CPS 8573/2 Revegetation Plan

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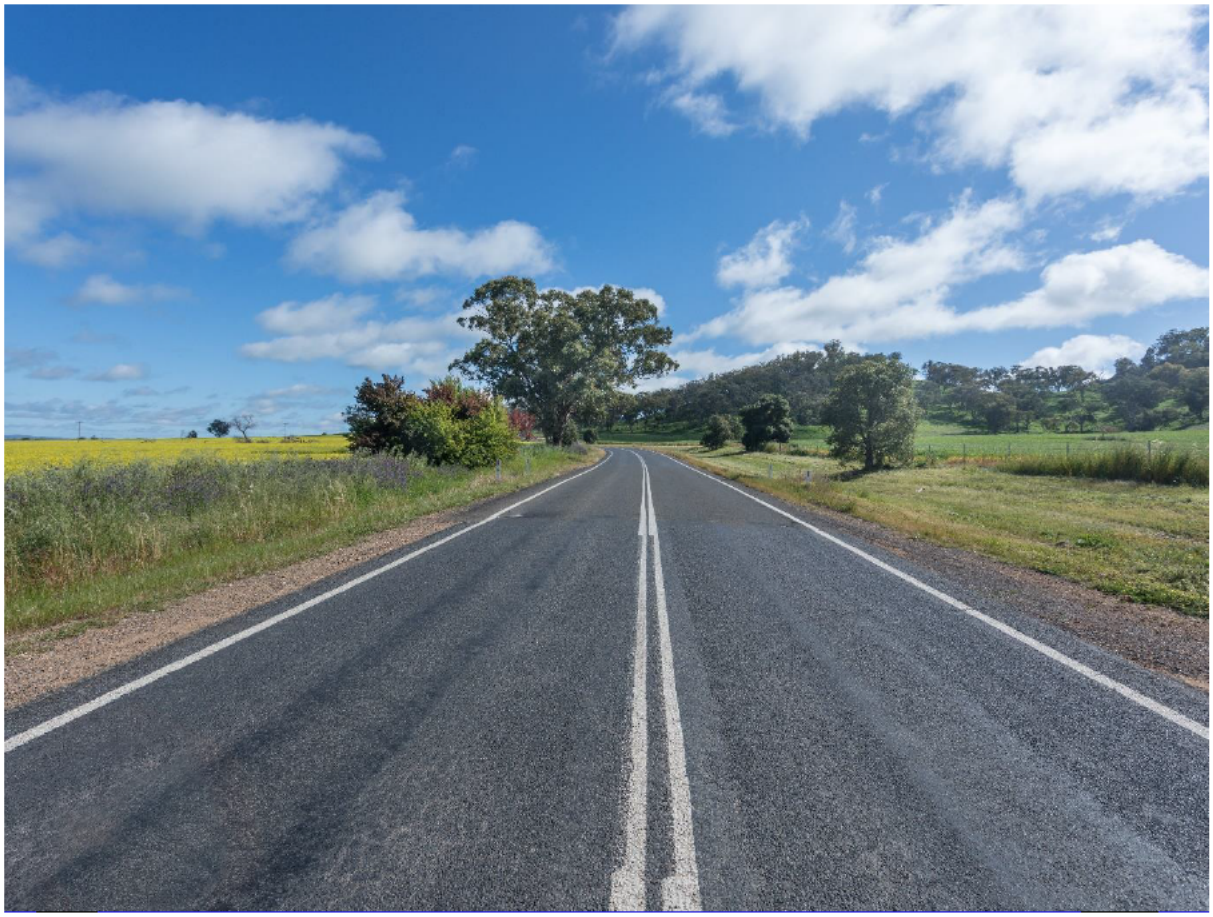
Main Roads Western Australia

Bindoon Bypass – Northern Section
9 September 2022



CPS 8573/2 Revegetation Plan

Client name:	Main Roads Western Australia		
Project name:	Bindoon Bypass – Northern Section		
Client reference:	PSA JAC-P0239	**Project no:**	IW218074
Document no:	D22#914587	**Project manager:**	Lisa Boulden
Revision no:	Rev 0	**Prepared by:**	Callum Mair
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Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
Rev A	19/08/22	Initial draft	C. Mair	L. Boulden	L. Boulden	L. Boulden
Rev B	29/08/22	Incorporation of Main Road comments	C. Mair	L. Boulden	L. Boulden	L. Boulden
Rev C	6/09/22	Incorporation of Main Road comments	C. Mair	L. Boulden	L. Boulden	L. Boulden
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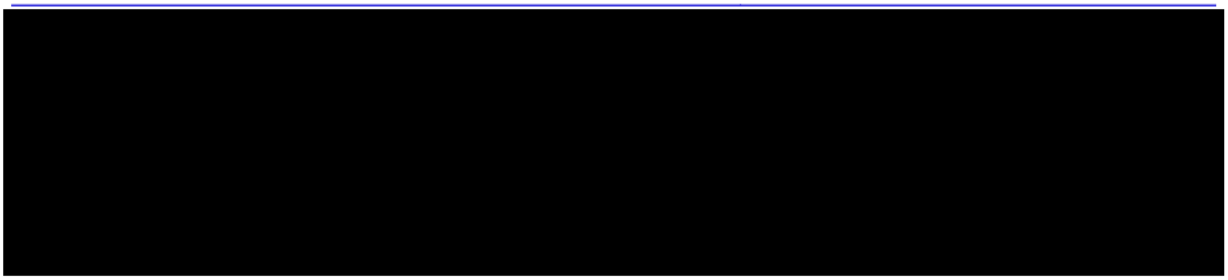

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Executive Summary

This Revegetation Plan details the implementation, management, and monitoring of revegetation activities for the Bindoon Bypass – Northern Section (BBN) of Great Northern Highway (GNH), to satisfy the requirements of Condition 14 of Clearing Permit CPS 8573/2.

A brief summary of key revegetation details is provided within **Table 0-1**.

Table 0-1 Revegetation Summary

Aspect	Details
Proposed Revegetation Area (ha)	22 ha
Number of seedlings (shrubs and trees) to be planted	0.5 plants/m^2
Kilograms of seed to be spread	5 kg seed/ha
Local Government Area	Shire of Chittering
Location of the Revegetation Area(s)	The revegetation/rehabilitation areas are within 16kms south-south-west of New Norcia and situated along a continuous stretch on the western side of the BBN, between SLK 96.2 and SLK 100.6 (Burnett Road). The areas comprise a mix of retained roadside vegetation, redundant road carriageway and cleared areas.
Current Land Use, Site History and Adjoining Land Use	The BBN passes through a predominantly agricultural landscape (largely cropping and sheep farming) of cleared paddocks, with areas of remnant native vegetation (marri and wandoo woodland). The immediate area comprises the GNH road alignment.
Details of Ownership, Vesting and Zoning of the Land	All revegetation/rehabilitation will occur within land which is either owned by Main Roads (through recent acquisition for the road reserve), or Crown land managed by Main Roads.
Physical Site Factors	• No evidence of dieback (*Phytophthora cinnamomi*) was confirmed within the revegetation/rehabilitation areas. • A total of 52 introduced weed species have been recorded within the BBN area. Asparagus asparagoides was the only declared pest and Weed of National Significance (WONS). • Southern sections of BBN pass over several small tributaries which later flow into the Brockman River. • Kangaroos and introduced rabbits are known to occur within the area.
Vegetation Association/ Complex/ Type of the reference site(s)	The field survey defined 11 vegetation associations within the BBN project area, broadly classified as Medium Woodland of Wandoo, York Gum, Flooded Gum and/or Marri, Low paperbark Forest, Medium Marri Forest and Acacia/Casuarina Shrublands. Vegetation within the study area ranged from degraded to excellent condition, with 74% considered completely degraded.

