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NorthLinkWA
Perth-Darwin National Highway

Condition Environmental Management Plan

Flora and Vegetation – Progressive Rehabilitation

Perth–Darwin National Highway (Swan Valley Section)

AUGUST 2018





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Document Control					
Revision	Date	Description	Prepared	Reviewed	Approved
A	26/07/2016	Draft (Coffey v1)	D. Anthony	E. Waterhouse	E. Waterhouse
B	19/08/2016	Draft for consultation (Coffey v2)	M. Holliday	E. Waterhouse	E. Waterhouse
C	04/10/2016	Draft for consultation (Coffey v3)	M. Holliday	D. Morley	D. Morley
D	17/11/2016	Draft (Coffey v4)	M. Holliday	D. Morley	D. Morley
0	25/11/2016	Final for submission to OEPA (Coffey v5)	M. Holliday	D. Morley	D. Morley
1	16/01/2017	Addressed OEPA comments (Coffey v6)	M. Holliday	D. Morley	D. Morley
2	31/01/2017	Addressed OEPA comments (Coffey v7)	M. Holliday	D. Morley	D. Morley
3	06/02/2017	Addressed OEPA comments (Coffey v8)	D. Morley	D. Morley	D. Morley
4	31/08/2018	Amended following annual review (ELA v9)	D. Morley	J. Longstaff	J. Longstaff

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ENAUPERT04483AA_60_FVRehabilitation_CEMP_v9
EP2016/048



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1 SUMMARY

This Condition Environmental Management Plan (Condition EMP) (this plan) is submitted in accordance with Ministerial Statement No. 1036 conditions 7-1 and 11-1 for the Perth–Darwin National Highway (Swan Valley Section) (PDNH) by Main Roads Western Australia (MRWA). It is a revision of the previous version approved by the former Office of the Environmental Protection Authority (OEPA) on 8 February 2017 (reference NLWA-03-EN-RP-0053 / Rev 3).

This document sets out the rehabilitation management actions to achieve successful revegetation. MRWA will only rehabilitate the redundant section of Beechboro Road North from Jules Steiner Memorial Drive to Gnangara Road (hereafter known as the rehabilitation site). There are no locations within the proposal development envelope that will be temporarily cleared during construction and therefore there are no locations of temporary clearing that require rehabilitation.

Table 1 details the environmental management targets and completion criteria to measure achievement of the environmental objectives that must be met through implementation of this plan.

Table 1 Flora and Vegetation Rehabilitation Condition EMP summary

Item	Details
Title of proposal	Perth–Darwin National Highway (Swan Valley Section)
Proponent name	Commissioner for Main Roads Western Australia
Ministerial Statement No.	1036
Purpose of this Condition EMP	The Flora and Vegetation – Progressive Rehabilitation – Condition EMP is submitted to fulfil the requirements of conditions 7-1 and 11-1 of the above Statement.
EPA’s environmental objectives for the key environmental factors	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.
Condition environmental objectives	To manage the implementation of the proposal to meet the following environmental objectives: <ul style="list-style-type: none">To progressively rehabilitate the areas of native vegetation cleared as a result of implementation of the proposal that are no longer required for construction activities or not required for ongoing operations.To rehabilitate the section of Beechboro Road North from Jules Steiner Memorial Drive to Gnangara Road within twelve months of decommissioning this section of road.
Management target 1:	Rehabilitation of the redundant section of Beechboro Road North has commenced within 12 months of decommissioning.
Management target 2:	After three years, the rehabilitation site meets the completion criteria using locally native species.
Completion criterion 1:	Total native species richness across the rehabilitation site is a minimum of 46 native species.
Completion criterion 2:	Average native species per quadrat is a minimum of 26 native species per 100 m ² .



Item	Details
Completion criterion 3:	Tree species richness across the rehabilitation site is to include the following five tree species: <ul style="list-style-type: none">• <i>Banksia attenuata</i>.• <i>Banksia menziesii</i>.• <i>Corymbia calophylla</i>.• <i>Eucalyptus marginata</i> subsp. <i>thalassica</i>.• <i>Eucalyptus todtiana</i>.
Completion criterion 4:	Average native shrub species richness per quadrat is a minimum of nine species.
Completion criterion 5:	Foliage cover of native species averages a minimum of 50% across the rehabilitation site.
Completion criterion 6:	Weed cover averages a maximum of 10% across the rehabilitation site.
Completion criterion 7:	No plants listed as declared pests under section 22(2) of the <i>Biosecurity and Agriculture Management Act 2007</i> or Weeds of National Significance are present within the rehabilitation site.

