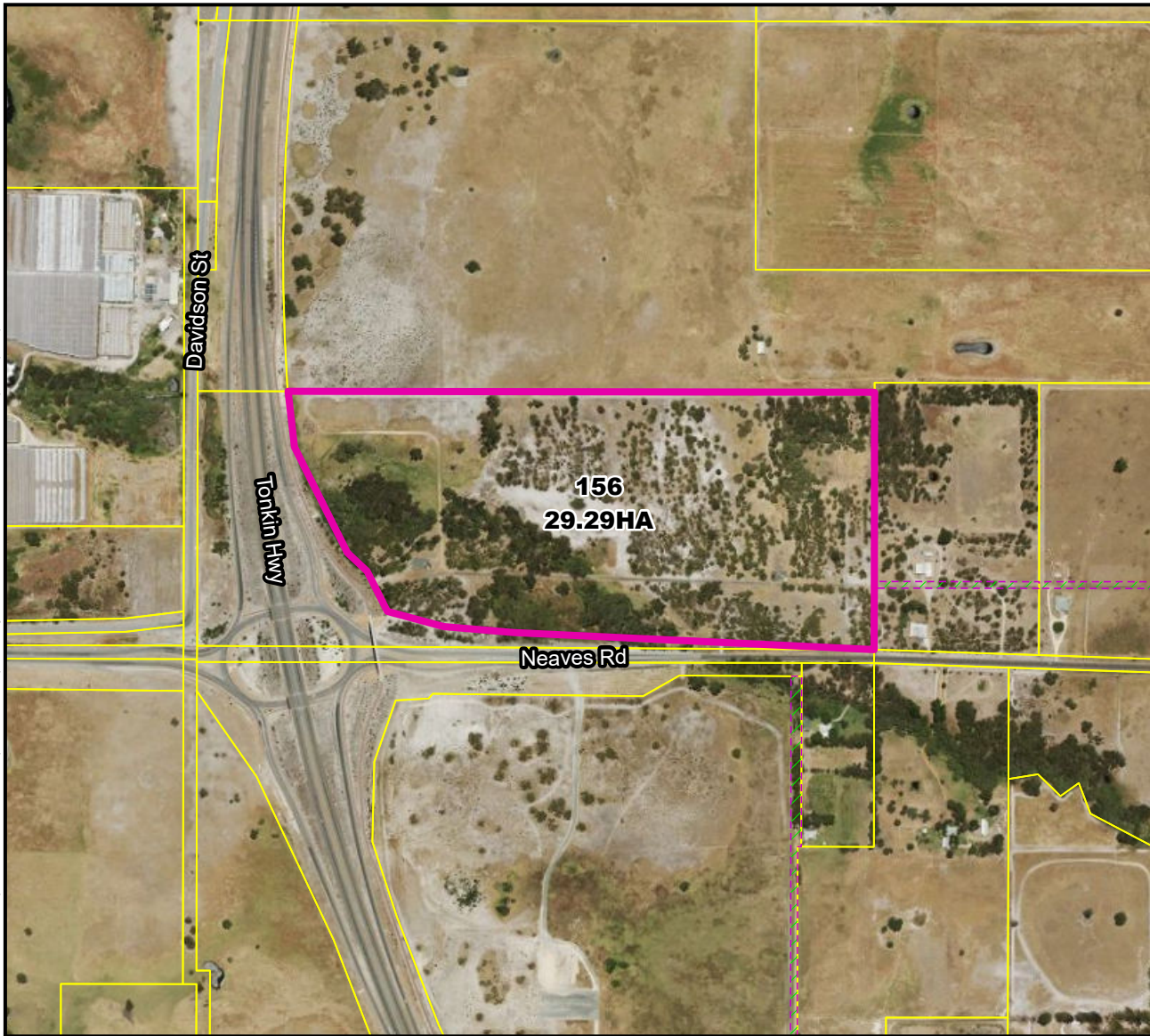
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Appendix 1 – Location Map

Appendix 1 Figure 1 Offset Site Location for Lot 156 Neaves Road, Bullsbrook

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DATUM GDA 1994 Perth Coastal Grid 1994

1:10,000
(when printed at A4)

Data sources:
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010), Geoscience Australia, Streetspro

LEGEND

- Lot 156 Neaves Rd, Bullsbrook
- Cadastre
- Easement
- WP4 Development Envelope – Assessed (8 Feb 22)