Aspect	Details
	The reference site is situated within roadside vegetation adjacent to the BBN and comprises medium woodland (wandoo), specifically Low *Eucalyptus wandoo subsp. wandoo* open woodland over *Allocasuarina humilis* and *Xanthorrhoea preissii* mid shrubland over *Mesomelana psuedostygia* and *Lepidosperma tenue* sedgeland. The site is in Excellent vegetation condition.
Permit Specific Requirements	The Revegetation Plan specifically addresses Condition 14 of Clearing Permit CPS 8573/2, namely: *a) Within 24 months of clearing commencing, the Permit Holder must submit a Project Revegetation Plan to the CEO for approval for the revegetation/rehabilitation of 20.6 hectares of land within the areas cross-hatched red in Figures 1 a-d of Schedule 1, which shall be developed in accordance with A Guide to Preparing Revegetation Plans for Clearing Permits (Department of Water and Environmental Regulation (DWER) 2018).* *b) The Project Revegetation Plan must be prepared by an environmental specialist.* *c) The Project Revegetation Plan must include the following:* *i. site preparation* *ii. weed control* *iii. regeneration, direct seeding or planting, at an optimal time* *iv. a vegetation establishment period* *v. revegetation success completion criteria based on selected reference sites, including but not limited to target weed cover, target vegetation condition, target density and target structure* *vi. remedial actions to be undertaken if completion criteria are not met* *vii. ongoing maintenance and monitoring of the area to be revegetated and rehabilitated* *viii. timeframes for completion of the activities* *ix. management commitments that will be achieved.* *d) The Permit Holder shall implement the Project Revegetation Plan as approved by the CEO.*
Existing or Proposed Management Arrangements	All revegetation/rehabilitation areas are situated within areas that are undertaken is either owned by Main Roads (through recent acquisition for the road reserve) or Crown land managed by Main Roads.

<table>
<tr><th>Aspect</th><th>Details</th></tr>
<tr><td>Completion Criteria</td><td>
<table>
<tr><th>Criterion Name</th><th>Measure</th><th>Unit</th><th>Target for 2028</th></tr>
<tr><td>Species Richness</td><td>Quadrat species richness (average across quadrats)</td><td>Species count</td><td>17 species per 100m2
(At least 50% of number of species at reference site)</td></tr>
<tr><td rowspan="2">Stem Density</td><td>Tree density (dominant species only)</td><td>Stems/ha</td><td>300 stems/ha</td></tr>
<tr><td>Shrub density</td><td>Steams/ha (large shrubs) or count/quadrat (small shrubs</td><td>3,000 stems/ha</td></tr>
<tr><td rowspan="2">Weed Cover</td><td>Total cover</td><td>Percentage count</td><td>30% or lower across the site</td></tr>
<tr><td>Weeds of National Significant and Declared Plants</td><td>Percentage count</td><td>Managed in accordance with the Biosecurity and Agriculture Management Act 2007</td></tr>
<tr><td>Vegetation Structure</td><td>Using Muir (1977)</td><td>Vegetation type</td><td>Structure to meet Trees 5-15m life form/height class, with a sparse canopy cover (ie. Low Woodland A classification)</td></tr>
</table>
</td></tr>
<tr><td>Monitoring</td><td>A total of 10 permanent monitoring quadrats of 100m^2 each will be established across the revegetation/rehabilitation patches. A total of 20 photo monitoring points will also be established.

Monitoring will measure the following parameters:
• native species - all species identified, count of tree stems and total stems (where possible), average cover estimate;
• weed species - dominant species identified, ground cover percentage, and
• weed cover - total, grasses, non-grasses.
• Vegetation structure (using Muir (1977))

A vegetation establishment period of 5 years has been set. This period is considered sufficient to maximise the likelihood of revegetation success and achieving the completion criteria.</td></tr>
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1. Introduction

1.1 Purpose of Document

This Revegetation Plan will be used to implement, manage, and monitor revegetation activities for the Bindoon Bypass – Northern Section (BBN) of Great Northern Highway (GNH), in line with requirements of Condition 14 of CPS 8573/2. Specifically, the plan addresses the following:

Condition 14. Revegetation Plan

a) *Within 24 months of clearing commencing, the Permit Holder must submit a Project Revegetation Plan to the CEO for approval for the revegetation/rehabilitation of 20.6 hectares of land within the areas cross-hatched red in Figures 1 a-d of Schedule 1, which shall be developed in accordance with A Guide to Preparing Revegetation Plans for Clearing Permits (Department of Water and Environmental Regulation (DWER) 2018).*

b) *The Project Revegetation Plan must be prepared by an environmental specialist.*

c) *The Project Revegetation Plan must include the following:*

   i. *site preparation*
   ii. *weed control*
   iii. *regeneration, direct seeding or planting, at an optimal time*
   iv. *a vegetation establishment period*
   v. *revegetation success completion criteria based on selected reference sites, including but not limited to target weed cover, target vegetation condition, target density and target structure*
   vi. *remedial actions to be undertaken if completion criteria are not met*
   vii. *ongoing maintenance and monitoring of the area to be revegetated and rehabilitated*
   viii. *timeframes for completion of the activities*
   ix. *management commitments that will be achieved.*

d) *The Permit Holder shall implement the Project Revegetation Plan as approved by the CEO.*

This Revegetation Plan has been structured to meet the above requirement and has been prepared by experienced environmental and revegetation specialists employed by Jacobs and working on behalf of Main Roads Western Australia (Main Roads). Lead authors who prepared this plan are as follows:

Name: Callum Mair	Name: Lisa Boulden
Qualification: Bachelor of Environmental Science, minor in Conservation Biology (Hons). Murdoch University	Qualifications: Bachelor of Science (Conservation Biology), Post Graduate Diploma in Environmental Management. Murdoch University
Years of experience: 15	Years of experience: 17

The document has also undergone review and contribution by experienced Environmental Officers and Vegetation Managers within Main Roads.

1.2 Bindoon Bypass – Northern Section

This plan addresses the revegetation of 20.6 ha in relation to upgrade of the BBN. It is noted that the road reserve either side of the upgraded road will be landscaped and revegetated along the full length of the alignment, in accordance with Main Roads requirements and the Project's Landscaping Plan. This Revegetation Plan comprises a sub-set of the total landscaping that will be undertaken.

The BBN upgrade is located on Great Northern Highway (GNH) between Straight Line Kilometre (SLK) 94.74 and SLK 112.2, approximately 100km north-east of Perth and 28km north-east of Bindoon. The Project comprises a combination of upgrades to existing portions of highway (online) and the construction of new road in mostly cleared paddocks adjacent to the existing alignment (offline). The BBN commences at the northern extent of the Bindoon Bypass – Southern Section alignment, departing from the existing GNH near Calingiri Road, and approximately paralleling the existing GNH northwards to tie into the southern end of the New Norcia Bypass, 1.6 km south of New Norcia. The total length of the BBN is approximately 17.5km.

Clearing Permit 8573/2 was approved on 15 February 2021 and permitted the clearing of no more than 28.6 ha of native vegetation along the road alignment.

The boundary of CPS 8573/2 is provided on **Figure 1-1**, with permitted clearing areas noted within Schedule 1 (Figures 1a-d) of CPS 8573/2.