2 CONTEXT, SCOPE AND RATIONALE

2.1 Description of the Proposal

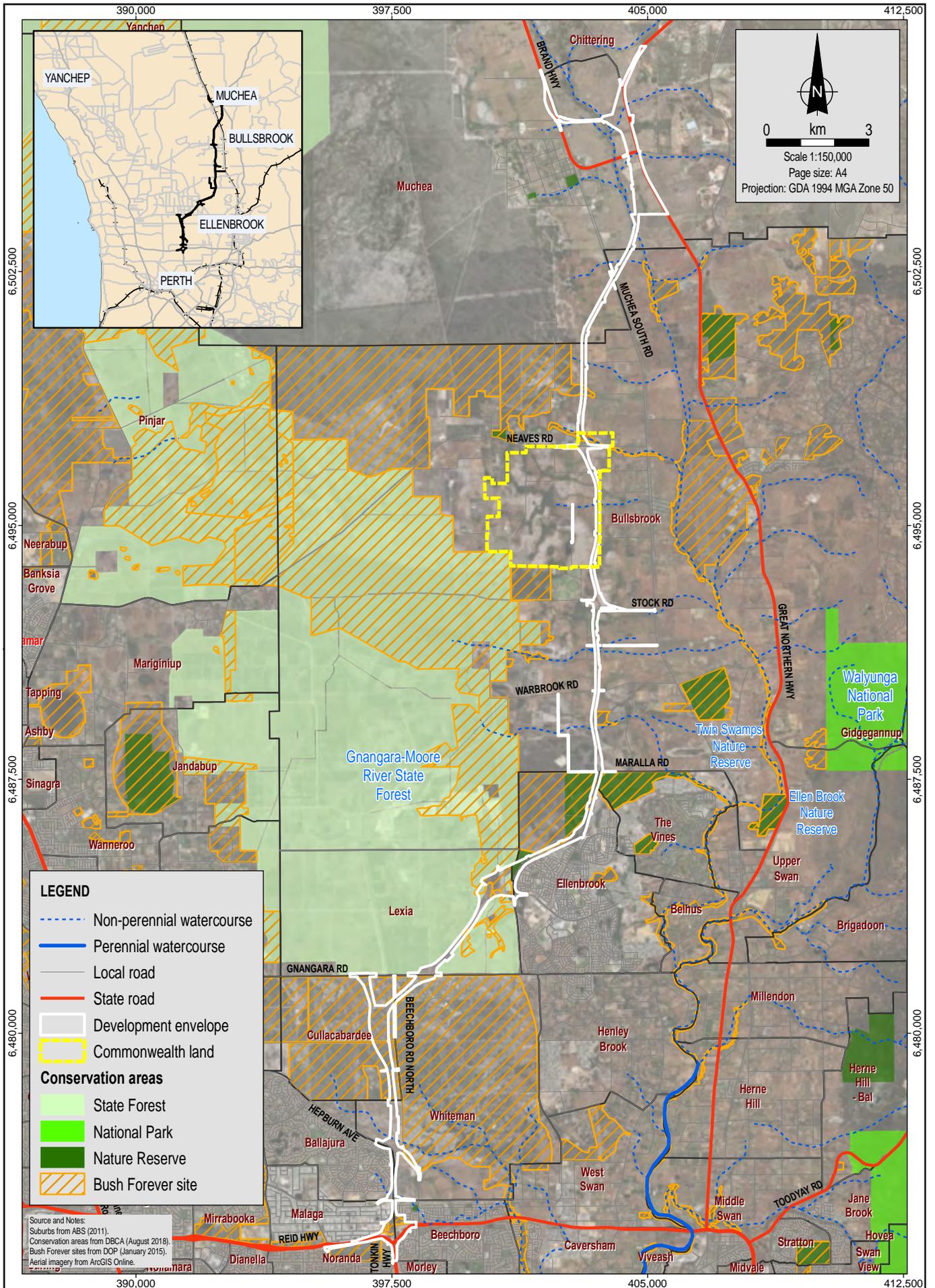
MRWA proposes to construct a new 38 km section of the Perth–Darwin National Highway (PDNH) (Figure 1) between Malaga and Muchea in Western Australia (the proposal). The proposal will consist of a dual carriageway highway and will connect the intersection of Tonkin Highway and Reid Highway in the south with Great Northern Highway and Brand Highway in the north.

2.2 Key Environmental Factors

This plan addresses the flora and vegetation environmental factor, which is part of the Land theme. The relevance of this environmental factor to the proposal is presented in Table 2.

Table 2 Environmental aspects of the rehabilitation of the redundant section of Beechboro Road North

Environmental aspect of the proposal	Affected species, populations and communities	Impact	Activity/threatening process
Failure to rehabilitate a proposal site; or poor site rehabilitation.	Flora and vegetation types identified in Coffey (2015b) for the proposal footprint. Beechboro Road North species list identified in Appendix A.	<ul style="list-style-type: none">• Weed invasion.• Spread of dieback.• Loss of topsoil.• Rubbish dumping.• Unauthorised vehicle access.• Increased risk of fire.	Poor site preparation and/or topsoil management. Increased soil erosion from wind and water runoff from ground surfaces exposed for long periods.



2.3 Requirements of the Conditions

This plan is submitted in accordance with Ministerial Statement No. 1036, conditions 7-1 and 11-1 to 11-6 for the proposal. The requirement of these conditions are described in Table 3.

This plan will be made publicly available for the life of the proposal, in accordance with condition 5-1.

No clearing solely for temporary activities is planned and therefore no actions are required to be taken or specified to meet the environmental objective stated in condition 11-1(1).