**GEHBI WP4 Offset Location
 Lot 156 Neaves Road, Bullsbrook**

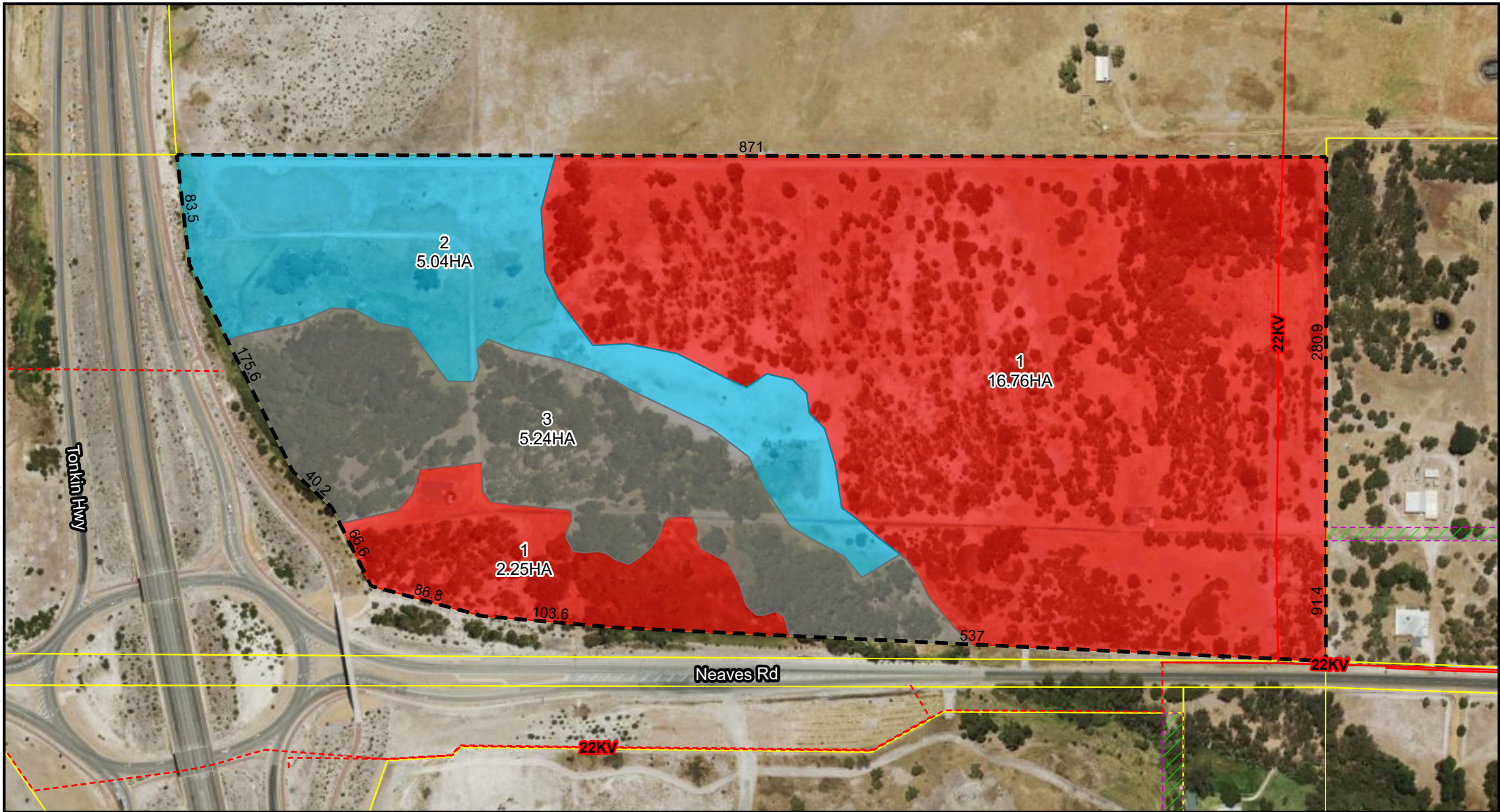
MAIN ROADS WA
 GREAT EASTERN HIGHWAY BYPASS
 INTERCHANGE PROJECT

**Figure
 1**

Appendix 2 – Revegetation Map

Appendix 2 Figure 2 Revegetation Plan for Lot 156 Neaves Road, Bullsbrook

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DATUM GDA 1994 Perth Coastal Grid 1994

1:4,000
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0 25 50 75 100
Metres

Data sources:
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010), Geoscience Australia, Streetspro

- LEGEND**
- Pest Control Fence (2,346.8m total length)
 - Revegetation Zones
 - Zone 1 - Partial Revegetation
 - Zone 2 - Full Revegetation
 - Zone 3 - Wetland/Weed Control
 - Distribution Overhead Powerlines (WP-031)
 - - - Distribution Underground Cables (WP-034)