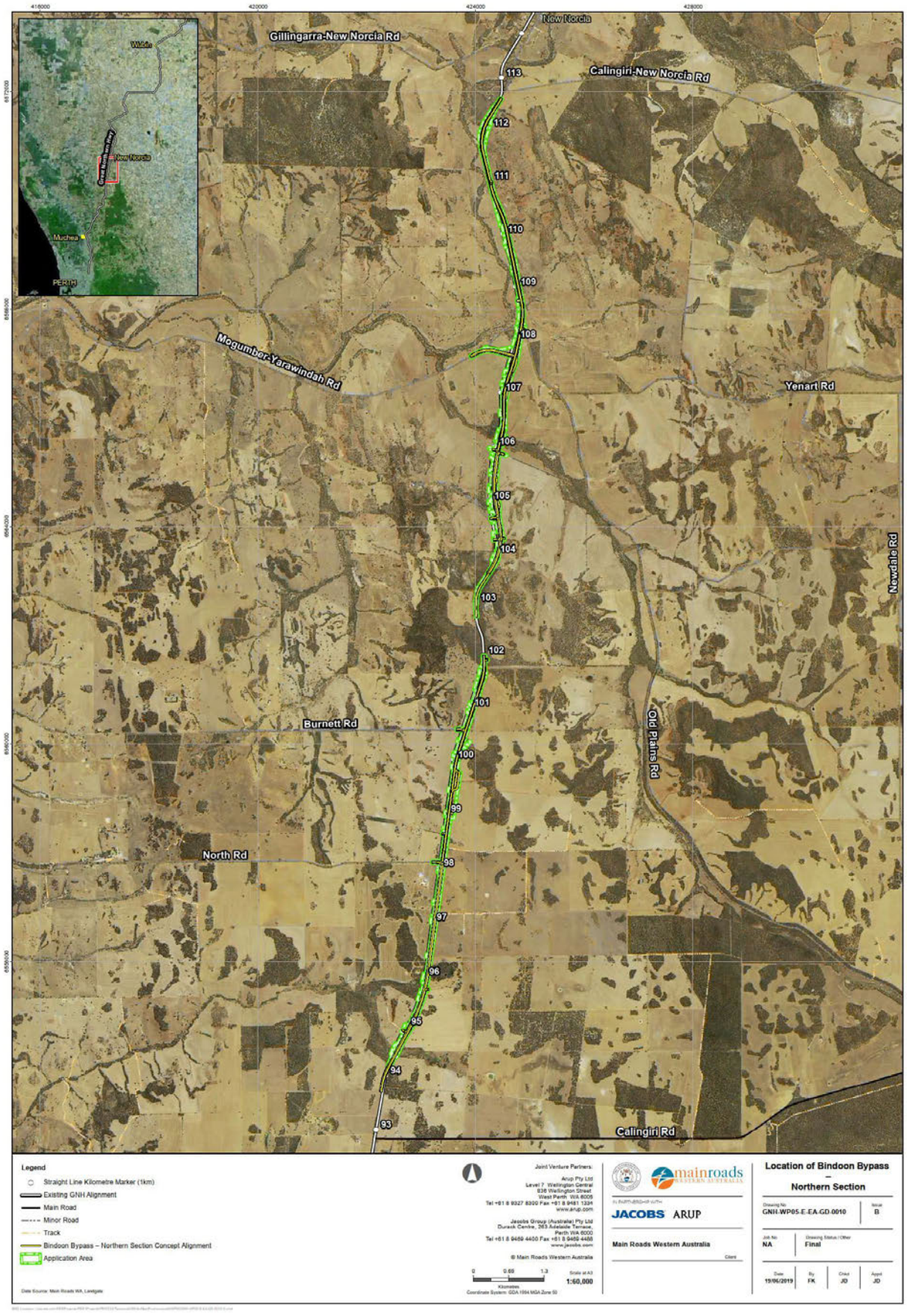

Figure 1-1 Location of Clearing Permit CPS 8573/2 covering the Bindoon Bypass Northern Section

2. Background Information

2.1 Land Ownership

Vegetation clearing has been and will continue to be undertaken for the purposes of road construction, widening, and associated activities. All land where clearing is undertaken is either owned by Main Roads (through recent acquisition for the road reserve) or Crown land managed by Main Roads.

2.2 Flora and Vegetation

A desktop review and ecological survey were conducted by Phoenix Environmental Sciences, over four survey phases between October 2014 and March 2018. During the desktop review, ninety-two conservation significant flora species were identified within 2km of BBN. Of this, 12 significant flora species were considered likely to occur within the BBN project area, including three Threatened species (*Asterolasia nivea*, *Banksia serratuloides*, and *Spirogardnera rubescens*). Fourteen conservation significant flora species were recorded during the field surveys:

- *Conospermum densiflorum* subsp. *unicephalatum* (Endangered)
- *Banksia serratuloides* subsp. *serratuloides* (Vulnerable)
- *Hakea chromatropa* (P1)
- *Leucopogon darlingensis* subsp. *rectus* (P2)
- *Synaphea rangiferops* (P2).
- *Acacia anarthros* (P3)
- *Acacia drummondii* subsp. *affinis* (P3)
- *Daviesia debilior* subsp. *sinuans* (P3)
- *Melaleuca sclerophylla* (P3)
- *Calothamnus pachystachyus* (P4)
- *Grevillea drummondii* (P4)
- *Hibbertia miniata* (P4)
- *Persoonia sulcata* (P4)
- *Synaphea grandis* (P4)

One Threatened Ecological Community (TEC) was identified as likely to occur in the BBN project area – the Eucalypt Woodlands of the Western Australian Wheatbelt. However, the field survey revealed none of the remnant vegetation in the study area to be aligned with this or any other TEC or Priority Ecological Community (PEC).

The field survey defined 11 vegetation associations within the BBN project area, broadly classified as Medium Woodland of Wandoo, York Gum, Flooded Gum and/or Marri, Low paperbark Forest, Medium Marri Forest and Acacia/Casuarina Shrublands. Vegetation within the study area ranged from degraded to excellent condition, with 74% considered completely degraded.

2.3 Weeds

During field surveys, a total of 52 introduced species were recorded in the BBN project area. One of these introduced species, *Asparagus asparagoides*, is a declared pest and WoNS. This was recorded in several locations in the study area. It is important to note that seven declared pest species were previously recorded in the GNH road reserve, which may be relevant to the study area (although the exact locations were not available). These species included; *Moraea flaccida*, *Moraea miniata*, *Echium plantagineum*, *Oxalis pes-caprae*, *Carthamus lanatus*, *Echium plantagineum* and *Asparagus asparagoides*.

2.4 Dieback

A dieback (*phytophthora cinnamomic*) assessment of GNH was undertaken, including the revegetation/rehabilitation areas. The majority of the assessment area was excluded, as it comprised cleared agricultural land. Of the remaining areas, 3.5% was considered uninfested and 6.3% uninterpretable. Seventeen samples taken from recently dead disease indicator plant species returned negative results for dieback (Terratree, 2016).

2.5 Fauna

A desktop review of conservation significant fauna species identified 13 conservation significant species as having potential to occur within the study area. This included seven Threatened or Specially Protected Species under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and or *Biodiversity Conservation Act 2016*, one migratory species and five priority species

One conservation significant species, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) was recorded in the BBN project area during the field surveys, with direct observation and extensive foraging evidence observed. A total of 44 confirmed nesting trees from 83 tress with hollows suitable for breeding were recorded, as well as a high density of potential breeding trees, thereby indicating the area to have both short and longer term breeding habitat for this species.

Seven fauna habitat types were identified as part of field surveys, namely:

- cleared land (agriculture, road, infrastructure);
- woodland (Jarrah, Marri, Wandoo and/or banksia);
- woodland (York Gum, Wandoo, Salmon Gum, and/or Gimlet);
- woodland (paperbark or sheoak);
- cleared and revegetated non-native woodland mosaic;
- shrubland (thicket); and
- forest (Jarrah and/or Marri).

2.6 Existing Hydrology and Drainage

Two nationally important wetlands occur within the Bindoon region; the Wannamal Lake System and the Chittering-Needonga Lake System. The region encompasses three surface water catchments, comprising the Brockman River, Gingin Brook and Ellen Brook catchments. The Brockman River and Ellen Brook catchments are located within the greater Swan River System, while the Gingin catchment form part of the Moore River catchment.

Northern sections of the BBN run parallel with the Moore River (between the New Norcia Road and Mogumber-Yarawindah Road turnoffs), before crossing over Yarawindah Brook. Southern sections of BBN pass over several small tributaries which later flow into the Brockman River.

2.7 Location of Proposed Revegetation

Based on a review of available land area and suitability for revegetation, a total of three patches have been identified for revegetation to meet the requirements of CPS 8573/2.

The three patches are situated along a continuous stretch on the western side of the BBN, between SLK 96.2 and SLK 100.6 (Burnett Road). All three patches largely comprise redundant carriageway and clearing for the new BBN alignment. It also captures retained vegetation along the redundant carriageway.

Locations of the proposed revegetation areas are provided within **Table 2-1** and **Figure 2-1, Figure 2-2** and **Figure 2-3**. A note is also included on the type of revegetation/rehabilitation that will be undertaken.