The former of Department of Parks and Wildlife (DPAW) was replaced by the Department of Biodiversity, Conservation and Attractions (DBCA) on 1 July 2017. References to DPAW in this plan have been changed to DBCA except for historical usage and direct quotations of the condition text from Ministerial Statement No. 1036.

Table 3 Summary of conditions

Condition number	Condition	Section in this plan
7-1	Prior to the commencement of ground disturbing activities, or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit Condition Environmental Management Plans to the satisfaction of the CEO to demonstrate that the environmental objectives in condition 11-1 will be met.	This plan
7-2	<p>The Condition Environmental Management Plans shall:</p> <ol style="list-style-type: none"> 1. Prioritise risk-based management actions that will be implemented to meet the environmental management objectives in condition 11-1. 2. Specify measurable management targets for determining the efficacy of the risk-based management actions. 3. Specify monitoring to be conducted to measure the efficacy of management actions against management targets. 4. Specify, in the event that the management targets are not achieved a procedure for revision of management actions and changes to proposal activities. The procedure shall include an investigation to determine the cause of the management targets being exceeded. 5. Provide the format and timing for annual reporting required by condition 4-6 for: <ol style="list-style-type: none"> (a) Verification of the implementation of management actions to demonstrate that condition 11-1 has been met for the reporting period. (b) Reporting on the efficacy of management actions against management targets. 6. Provide for reporting when management actions are not implemented. 	Section 3

Condition number	Condition	Section in this plan
7-3	<p>After receiving notice in writing from the CEO that a Condition Environmental Management Plans satisfies the requirements of condition 7-2 for condition 11-1 the proponent shall prior to the commencement of ground disturbing activities:</p> <ol style="list-style-type: none"> 1. Implement the provisions of the approved Condition Environmental Management Plans. 2. Continue to implement the approved Condition Environmental Management Plans until the CEO has confirmed by notice in writing that the proponent has met the relevant objectives specified in the approved Condition Environmental Management Plan and no longer needs to implement that particular Condition Environmental Management Plan. 	This plan
7-4	<p>In the event that monitoring, tests, surveys or investigations indicate that management actions specified in a Condition Environmental Management Plan are not implemented or that management targets specified in a Condition Environmental Management Plans are exceeded, the proponent shall:</p> <ol style="list-style-type: none"> 1. Report the exceedance or failure to implement management actions in writing within 7 days of identification. 2. Investigate to determine the cause of the management actions not being implemented and/or management targets being exceeded. 3. Investigate to provide information for the determination by the CEO of potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions. 4. Provide a report to the CEO within 60 days of the reporting required by condition 7-4(1). The report shall include: <ol style="list-style-type: none"> (a) Cause for failure to implement management actions and/or management targets exceeded. (b) The findings of the investigation required by conditions 7-4(2) and 7-4(3). (c) Details of revised and/or additional management actions to be implemented to prevent exceedance of the management targets and/or ensure implementation of management actions. (d) Relevant changes to proposal activities. (e) Measures to prevent, control or abate the environmental harm which may have occurred. 	Section 3.6
7-5	The proponent may review and revise the Condition Environmental Management Plans, or as otherwise specified by the CEO.	Section 4
7-6	The proponent shall implement the latest revision of the Condition Environmental Management Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 7-2.	Section 4

Condition number	Condition	Section in this plan
11-1	<p>The proponent shall manage the implementation of the proposal to meet the following environmental objectives:</p> <ol style="list-style-type: none"> To progressively rehabilitate the areas of native vegetation cleared as a result of implementation of the proposal that are no longer required for construction activities or not required for ongoing operations. To rehabilitate the section of Beechboro Road North from Jules Steiner Memorial Drive to Gngangara Road within twelve months of decommissioning this section of road. <p>Through implementation of the Flora and Vegetation – Progressive Rehabilitation Condition Environmental Management Plan, approved by the CEO.</p>	This plan
11-2	The proponent shall identify and map areas to be rehabilitated as required by Condition 11-1.	Section 2.4 and Figure 2
11-3	Those areas to be rehabilitated as identified in condition 11-2 shall not include areas required for ongoing operations including, but not limited to, drainage basins, road embankments and median strips.	Section 2.4
11-4	The proponent shall prepare the Flora and Vegetation – Progressive Rehabilitation Conditional Environmental Management Plan required by condition 7-1 on advice of the Department of Parks and Wildlife.	Section 5
11-5	The management targets as required by condition 7-2(2) must include rehabilitation completion criteria using locally native species.	Sections 1, 3.2 and Table 6
11-6	The proponent shall not plant known species of foraging habitat for black cockatoos, including but not limited to, <i>Banksia</i> spp., <i>Hakea</i> spp., <i>Grevillea</i> spp. and <i>Eucalyptus</i> spp. within 10 m of the constructed road carriageway.	Section 2.4 and Table 5

2.4 Rationale and Approach in Meeting the Environmental Objective

The EPA's objective is to ensure that areas are rehabilitated and decommissioned in an ecologically sustainable manner (EPA, 2015).

The proposal will be permanent infrastructure and is unlikely to be decommissioned. Beechboro Road North, from Jules Steiner Memorial Drive to Gngangara will be decommissioned and rehabilitated in accordance with the EPA's objective.