Revegetation Plan
Lot 156 Neaves Road, Bullsbrook

MAIN ROADS WA

GREAT EASTERN HIGHWAY BYPASS
 INTERCHANGE PROJECT

Figure
2

Appendix 3 – Tubestock List

Appendix 3 Table 3 Tubestock Species and Allocations

Species	Common Name	Form	Zone 1*	Zone 2**	Total
<i>Actinostrobus pyramidalis</i>	Swamp cypress	Shrub	1560	1040	2600
<i>Allocasuarina obesa</i>	Sheoak	Tree	2040	1360	3400
<i>Allocasuarina humilis</i>	Dwarf Sheoak	Shrub	1560	1040	2600
<i>Astartea scoparia</i>	Recherche Astartea	Shrub	2055	1370	3425
<i>Baumea juncea</i>	Bare Twig rush	Sedge	1740	1160	2900
<i>Callitris pyramidalis</i>	Swamp Cypress	Shrub	2460	1640	4100
<i>Casuarina obesa</i>	Swamp Sheoak	Tree	2055	1370	3425
<i>Corymbia calophylla</i>	Marri	Tree	4650	3100	7750
<i>Eucalyptus tottiana</i>	Coastal Blackbutt	Tree	3180	2120	5300
<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	Flooded Gum	Tree	2700	1800	4500
<i>Hakea varia</i>	Variable-leaved Hakea	Shrub	1560	1040	2600
<i>Hypocalymma angustifolium</i>	no common name	Shrub	4230	2820	7050
<i>Jacksonia furcellata</i>	Grey Stinkwood	Shrub	2490	1660	4150
<i>Juncus pallidus</i>	Pale Rush	Sedge	4230	2820	7050
<i>Kunzea glabrescens</i>	Spearwood	Shrub	4230	2820	7050
<i>Lepidosperma longitudinale</i>	Pithy Sword-sedge	Sedge	2700	1800	4500
<i>Melaleuca lateritia</i>	Robin Red-breast Bush	Shrub	2055	1370	3425
<i>Melaleuca preissiana</i>	Stout Paperbark	Tree	4230	2820	7050
<i>Melaleuca phoenicea</i>	Scarlet Bottlebrush	Shrub	2700	1800	4500
<i>Melaleuca raphiophylla</i>	Swamp Paperbark	Tree	4230	2820	7050
<i>Melaleuca teretifolia</i>	Paperbark	Shrub	2055	1370	3425
<i>Pericalymma ellipticum</i>	Swamp Tea-tree	Shrub	2640	1760	4400
<i>Persoonia saccatta</i>	Snotty gobbler	Shrub	1560	1040	2600
<i>Regelia inops</i>	no common name	Shrub	2760	1840	4600
<i>Regelia ciliata</i>	Regelia	Shrub	1560	1040	2600
<i>Taxandria linearifolia</i>	Swamp Peppermint	Shrub	4620	3080	7700
<i>Verticordia plumosa</i> var. <i>brachyphylla</i>	Plumed Feather flower	Shrub	300	200	500
Total	-	-	72,150	48,100	120,250

*Zone 1 makes up approximately 80% of the proposed revegetated area. Given the area only needs to be partially revegetated, 60% of the total seedling allocation has been allocated to this Zone.

**Zone 2 makes up approximately 20% of the proposed revegetated area. Given the area needs to be fully revegetated, 40% of the total seedling allocation has been allocated to this Zone.

Appendix 4 – Indicative Revegetation Schedule

Appendix 4 Table 4 Indicative Revegetation Schedule

*Note: schedule is indicative and based on seasonal variations.

Description/Timing	Win-23	Spr-23	Sum-23	Aut-24	Win-24	Spr-24	Sum-24	Aut-25	Win-25	Spr-25	Sum-25	Aut-26	Win-26	Spr-26	Sum-26	Aut-27	Win-27	Spr-27	Sum-27	Aut-28
Initial Works*																				
Pre-revegetation weed control	■	■		■																
Fence installation			■																	
Site Preparation*																				
Scalping				■																
Ripping				■																
Implementation*																				
Tubestock planting					■															
Maintenance*																				
Formal monitoring (including report)							■	■	■	■	■	■	■	■	■	■	■	■	■	■
Weed control							■	■	■	■	■	■	■	■	■	■	■	■	■	■
Infill planting								■				■					■			
*Note: schedule is indicative and based on seasonal variations.																				



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