Table 2-1 Areas of proposed revegetation

Rehabilitation Patch	Approx SLK From	Approx SLK To	Area (ha)	Key Revegetation/Rehabilitation Elements
1	100.6	98.7	9.48	Seeding (within redundant carriageway), with a mix of planting and seeding for cleared areas and areas of retained roadside vegetation
2	98.6	98.2	2.00	
3	98.1	96.2	10.93	
		TOTAL	**22.41 ha**	

Figure 2-1 Location of Revegetation Patch 1 (SLK ~100.6 to ~98.7)

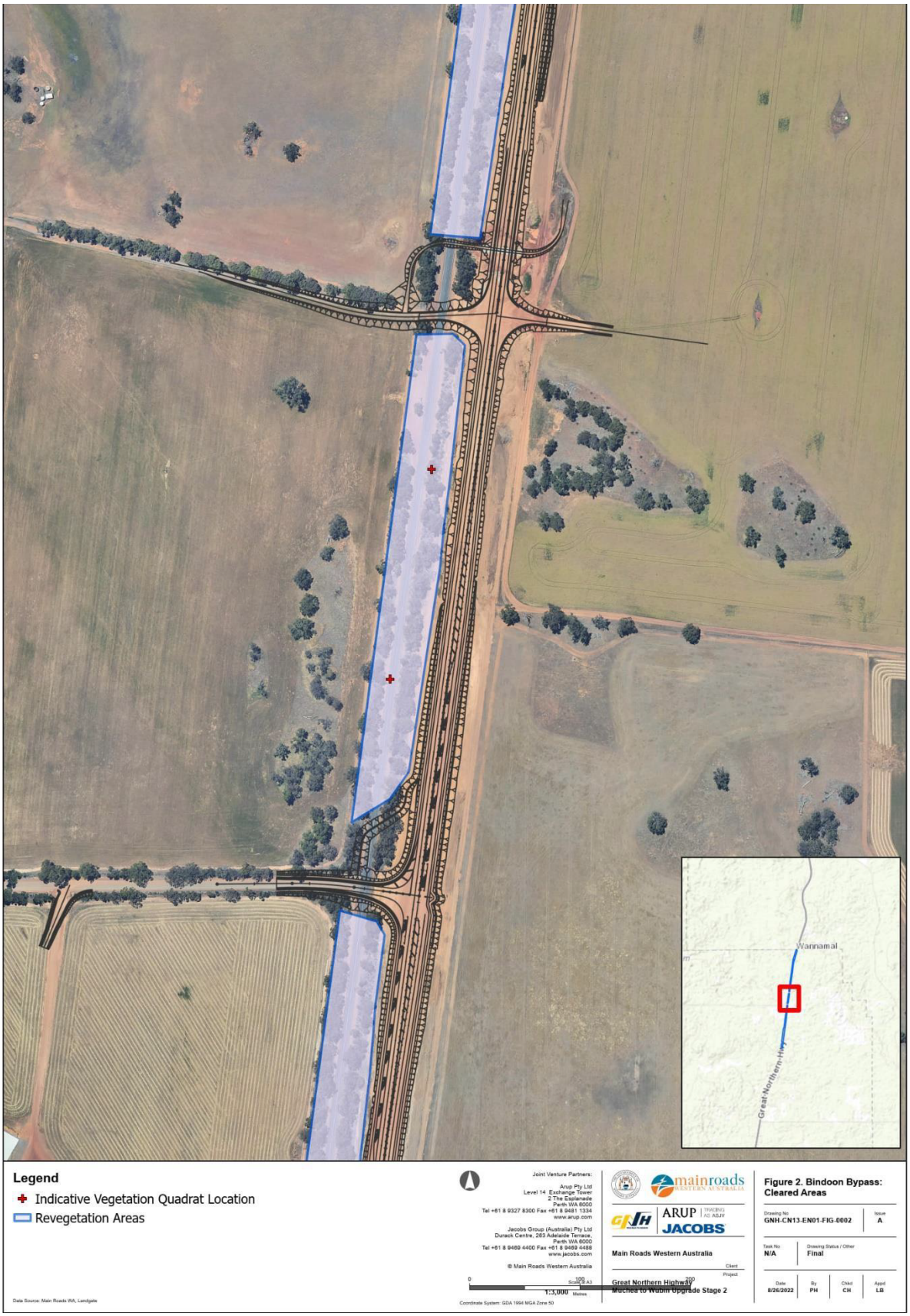

Figure 2-2 Location of Revegetation Patch 2 (Central Polygon) (SLK ~98.6 to ~98.2)

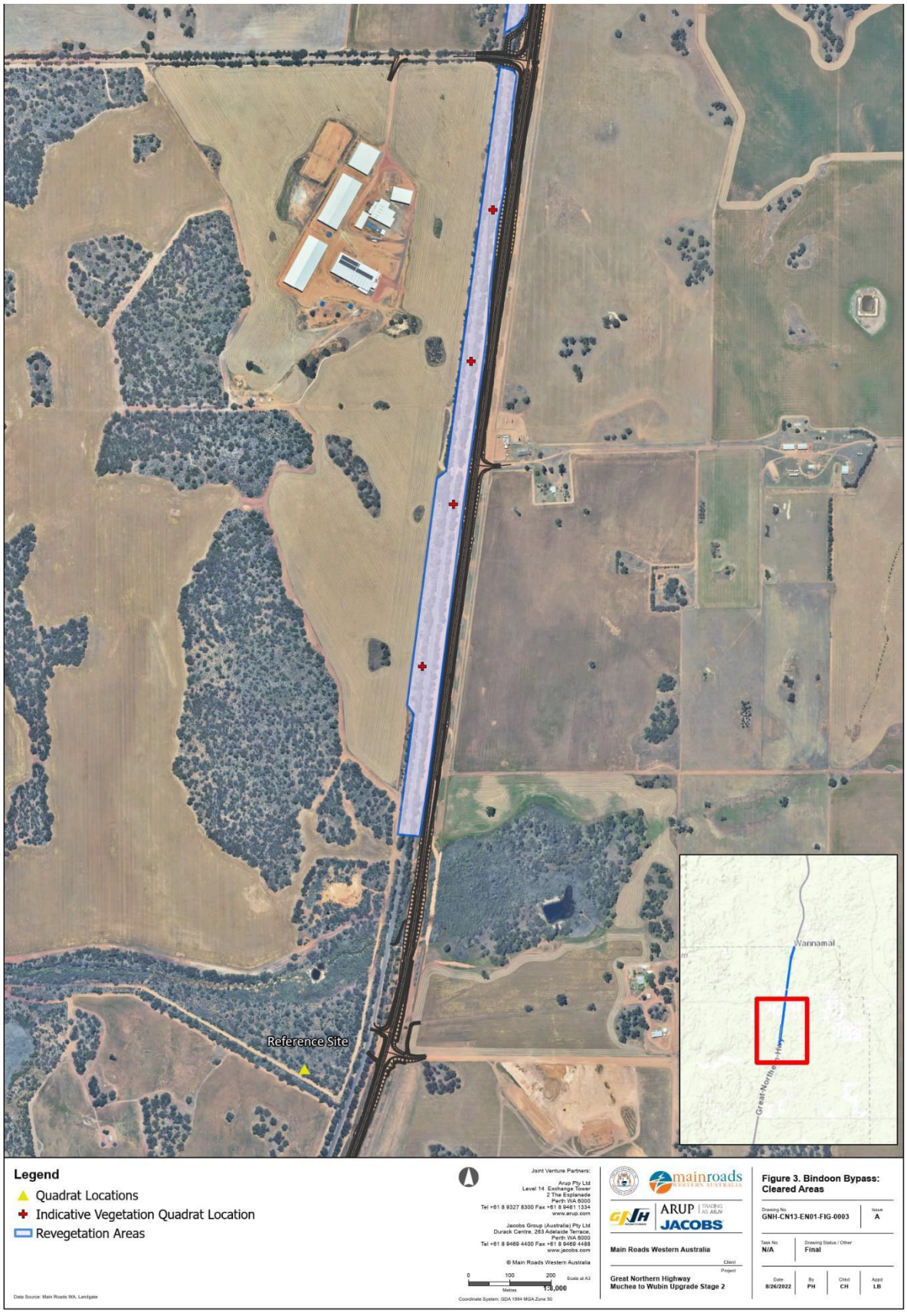

Figure 2-3 Location of Revegetation Patch 3 (SLK ~98.1 to ~96.2)

3. Revegetation Implementation

3.1 Overview

Revegetation and rehabilitation along the Bindoon Bypass Northern Section will be wholly contained within the road reserve and comprise a mix of:

- direct seeding within areas of redundant carriageway;
- a mix of plantings and direct seeding with cleared areas; and
- a mix of plantings and direct seeding within retained vegetation adjacent to the redundant carrriageway

Retained remnant vegetation has been included within the area. This will be rehabilitated, with the aim of improving its overall condition (these areas were largely considered to contain vegetation in a 'good' condition during flora surveys).