2.4.1 Revegetation Setbacks and Placement

Revegetation along the development envelope will comply with MRWA Vegetation Placement within the Road Reserve Doc. No. 6707/022 (MRWA, 2013). This guide defines the recommended setbacks and clearance requirements that apply to all revegetation or landscaping associated with new road construction.

Placement of vegetation near road infrastructure is restricted to maintain road safety. These requirements minimise ongoing maintenance and maintain a standard amenity level for road users. Revegetation will incorporate these restrictions when undertaking planting, in particular, the need for roadside maintenance and clear zones.

Rehabilitation conducted in accordance with this plan does not include areas required for ongoing operations such as drainage basins, road embankments and median strips. It should be noted that many of these areas



will be planted or landscaped, but this planting and landscaping will not be subject to this plan, as per condition 11-3.

No known species of foraging habitat for black cockatoos, including *Banksia* spp., *Grevillea* spp. and *Eucalyptus* spp. will be planted within 10 m of the constructed road carriageway, as per condition 11-6.

2.4.2 Revegetation – Beechboro Road North

The section of Beechboro Road North from Jules Steiner Memorial Drive to Gngara Road will be decommissioned and revegetated (the rehabilitation site) (Figure 2).

The rehabilitation site will be revegetated using the species listed in Appendix A, where practicable. These species are found in the vegetation associations occurring adjacent to Beechboro Road North (Coffey, 2015b).

The mid tree and low woodland species listed in Appendix A will be planted. Seeds of mid to low shrubland and mid to low herbland species will be present within the topsoil collected from similar vegetation associations adjacent to Beechboro Road North within the development envelope. Species composition in the topsoil is expected to be comparable to the adjacent vegetation. Only topsoil from areas uninfested with *Phytophthora cinnamomi* will be used.

Topsoil sourced from the alignment and used in the rehabilitation works will be:

- Assessed for weed infestation and dieback status prior to clearing of vegetation.
- From areas uninfested with *Phytophthora cinnamomi*.

2.4.3 *Phytophthora cinnamomi* (Dieback Disease)

Baseline mapping of *Phytophthora cinnamomi* within the proposal footprint was carried out by Terratree Pty Ltd (Terratree) (Terratree, 2015). The mapping indicates that existing *Phytophthora cinnamomi* infestation may occur where rehabilitation is planned. Revegetation in infested areas is less likely to be successful and, where practicable, *Phytophthora cinnamomi*-resistant native plants will be used.

A dieback hygiene plan will be in place for the rehabilitation works.

2.4.4 Key Assumptions and Uncertainties

The key assumption is that revegetation as proposed will be successful in improving amenity and the stability of disturbed areas, as well as ecological sustainability.

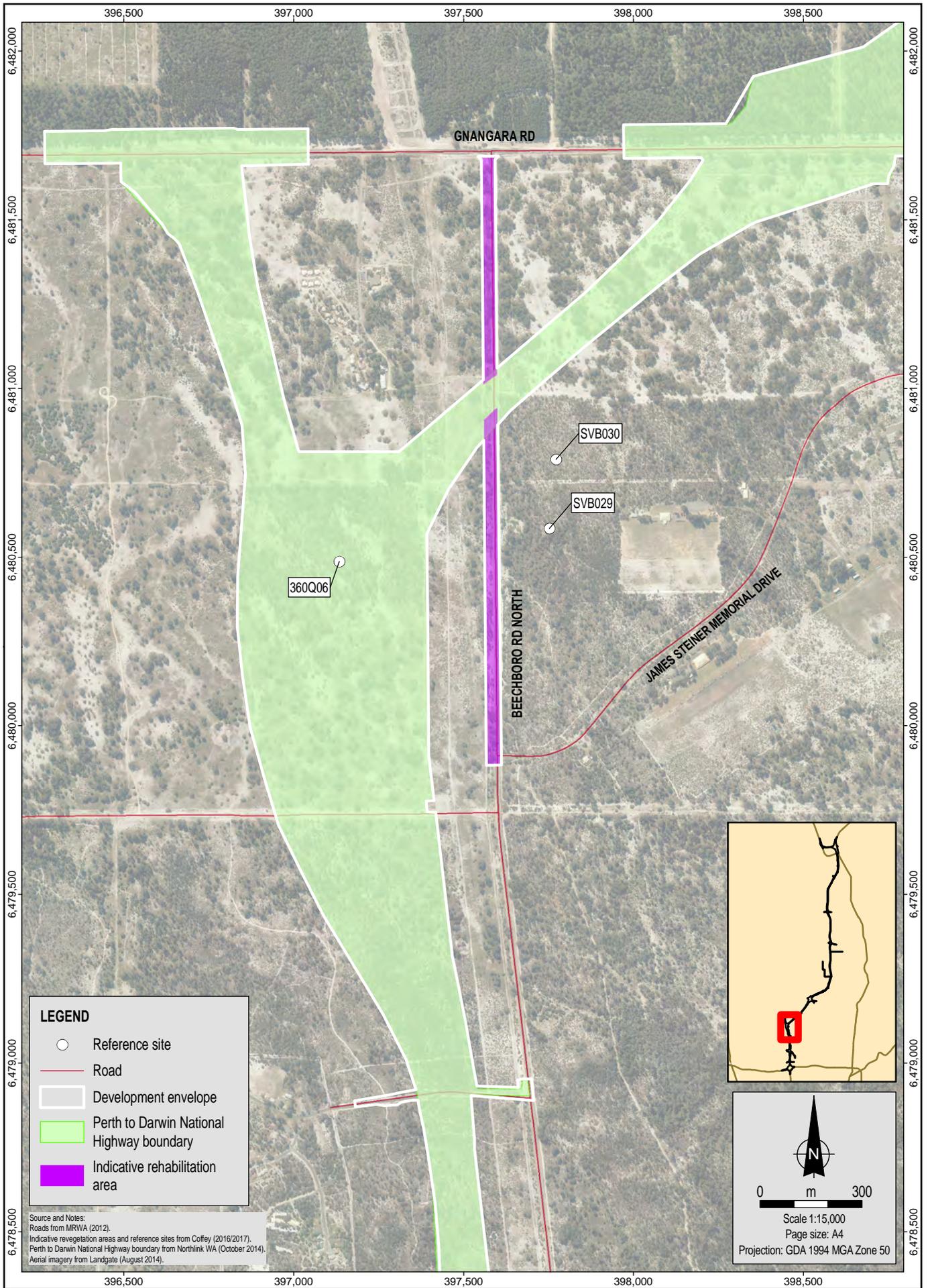
Seeds of mid to low shrubland and mid to low herbland species will be present within the topsoil collected for rehabilitation.

No areas of native vegetation within the development envelope will be temporarily cleared and therefore no management actions are required in relation to condition 11-1(1).

At its closest point, the rehabilitation site is approximately 20 m from the road carriageway, and therefore condition 11-6 will be met.

Uncertainties in the revegetation strategy relate to:

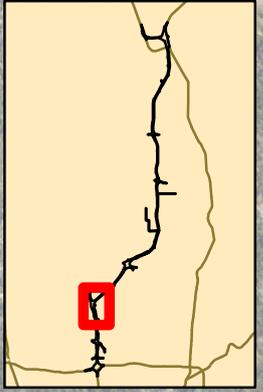
- The extent to which climatic factors outside of MRWA's control will impact on successful rehabilitation.
- Variation in soil condition over the proposal footprint and within the revegetation zones.
- Uncontrollable access to revegetation areas particularly in urban settings.
- The success of rehabilitation within *Phytophthora cinnamomi* 'infested' areas.



LEGEND

- Reference site
- Road
- ▭ Development envelope
- ▭ Perth to Darwin National Highway boundary
- ▭ Indicative rehabilitation area

Source and Notes:
 Roads from MRWA (2012).
 Indicative revegetation areas and reference sites from Coffey (2016/2017).
 Perth to Darwin National Highway boundary from Northlink WA (October 2014).
 Aerial imagery from Landgate (August 2014).



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 Projection: GDA 1994 MGA Zone 50

2.4.5 Management Approach

The management approach has been informed by best practice and recent experience on similar road projects in Western Australia. Rehabilitation occurs where impacts cannot be avoided or minimised.

2.4.6 Rationale for Choice of Management Targets/Completion Criteria

The rationale for the choice of each management target/completion criterion is described below.

Management target 1: Rehabilitation of the redundant section of Beechboro Road North has commenced within 12 months of decommissioning.

This management target focuses on commencing the revegetation of the redundant section of Beechboro Road North from Jules Steiner Memorial Drive to Gngara Road within 12 months of decommissioning.

Management target 2: After three years, the rehabilitation site meets the completion criteria using locally native species.

This management target focuses on successful revegetation using locally native species that will be resilient three years after the rehabilitation works are completed. The proposed area for revegetation is adjacent to the Priority 3 (P3) Priority Ecological Community (PEC) SCP23b and Bush Forever site 304 (Coffey, 2015b). The vegetation on the eastern side of Beechboro Road North near the Whiteman Park archery range is also potential critical *Caladenia huegelii* habitat (Coffey, 2015b). Revegetation success in these locations will help to avoid impacts to adjacent vegetation and enhance ecological function. The three-year period is proposed to allow time for revegetation to become established and the completion criteria to be met.

Completion Criteria

Completion criteria have been developed with consideration given to the EPA's Guidance Statement No. 6 *Rehabilitation of Terrestrial Ecosystems* (EPA, 2006) and the Department of Environment Regulation's draft *A guide to preparing revegetation plans for clearing permits under Part V of the Environmental Protection Act 1986* (DER, 2016). The completion criteria have been developed with reference to three nearby survey sites from the flora survey (Coffey, 2015b) (reference sites).

The following paragraphs set out the completion criteria for the redundant section of Beechboro Road North and the rationale behind each. Table 4, which follows below, summarises how the values within the completion criteria have been derived from the flora and vegetation survey results for the reference sites. In accordance with the EPA and DER guidance, completion criteria for the rehabilitation site have been set at 60% of the corresponding parameters at the reference sites.