The total area to be revegetated and/or rehabilitated is 22.41ha, comprising the areas as outlined within **Table 2-1**. As noted within Section 1.2, this comprises a sub-set of wider landscaping (to meet the requirements of Condition 14 of CPS 8573/2) that is being undertaken by Main Roads for the entirety of the road reserve.

3.2 Revegetation Objective and Management Commitments

Revegetation activities will seek to re-establish vegetation values similar to those of vegetation that was cleared during construction of BBN. Rehabilitation activities will aim to improve the condition of areas of retained native vegetation within the road reserve.

The objective of this revegetation plan are as follows:

- To meet the requirements of condition 14 of CPS 8573/2;
- To create areas of suitable foraging habitat for Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*);
- To assist in providing ongoing roadside stability and minimise ongoing maintenance (including minimising erosion risks);
- To support local conservation and biodiversity in an otherwise extensively cleared landscape; and
- To provide resilient and self-sustaining vegetation which compliments adjacent remnant vegetation areas.

Revegetation will be completed to enhance the roadside environment and to ensure safe roads and roadsides are provided. To meet this objective, vegetation will be planted within the road reserve in accordance with standard Main Roads planting setbacks (**Table 3-1**).

Table 3-1 Main Roads planting setbacks

Features	Shrubs or Ground Covers	Trees
Painted edge line or kerb of road	4 metres	10 metres
Structures, roadside furniture, and light standards	3 metres	3 metres

Main Roads commits to undertaking the rehabilitation works in such a way which maximises the success of meeting revegetation success criteria first time, thereby minimising the need for extensive ongoing remedial actions. Sufficient funding has also been allocated from the Project budget to ensure the requirements of the Revegetation Plan can be met.

3.3 Site Preparation

Discussion on earthworks, topsoil respread and erosion control/mulch respread are applicable to areas of revegetation only. Rehabilitation areas (ie. areas of remnant vegetation) will not require this level of site preparation.

3.3.1 Earthworks

Areas nominated for revegetation will be cleared of any material that may hinder plant growth before further surface preparation works commence. All nominated finished soil surfaces will be prepared by ripping, tilling, mounding, tracking or other means to form a loose and roughened surface suitable for the revegetation works. Soil will be ripped to a depth of approximately 0.5 m to reduce soil compaction and aid in creating a suitable planting medium which facilitates faster root establishment and higher rainfall infiltration. Surface preparation shall be carried out along the contour unless detailed otherwise. Ripping and associated earthworks will be undertaken over Autumn/Winter of 2023 (**Figure 8-1**).

All battered surfaces with a slope of 1 Vertical in 3 Horizontal or flatter shall be prepared to a minimum depth of 300mm to prepare a loose surface. Except during the construction of benched or stepped batters, batter slopes shall be smoothly shaped to a uniform plane from top to bottom. The top and toe of all batters shall be rounded to match the shape of the surrounding topography. Finally, the surface of all batters and other areas nominated for revegetation and landscaping works shall be excavated and filled, shaped and/or graded as necessary to achieve the required finished soil levels and contours.

3.3.2 Topsoil Respread

Following the ripping of revegetation areas, topsoil (previously stockpiled as part of initial vegetation clearance and construction activities) will be respread across the revegetation areas. The use of site stripped topsoil will be prioritised wherever possible.

3.3.3 Erosion Control and Mulch Respread

Protective coverings will be used on surfaces at higher risk of erosion.

No weed-affected mulch is brought into the areas to be revegetated. Mulch shall be spread as soon as is practical after surface preparation and topsoiling. Dry mulch shall be placed before any planting. If a rainfall event occurs before mulch can be spread, creating soil erosion, the eroded material shall be replaced, and the soil surface prepared before spreading the mulch. Mulch shall be spread to an even depth by hand, machine or blower unit over the areas and the surface raked to present an even surface.

3.4 Methodology

3.4.1 Direct Seeding

A mixture of locally collected seed, as well as externally sourced seed will be used. Locally collected seed will be prioritised to maximise local provenance and genetic similarity with adjacent vegetation. Seed mixes shall be blended with a carrier-bulking agent (such as clean washed dry sand, vermiculite, or similar) in proportions by volume of bulking agent to seed, to suit the project requirements and allow for the even spreading of seed.

Direct seeding will take place in May-June to ensure maximum germination, once road works are completed, with a seeding density of 5 kg/ha (see **Appendix A**). Seeding outside of this period may lead to germination delays and increase the probability of seed loss through deep burial, surface erosion or predation by animals.

Site preparation will take place immediately before seeding, for direct seeding sites that were old roads the redundant road surface will be left and blended into the pavement layers below during the ripping. No topsoil or mulch shall be placed onto the broken up redundant carriage way prior to seeding.

Seed will be sown uniformly in overlapping passes to allow for complete seed coverage of the prepared surfaces. Farm machinery, calibrated blower or spreader will be used as necessary. Seed will be covered by

light harrowing, scarifying, bagging, dragging or raking of the seeded area as soon as practical and within the same day of seeding.

3.4.2 Planting

Planting with seedlings will occur after seeding, ideally late June to July, with a seeding density of approximately 0.5 plants/m^2. All seedlings will be 'hardened off' before planting and preferably watered with a seaweed solution (Seasol) with their final watering before leaving the nursery. Tree bags may be placed over seedlings however due to the large number of seedlings to be planted it will not be practical to bag each one.

Seedlings will be sourced from local provenance species. All seedlings will be grown by nurseries that hold accreditation under the Nursery Industry Accreditation Scheme of Australia (NIASA), thereby ensuring a high quality of supplied material and soils containing the seedling which are free of dieback. Seedling tubestock will be free of weed species, with further checks undertaken for weed material prior to planting.

3.5 Species Selection and Rates

Plant species and densities used will mirror those as part of the Project's wider Landscaping Plan. A list of plant mixes and densities for each rehabilitation area are provided within **Appendix A**. Plant species have been selected to be consistent with the surrounding reference sites and are based on species breakdowns that are reflective of adjacent remnant and retained vegetation areas.

Plant species have been selected to provide suitable food plants for foraging Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*). *Allocasuarina*, *Corymbia*, *Eucalyptus* and *Grevillea* (known Black Cockatoo foraging species) make up part of the revegetation species mixes.

Vegetation setbacks from the road will be implemented in accordance with **Table 3-1**.

3.6 Weed Control

Weed control will involve the management of site topsoil and herbicide treatments to reduce the amount of weeds present. This will reduce the competition for available water and nutrients with native seedlings, leading to a more successful revegetation outcome. Weed control shall be carried out after the opening rains and once the annuals emerge, it shall also be completed several weeks prior to planting/seeding. A herbicide application record sheet will be completed for all weed spray operations.

3.7 Fauna Management

It is recognised that vegetation inside road reserves can act as corridors for wildlife movement and removal of road reserve vegetation has the potential to impact on the movement of fauna. Vegetation along the revegetation area lies in close proximity to various pockets of remnant vegetation, including areas outside of the road reserve. Proposed revegetation in these areas, will provide an opportunity to enhance vegetation corridors linking these remnant areas, thus strengthening the alternative routes for wildlife.