Completion criterion 1: Total native species richness across the rehabilitation site is a minimum of 46 native species.

Overall species richness will demonstrate that the rehabilitation site has sufficient species richness on a wider scale to be comparable to adjacent bushland. This completion criterion has been set at 60% of the 76 native species that were recorded at the three reference sites.

Completion criterion 2: Average native species per quadrat is a minimum of 26 native species per 100 m².

Average species richness per quadrat will demonstrate that local scale species richness is similar to adjacent bushland. This completion criterion has been set at 60% of the average native species richness of 43.3 per quadrat measured across the three reference sites.

Completion criterion 3: Tree species richness across the rehabilitation site is to include the following five tree species:

- ***Banksia attenuata*.**

- 
- *Banksia menziesii*.
 - *Corymbia calophylla*.
 - *Eucalyptus marginata* subsp. *thalassica*.
 - *Eucalyptus todtiana*.

Tree species richness will demonstrate that the rehabilitation is developing structural complexity. These five tree species are common across the three reference sites.

Completion criterion 4: Average native shrub species richness per quadrat is a minimum of nine species.

Shrub species richness will demonstrate that the rehabilitation is developing structural complexity. This completion criterion has been set at 60% of the average shrub richness of 15 measured at the three reference sites.

Completion criterion 5: Foliage cover of native species averages a minimum of 50% across the rehabilitation site.

Projected foliage cover of native vegetation (not including weeds) has been used as a completion criterion over other methods of abundance and diversity such as stem density. The rationale for this is that there is data available from the reference sites for foliage cover, but not for stem density.

Completion criterion 6: Weed cover averages a maximum of 10% across the rehabilitation site.

Projected foliage cover for weeds has been used as it is a simple and quantifiable measure for monitoring. The completion criterion of 10% has been set following advice from the former DPAW.

Completion criterion 7: No plants listed as declared pests under section 22(2) of the *Biosecurity and Agriculture Management Act 2007* or Weeds of National Significance are present within the rehabilitation site.

The absence of Weeds of National Significance (WONS) and Declared Pests under the BAM Act has been chosen as a completion criterion. The rationale for this is that these weed species are listed and controlled under policy and legislation.



Table 4 Determination of completion criteria values from reference sites

Completion criterion number and associated parameter	Baseline floristic data at reference sites	Completion target expressed in terms of reference site data	Completion target expressed in absolute values
1 – Total native species richness across rehabilitation site	76 native species across 3 reference sites.	Minimum of 60% of number of native species across rehabilitation site when compared to all the reference sites.	The rehabilitation site needs to achieve a minimum of 46 native species.
2 – Average native species per quadrat	Average of 43.3 species per quadrat.	Minimum of 60% of number of native species in each quadrat at rehabilitation site when compared to the average across the reference sites.	The rehabilitation site needs to achieve a minimum of 26 native species per quadrat.
3 – Tree species richness across rehabilitated site	Five common tree species.	Five of the common tree species of the reference site to be present at the rehabilitation site.	The following species shall be present in the rehabilitation site: <ul style="list-style-type: none"> • <i>Banksia attenuata</i> • <i>Banksia menziesii</i> • <i>Corymbia calophylla</i> • <i>Eucalyptus marginata</i> subsp. <i>thalassica</i> • <i>Eucalyptus todtiana</i>
4 – Average shrub species richness per quadrat	Average shrub species richness of 15 species per quadrat.	Minimum of 60% shrub species in each quadrat at the rehabilitation site when compared to the average across the reference sites.	The rehabilitation site needs to achieve a minimum of 9 shrub species per quadrat.
5 – Foliage cover of native species	Average foliage cover across the three reference sites is 67%.	Minimum of 50% native species foliage cover.	The rehabilitation site needs to achieve a projected foliage cover of native species of 50%.
6 – Weed cover	Rehabilitated site is adjacent to significantly degraded areas.	Weeds are manageable and not likely to outcompete revegetation.	The rehabilitation site needs to have no greater than 10% weed cover.
7 – Declared weeds and WONS	Some declared weeds present in adjacent bushland (One-leaf Cape Tulip – <i>Moraea faccida</i>)	(Managed as required by regulations. No declared weeds or WONS present.)	The rehabilitation site must have no declared weeds or WONS present.

Note: Table developed from DER (2016).



3 EMP PROVISIONS

3.1 Condition Environmental Objective

Implementation condition 11-1 details the environmental objectives that are to be met during construction of the proposal, namely:

- To progressively rehabilitate the areas of native vegetation cleared as a result of implementation of the proposal that are no longer required for construction activities or not required for ongoing operations.
- To rehabilitate the section of Beechboro Road North from Jules Steiner Memorial Drive to Gnangara Road within twelve months of decommissioning this section of road.

3.2 Management Actions to be Implemented

Risk-based management actions have been identified and prioritised to achieve the condition environmental objectives (Table 5). These management actions focus the greatest management effort on ensuring revegetation is resilient using local provenance native species. These management actions were specifically developed to meet the environmental objectives in Section 3.1 and will be implemented by MRWA for the proposal.