To increase fauna habitat any large boulders and wood debris brought to the surface during ripping will be left for habitat. Suitable large tree trunks that can be placed in the revegetation site following ripping may also be reused from previous clearing activities.

To assist in protected recently planted seedlings from being eaten by kangaroos or pest species such as rabbits, fencing will be installed around the outer perimeter of the revegetation areas (ie. the border of the road reserve).

In the event of high levels of herbivory, tree guards may be installed around recently planted seedlings.

Signage will be installed to denote the area as being revegetated and to minimise pedestrian and vehicle access.

3.8 Vegetation Establishment Period

Condition 14 of clearing permit CPS 8573/2 specifies that the Revegetation Plan must provide the timeframe for the establishment of vegetation, in order to achieve the completion criteria. A vegetation establishment period of 5 years has been set. This period is considered sufficient to maximise the likelihood of revegetation success and achieving the completion criteria noted within **Section 4**.

In the event that completion criteria have not been achieved by five years, ongoing monitoring and remedial actions shall continue until such time as all completion criteria are satisfied.

4. Completion Criteria

4.1 Overview

One set of completion criteria have been established for the 22.41ha of revegetation/rehabilitation.

Revegetation activities will seek to re-establish vegetation values similar to those of vegetation that was cleared during construction of BBN. Rehabilitation activities will aim to improve the vegetation condition of areas of retained native vegetation within the revegetation sites.

The completion criteria detailed below, are anticipated to quantify when revegetation areas have achieved the revegetation plan objectives (noted within **Section 3.2**). Performance against the completion criteria targets will then determine if future remedial (contingency) actions are then required (see **Section 6**).

Completion criteria and associated justification for each, is provided within **Table 4-1**.

Table 4-1 Revegetation completion criteria

Revegetation / Rehabilitation Type		Criterion Name	Measure	Unit	Target for 2028	Justification of Target
Redundant road carriageway Retained vegetation Cleared areas (revegetation)	A	Species Richness	Quadrat species richness (average across quadrats)	Species count	17 species per 100m^2 (At least 50% of number of species at reference site)	50% of total species recorded within the reference site (34 species), which reflects remaining areas of remnant roadside vegetation in the area.
	B	Stem Density	Tree density (dominant species only)	Stems/ha	300 stems/ha	Reflects a typical woodland canopy coverage of ≤30%.
			Shrub density	Steams/ha (large shrubs) or count/quadrat (small shrubs	3,000 stems/ha	Reflects numbers of individual shrub species within the reference site
	C	Weed Cover	Total cover	Percentage count	30% or lower across the site	Reflects a relatively low coverage of weed species present within the reference site.
			Weeds of National Significant and Declared Plants	Percentage count	Managed in accordance with the *Biosecurity and Agriculture Management Act 2007*	Only 1 WON/declared pest plant identified during flora survey
	D	Vegetation Structure	Using Muir (1977)	Vegetation type	Structure to meet Trees 5-15m life form/height class, with a sparse canopy cover (ie. Low Woodland A classification)	Reflects vegetation structure of the reference site, which comprises low eucalyptus marri/wandoo woodland over mid shrubland

4.2 Reference Site

A reference site has been used for the collection of baseline data, to assist in forming the completion criteria described within **Section 4.1**. Data was collected for the site via a 10 m x 10 m quadrat (No. CAL17018), as part of the flora and fauna assessment undertaken in November 2017 (Phoenix Environmental Sciences, 2019).

The reference site is situated within remnant roadside vegetation adjacent to the BBN and comprises medium woodland (wandoo), specifically Low *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Allocasuarina humilis* and *Xanthorrhoea preissii* mid shrubland over *Mesomelana psuedostygia* and *Lepidosperma tenue* sedgeland (**Figure 4-1**). The site is in Excellent vegetation condition.

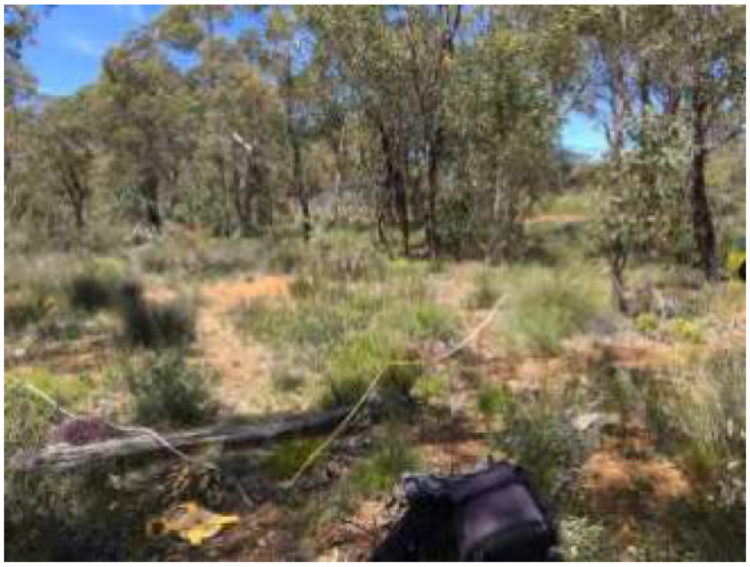

Figure 4-1 Low wandoo vegetation association within Reference Site

Key environmental and botanic elements of the reference site are provided within **Table 4-2**.

Table 4-2 Key environmental and botanic aspects of reference site

Aspect	Recorded measure
Position (coordinates)	-31.132973, 116.190738
Total vegetation cover (%)	40
Tree/shrub cover >2 m (%)	10
Shrub cover <2 m (%)	30
Grass cover (%)	5
Herb cover (%)	1
Topography	Plain
Soil and soil colour	Red-brown laterite

A full list of plant species recorded within the reference site is presented within **Appendix B**.

The reference site was considered representative of typical remnant roadside vegetation that is present along the BBN alignment.

Several quadrats within the revegetation area were also used in developing the completion criteria. These areas were situated within areas which have since been cleared for construction of the new road formation.

5. Monitoring and Maintenance

Upon the completion of initial revegetation/rehabilitation activities, ongoing monitoring of the patches will be undertaken to measure site performance against the completion criteria. Monitoring is intended to identify if any further follow up works are necessary (see **Section 6 Remedial Actions**), should monitoring results show that completion criteria may not be achieved.

5.1 Monitoring Methodology

Methodology for monitoring the success of the revegetation/rehabilitation areas will involve the establishment of quadrats and photo monitoring points.

A total of 10 permanent monitoring quadrats of 100m^2 each (ie. 10m x 10m) will be established across the revegetation/rehabilitation patches. This equates to approximately one quadrat for every two hectares of revegetation/rehabilitation. Indicative monitoring quadrat locations are provided within **Figure 2-1** to **Figure 2-3**.

The following parameters will be recorded within each quadrat:

- native species - all species identified, count of tree stems and total stems (where possible), average cover estimate;
- weed species - dominant species identified, ground cover percentage, and
- weed cover - total, grasses, non-grasses.
- Vegetation structure (using Muir (1977))

A total of 20 photo monitoring points will also be established. Ten of these will utilise the fixed corner points of monitoring quadrats (photos taken from the southwest corner looking to the northeast corner of each quadrat), as well as 10 other locations.

All monitoring will be recorded using Main Roads field monitoring sheets (D13#550471).

5.2 Monitoring Timing

Revegetation and rehabilitation patches will be inspected in Spring (November) after planting and seeding to assess if infill plantings are required during the following winter. Whilst the patches may show good survival rates, it is important to inspect the site early given the lead in times for seedling orders (required from nurseries by December at the latest). Should no infill planting be required, a second inspection will occur in April/May during the following year.

Future monitoring events will then be carried out in Spring (November), every year for 5 years. If completion criteria are not met after 5 years, monitoring will continue to be undertaken annually until completion criteria are achieved.

5.3 Maintenance

Weed control will be required at least twice a year for the revegetation/rehabilitation patches until completion criteria is reached. Some control may be required outside of these times to target select species that are active outside of these months. The extent of control requirements (I.e. target species, area affected, timing) shall be determined through the monitoring program.