The stockpiling and reuse of topsoil is commonly used for rehabilitation. The success of rehabilitation using topsoil is in turn dependent on the management of topsoil stockpiles. Viability of topsoil will depend on existing vegetation condition, weeds and disease.

Vegetation clearance and topsoil stripping is typically best undertaken in dry conditions and when the seed bank is at its highest. Vegetation can be respread over the topsoil to prevent erosion and, if chipped, used as a mulch to prevent erosion (wind and water) and weeds establishing and to retain soil moisture.

The timing of revegetation is a key to revegetation success. Where practicable, topsoil respreading, seeding and/or planting will be undertaken during optimal conditions. Optimal conditions for topsoil respreading is typically when conditions are dry. Optimal timing for Perth and surrounds for seeding is April to June and May to July for planting (MRWA, 2004).

MRWA will only rehabilitate the redundant section of Beechboro Road North from Jules Steiner Memorial Drive to Gnangara Road. No areas of native vegetation within the development envelope will be temporarily cleared and therefore no management actions are required in relation to condition 11-1(1).



Table 5 Risk-based management actions that will be implemented to meet the environmental objectives

Risk and key impacts	Management actions	Risk-based priority
Failure to rehabilitate.	(No specific management actions – the risk-based priority for failure to rehabilitate is low.)	Low
Poor rehabilitation success at the redundant section of Beechboro Road North.	Remove asphalt and/or bitumen from redundant road.	Medium
	Rip rehabilitation site to the depth of the road formation or at least 1 m.	
	Revegetation will consist of topsoil spreading, seeding and planting of species.	
	The stripping of topsoil and clearing of vegetation will be undertaken during optimal seasons, where practicable.	
	Topsoil for respreading in rehabilitation activities will be sourced from cleared areas in the proposal footprint. If sufficient suitable topsoil is not available within the proposal footprint, additional suitable topsoil will be sourced externally.	
	Topsoil will be deemed unsuitable for rehabilitation activities if it contains, or is known to come from a source containing, weeds (Declared Pests or WONS) or <i>Phytophthora cinnamomi</i> .	
	If unable to be spread onto the rehabilitation site immediately, topsoil intended for use in rehabilitation activities may be stockpiled for a maximum of 12 months prior to respreading.	
	Only topsoil from areas uninfested from <i>Phytophthora cinnamomi</i> will be used.	
	Weed-free stripped vegetation will be used to stabilise topsoil, and/or chipped and used as mulch.	
	If topsoil is not available, spread seed mix at a rate of 4.5 kg/ha onto rehabilitated site.	
	Revegetation will be conducted progressively where practicable, taking into account the optimal condition(s) and season(s) for achieving revegetation success.	
	Local provenance native species that represent floristic assemblages adjacent to rehabilitation site will be used for revegetation.	
	Tubestock planting of mid-tree and low woodland species will be at a minimum density of 2,500 stems per hectare.	
	Plant species known to be Black Cockatoo foraging habitat, including but not limited to <i>Banksia</i> spp., <i>Hakea</i> spp., <i>Grevillea</i> spp. and <i>Eucalyptus</i> spp., will not be planted within 10 m of the constructed road carriageway.	
Inspect for, and control, weeds four times per year until completion criteria are met.		
Establish six monitoring plots – three north and three south of the proposal alignment at the rehabilitation site.		
Install temporary fencing or tree guards and signage at the rehabilitation site.		

3.3 Management Target/Completion Criteria

Management targets and completion criteria will be used to measure and report achievement against the environmental objectives (Table 6).

The Environmental Protection Authority (EPA, 2006) Guidance Statement No. 6, Rehabilitation of Terrestrial Ecosystems and DER's *A guide to preparing revegetation plans for clearing permits under Part V of the Environmental Protection Act 1986* (DER, 2016) were considered in developing the completion criteria.

The completion criteria are to be met after three years. Monitoring will occur annually in spring after completion of revegetation until all completion criteria have been met.

Table 6 Management targets and completion criteria to measure the efficacy of management actions relative to the environmental objective

Item	Detail
Environmental objective (development envelope)	To progressively rehabilitate the areas of native vegetation cleared as a result of implementation of the proposal that are no longer required for construction activities or not required for ongoing operations.
	No clearing solely for temporary activities is planned, therefore this environmental objective is met.
Environmental objective (Beechboro Road North)	To rehabilitate the section of Beechboro Road North from Jules Steiner Memorial Drive to Gngangara Road within twelve months of decommissioning this section of road.
Management target 1	Rehabilitation of the redundant section of Beechboro Road North has commenced within 12 months of decommissioning.
Management target 2	After three years, the rehabilitation site meets the completion criteria using locally native species.
Completion criteria	
Completion criterion 1	Total native species richness across the rehabilitation site is a minimum of 46 native species.
Completion criterion 2	Average native species per quadrat is a minimum of 26 native species per 100 m ² .
Completion criterion 3	Tree species richness across the rehabilitation site is to include the following five tree species: <ul style="list-style-type: none"> • <i>Banksia attenuata</i>. • <i>Banksia menziesii</i>. • <i>Corymbia calophylla</i>. • <i>Eucalyptus marginata</i> subsp. <i>thalassica</i>. • <i>Eucalyptus todtiana</i>.
Completion criterion 4	Average native shrub species richness per quadrat is a minimum of nine species.
Completion criterion 5	Foliage cover of native species averages a minimum of 50% across the rehabilitation site.
Completion criterion 6	Weed cover averages a maximum of 10% across the rehabilitation site.
Completion criterion 7	No plants listed as declared pests under section 22(2) of the <i>Biosecurity and Agriculture Management Act 2007</i> or Weeds of National Significance are present within the rehabilitation site.