Infill planting may be undertaken for each revegetation site each winter, as required based on monitoring data. Quantities required for infill planting will be calculated in order to achieve the completion criteria. Infill planting numbers will be determined by comparing actual plant densities to required plant densities (as part of completion criteria) and planting additional plants to address the shortfall. Similarly, if species richness is not meeting completion targets, infill planting will concentrate on increasing species diversity.

Where tree guards are used, maintenance will be required to ensure the guards do not collapse or impede plant development and maintain adequate protection for the seedlings. All guard materials no longer

required will be removed from site and recycled / disposed of appropriately. Fences and gates will be inspected, with maintenance undertaken if these are damaged.

6. Remedial Actions

If, following post planting/seeding inspections, revegetation and rehabilitation areas appear that they will be unlikely to meet their completion criteria/targets within the specified timeframes, the following remedial actions outlined in **Table 6-1** will be undertaken until the targets are met:

Table 6-1 Remedial actions if completion criteria are not met

Contingency/maintenance/ remedial actions	Trigger point	Address Which Completion Criteria?
Weed Control If declared plants are present, then these will be controlled in accordance with the *Biosecurity and Agriculture Management Act 2007*	Presence of declared plant	WoNS and Declared weeds
If weed cover is not met, then herbicide will be applied to affected areas in June/July each year.	Greater than 30% coverage	Per cent weed cover
Infill Planting If the target Species Diversity and Plant Density criteria are not met, then infill planting/seeding will occur during the next planting season (June/July of each year).	Less than 300 stems/ha for trees or 3000/ha for shrubs.	Plant density
Infill Planting If Plant composition/structure criteria are not met, then specific species will be infill planted/seeded during the next planting season.	20% over storey, 70% mid-storey, 10% understorey	Plant composition Vegetation Structure
Infill Planting If key species (marri and wandoo) are absent from site, then it will be infill planted/seeded during the next planting season.	Species (marri and wandoo) absent from site	Plant composition Vegetation Structure
Pest control If rabbits/kangaroos are grazing on the newly planted seedlings to the point where completion criteria may not be achieved, then fencing or plant guards will be installed.	Visible grazing by rabbits and warrens present	Plant composition Vegetation Structure

If completion criteria are not achieved after the 5-year monitoring period, Main Roads will continue to monitor and maintain the revegetation areas until such time as the completion criteria are attained.

7. Reporting

Condition15 (b) of clearing permit CPS 8573/2 requires the Permit Holder to provide:

- A description of the revegetation and rehabilitation activities undertaken;
- The size of the areas revegetated and rehabilitated (in hectares);
- The date that revegetation and rehabilitation works began; and
- Actions taken in accordance with Condition 14 of this Permit.

Main Roads will include the information required by Condition 15 (b) in the Annual Compliance Report provided to the Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (DWER) (as per Condition 16 (a)).

8. Timeframes and Funding

Revegetation and revegetation works are proposed to commence as part of overall landscaping works in 2023, with works ongoing into 2024, dependant on when road construction is completed.

Funding for revegetation will be sourced from the overall Bindoon Bypass Northern Section project budget, for development and delivery of the works. Funding for ongoing maintenance and monitoring will be sourced from the regional Main Roads budget.

An indicative revegetation timeline is provided within **Figure 8-1**. Note that this timeline is dependent on the timing of the road construction

Figure 8-1 Indicative revegetation timeline*

Aspect	Winter Year 1	Spring Year 1	Summer Year 1/2	Autumn Year 2	Winter Year 2	Spring Year 2	Summer Year 2/3	Autumn Year 3	Winter Year 3	Spring Year 3	Summer Year 3/4	Autumn Year 4	Winter Year 4	Spring Year 4	Summer Year 4/5	Autumn Year 5	Winter Year 5	Spring Year 5	Summer Year 5
Initial weed control																			
Seed collection																			
Seedling order																			
Site preparation (for areas of revegetation)																			
Weed control																			
Direct seeding																			
Seedling planting																			
Follow up Weed control (if required)																			
Monitoring & Reporting																			
Infill planting																			
Maintenance Weed control																			

	optimum timing
	timing based on seasonal conditions

* - Indicative years are relative to the completion of construction activities.

9. References

Jacobs (2020). *Bindoon Bypass Construction Environmental Management Plan*. Arup Jacobs Joint Venture.

Muir, B. G. (1977). *Vegetation and habitat of Bendering Reserve Records of the Western Australian Museum*. Supplement 3

Phoenix Environmental Sciences (2019). *Flora and fauna assessment for Calingiri study area*: *Great Northern Highway, Muchea to Wubin Upgrade Stage 2 Project*.

Terratree (2016). *Phytophthora Dieback Assessment of Great Northern Highway (Bindoon Bypass to Bindi Bindi)*. Report prepared for Jacobs.

Appendix A Planting mixes and densities for each rehabilitation area

All three rehabilitation/revegetation patches contain a mix of redundant road carriageway, remnant roadside vegetation and cleared areas as part of the new BBN alignment. A breakdown of the different planting/seeding mixes and densities for each of these areas is provide within the table below.

Area	Botanical Name	Common Name	Type	Seed Density
Cleared areas	*Acacia lasiocarpa*	Wattle	Seedling	N/A
	Allocasuarina campestris	Shrubby Sheoak	Seedling	N/A
	Allocasuarina humilis	Dwarf Sheoak	Seedling	N/A
	Banksia nivea	Honeypot Dryanda	Seedling	N/A
	Banksia sessilis	Parrot Bush	Seedling	N/A
	Billardiera fusiformis	Australian Blue-bell	Seedling	N/A
	Bossiaea eriocarpa	Common Brown	Seedling	N/A
	Calothamnus quadrifidus	One Sided Bottlebrush	Seedling	N/A
	Corymbia calophylla	Marri	Seedling	N/A
	Dampiera linearis	Common Dampiera	Seedling	N/A
	Dianella revoluta	Blueberry lily	Seedling	N/A
	Eucalyptus accedens	Smooth-bark Wandoo	Seedling	N/A
	Eucalyptus drummondii	Drummond's Mallee	Seedling	N/A
	Eucalyptus loxophleba	York Gum	Seedling	N/A
	Eucalyptus wandoo	Wandoo	Seedling	N/A
	Grevillea obtusifolia	Gingin Gem	Seedling	N/A
	Grevillea vestita	Spider Flower	Seedling	N/A
	Hakea lissocarpha	Honeybush	Seedling	N/A
	Hakea prostrata	Harsh Hakea	Seedling	N/A
	Hakea trifurcata	Two-leaved hakea	Seedling	N/A
	Hakea undulata	Wavy-leaved Hakea	Seedling	N/A
	Hakea varia	Variable-leaved Hakea	Seedling	N/A
	Hypocalymma angustifolium	Myrtle	Seedling	N/A
	Kunzea recurva	Purple Kunzea	Seedling	N/A
	Leptospermum erubescens	Roadside Teatree	Seedling	N/A
	Melaleuca elliptica	Granite Honey	Seedling	N/A
	Melaleuca lateritia	Robin Red-breast	Seedling	N/A
	Melaleuca radula	Graceful Honey-myrtle	Seedling	N/A
	Acacia drummondii	Drummond's Wattle	Seed	450 g/ha
	Acacia pulchella	Prickly Moses	Seed	700 g/ha
	Banksia fraseri	Possum Banksia	Seed	60 g/ha
	Banksia kippistiana		Seed	60 g/ha
	Hakea cyclocarpa	Ramshorn Hakea	Seed	100 g/ha
	Hakea incrassata	Marble Hakea	Seed	100 g/ha

Area	Botanical Name	Common Name	Type	Seed Density
	Melaleuca trichophylla	Pretty Honey	Seed	400 g/ha
	Xanthorrhoea preissii	Grass Tree	Seed	300 g/ha
Redundant road carriageway Retained vegetation areas	*Acacia acuminata*	Jam Wattle	Seed	150 g/ha
	Acacia colletioides	Pin Bush	Seed	100 g/ha
	Acacia drummondii	Drummonds Wattle	Seed	200 g/ha
	Acacia hemiteles	Tan Wattle	Seed	100 g/ha
	Acacia lasiocarpha	Wattle	Seed	500 g/ha
	Acacia microbotrya	Manna Wattle	Seed	150 g/ha
	Acacia pulchella	Prickly Moses Wattle	Seed	500 g/ha
	Allocasuarina acutivalvis		Seed	100 g/ha
	Allocasuarina campestris	Shrubby Sheoak	Seed	100 g/ha
	Allocasuarina huegeliana	Rock Sheoak	Seed	150 g/ha
	Allocasuarina humilis	Dwarf Sheoak	Seed	600 g/ha
	Calothamnus quadrifuidus	One sided Bottlebrush	Seed	650 g/ha
	Hakea Lissocarpha	Honey Bush	Seed	300 g/ha
	Hakea varia	Variable leaved Hakea	Seed	200 g/ha
	Hakea trifurcata	Two leaved Hakea	Seed	150 g/ha
	Hakea undulata	Wavy-leaved Hakea	Seed	150 g/ha
	Kennedia prostrata	Running Postman	Seed	200 g/ha
	Kunzea recurva	Purple Kunzea	Seed	300 g/ha
	Leptospermum erubescens	Roadside Teatree	Seed	300 g/ha
	Patersonia occidentalis	Long purple flag	Seed	100 g/ha

Appendix B Reference Site Species List

Vegetation Association: Medium Woodland; Wandoo

Botanical Name
Acacia willdenowiana
Allocasuarina humilis
Amphipogon caricinus
Amphipogon turbinatus
Austrostipa elegantissima
Banksia armata
Boronia ovata
Borya sphaerocephala
Bossiaea eriocarpa
Burchardia congesta
Cassytha racemosa forma *racemosa*
Conostylis androstemma
Conostylis setigera subsp. *setigera*
Daviesia debilior subsp. *sinuans*
Eucalyptus wandoo
Glischrocaryon aureum
Goodenia trichophylla
Grevillea synapheae subsp. *synapheae*
Hakea erinacea
Hakea incrassata
Hibbertia hibbertioides var. *hibbertioides*
Hibbertia hypericoides
Laxmannia squarrosa
Lepidobolus preissianus
Lepidosperma pubisquameum
Lepidosperma tenue
Mesomelaena pseudostygia
Opercularia vaginata
Pterochaeta paniculate
Schoenus clandestinus
Stylidium pubigerum
Tetratheca confertifolia
Xanthorrhoea preissii
Xanthosia ciliate

Appendix C Vegetation Monitoring Sheet

Site Number/ Site Reference		SLK		Side of Road		Lat Easting		Long Northing	
Revegetation History									
Current Site Conditions									
Date	Total number of species present in 10 m x 10 m (100 m^2)			Total number of individual plants present in 10 m x 10 m (100 m^2)			Approximate number of plants present in one hectare		
% Weed cover of Quadrat		Weed Species Present in Quadrat							
Vegetation Structure [using Muir (1977)]									
Additional Comments									

Conservation significant flora:

The application for CPS 8573/1 and 8573/2 was supported by a biological survey undertaken by Phoenix Environmental Services (Phoenix) in 2019 (our ref: D20#504158).

The flora species list from the biological survey was compared against the current DBCA Threatened and Priority Flora list. This review did not identify any new conservation significant flora species but identified one delisted species. The remaining species have not changed in conservation status since the biological survey (see Table 1).

Table 1 Flora species identified in the 2019 Phoenix Biological survey currently listed as threatened or priority (DBCA, 2025)

Species	Conservation Status	
	2019	2025
Acacia anarthros	P3	P3
Acacia drummondii subsp. *affinis*	P3	P3
Banksia serratuloides subsp. *serratuloides*	VU	VU
Calothamnus pachystachyus	P4	P4
Conospermum densiflorum subsp. *unicephalatum*	EN	EN
Daviesia debilior subsp. *sinuans*	P3	P3
Grevillea drummondii	P4	P4
Hakea chromatropa	P1	P1
Hibbertia miniata	P2	P4
Hibbertia montana	P4	Delisted
Leucopogon darlingensis subsp. *rectus*	P2	P2
Melaleuca sclerophylla	P3	P3
Persoonia sulcata	P4	P4
Synaphea grandis	P4	P4
Synaphea rangiferops	P2	P2

Ecological Communities

A search against the current DBCA TEC/PEC spatial dataset identified six ecological communities that occur within 20 km of the clearing permit boundary.

- Claypans with shrubs over herbs (P1)
- Banksia Woodlands of the SCP (P3)
- Wheatbelt Woodlands Eucalypt woodlands (P3)
- SCP23b Swan Coastal Plain Banksia attenuata - Banksia menziesii woodlands (P3)
- SCP3b Corymbia calophylla — Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain (EN)
- SCP07 Herb rich saline shrublands in clay pans (EN)

Of these communities, only the Wheatbelt Woodlands ecological community occurred within 10 km of the clearing permit boundary, and this included 11 occurrences that intersect the northern section of the clearing permit boundary.

The 2019 biological survey did not identify any TEC or PEC within the survey area. This determination included an assessment of several patches of vegetation against the diagnostic characteristics for the Eucalypt Woodlands of the Western Australian Wheatbelt

TEC as listed in the 2015 approved EPBC Act conservation advice[1]. The assessment found that although several patches of eucalypt woodlands met the diagnostic criteria, these sites were all in a 'degraded' condition therefore not representing the TEC. This conservation advice and diagnostic criteria remains current.

The conservation status of this community has not changed since the 2019 survey undertaken by Phoenix and it is still listed as Priority 3.

Fauna

The list of fauna species identified by Phoenix (2019) in their desktop assessment was reviewed against the current DBCA threatened and Priority fauna list. This review found no newly listed species, two species that had changed in conservation status, and 26 species that had not changed in status. Only 13 of the conservation significant species were considered by Phoenix (2019) to be relevant to the survey area and none of these had changed in conservation status.

Table 2 Fauna species identified in the 2019 Phoenix biological survey currently listed as threatened or priority (DBCA, 2025)

Species		Conservation Status	
	Relevant to survey area	2019	2025
Idiosoma nigrum		EN	EN
Idiosoma mcclementsorum	Yes	P2	P2
Throscodectes xederoides	Yes	P3	P3
Leipoa ocellata	Yes	VU	VU
Oxyura australis	Yes	P4	P4
Apus pacificus	Yes	MIG	MIG
Falco peregrinus	Yes	OS	OS
Thinornis rubricollis	Yes	P4	P4
Rostratula australis	Yes	EN	EN
Actitis hypoleucos		MI	MI
Numenius madagascariensis		VU	CR
Calidris acuminata		MI	MI
Calidris ruficollis		MI	MI
Calidris ferruginea		VU	CR
Calidris melanotos		MI	MI
Tringa glareola		MI	MI
Tringa nebularia		MI	MI
Limosa limosa		MI	MI
Gelochelidon nilotica		MI	MI
Calyptorhynchus banksii naso	Yes	VU	VU
Zanda latirostris	Yes	VU	VU
Zanda baudinii	Yes	EN	EN
Dasyurus geoffroii	Yes	VU	VU
Isoodon fusciventer	Yes	P4	P4
Parantechinus apicalis		EN	EN
Phascogale calura		CD	CD
Notomys longicaudatus		Ex	Ex
Notomys macrotis		Ex	Ex

[1] Department of the Environment (2015) Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt.

Conclusion:

A desktop review of the current information relevant to conservation significant flora, ecological communities and fauna indicates that:

- The flora species that were originally identified in the project area have not increased in conservation status since the original survey and clearing permit assessment.
- The only priority or threatened ecological community mapped in the vicinity of the project area was determined to not be present in the original survey.
- No changes to conservation status have occurred to those fauna species considered relevant to the project area.

Based on the above, it is considered there are no changes to conservation values that would trigger the need for a re-assessment of the remaining clearing against the Clearing Principles.