3.4 Monitoring

The purpose of monitoring is to inform, through the management targets/completion criteria, if the environmental objectives are being achieved or whether management actions need to be reviewed and revised.

The road carriageway is approximately 20 m away from the rehabilitation site, and therefore condition 11-6 is met and does not require monitoring.

Reference sites used in developing the completion criteria are the quadrats 360Q06, SVB029 and SVB030 (shown in Figure 2) from the Level 2 floristic survey carried out as part of the PER (Coffey, 2015b). These quadrats are the closest to the rehabilitation site for which full data is readily obtainable. Table 7 contains a summary of species richness and projected foliage cover from these three sites. A list of species found in these sites is included in Appendix A.

Table 7 Summary of overall species richness, shrub species richness and foliage cover from the three reference sites 360Q06, SVB029 and SVB030

Reference site	Overall species richness	Shrubs species richness	Foliage cover
SVB029	39	10	50%
SVB030	51	24	63%
360Q06	40	11	88%
Average	43.33	15	67%
Total species	76	28	–

Monitoring will be undertaken for each completion criterion as detailed in Table 8. The location, parameters and frequency of monitoring is specified. Early warning indicators provide advance warning that a management target/completion criterion may not be met. The results of monitoring will be compared against these indicators and will enable actions to be put in place to control the contributing processes so that the management objective can be met.

Table 8 Monitoring to measure the efficacy of management actions against the management targets and completion criteria

Indicator	Parameter	Location	Completion criteria	Frequency	Early warning indicator
Commencement of rehabilitation	Has rehabilitation commenced within 12 months of decommissioning Beechboro Road North?	The redundant section of Beechboro Road North.	Rehabilitation has commenced within 12 months of the decommissioning of rehabilitation site.	Monthly starting at nine months after decommissioning .	Rehabilitation not yet commenced nine months after decommissioning of redundant section of Beechboro Road North.
Weeds	Visual observation of weed cover in 10 x 10 m monitoring plot. Record observations at each plot. Photographic record at each plot. Refer to Appendix A for detailed method.	The redundant section of Beechboro Road North.	Average weed cover across all quadrats < 10%. No declared pest weed species or WONS present.	Post revegetation. Quarterly for three years. After initial three years, annually in spring until completion criterion is met.	Weed infestation > 5% after first year. Declared pest weeds or WONS present.
Species richness	Visual observation of species richness, shrub species richness, and tree species richness within 10 x 10 m monitoring plot. Count of total species richness across the site. Photographic record at each plot. Refer to Appendix A for detailed method.	The redundant section of Beechboro Road North.	Total native species richness across the rehabilitation site is a minimum of 46 native species. Species richness per 100 m ² averages more than 26 native species. All tree species present. Shrub species richness per quadrat at least nine species.	Post revegetation. Annually in spring for three years or until completion criterion is met.	Native species richness < 20 two years from completion of seeding, planting or topsoil respread. One or more tree species not present.

Indicator	Parameter	Location	Completion criteria	Frequency	Early warning indicator
Vegetation cover	Visual observation of vegetation cover within 10 x 10 m monitoring plot. Refer to Appendix A for detailed method.	The redundant section of Beechboro Road North.	Mean vegetation cover of native species is more than 50% across revegetation area.	Post revegetation. Annually in spring for three years or until completion criterion is met.	Mean vegetation cover of native species < 50% after two years.

Monitoring of the rehabilitation site will commence upon completion of revegetation and will continue annually in spring for three years post construction. The monitoring program will be reviewed three years after the commencement of revegetation. If environmental objectives are not met, monitoring will continue until they are met.

3.5 Review and Revision of Management Actions

Where an early warning indicator is triggered, management actions are not implemented and/or the management target is not met, MRWA will:

- Investigate the reasons for the management actions not being implemented and/or management targets being exceeded.
- Investigate to determine potential environmental harm or alteration of the environment that occurred due to failure to implement management actions.
- Review and the management actions (Table 5) and revise if required.
- Develop additional management actions where necessary.

Potential adaptive management actions are listed in Section 4.

If it is identified that an area of native vegetation is required to be temporarily cleared, this plan will be reviewed and revised accordingly.

3.6 Reporting Provisions

3.6.1 Annual Compliance Assessment Report

The annual compliance assessment report (CAR) will include a summary of compliance against the management actions detailed in Table 5. The results of monitoring undertaken in Table 8 will be included in the appendices of the CAR including the following information:

- Documentation of monitoring undertaken.
- Comparison of monitoring results against the management targets/completion criteria and early warning indicators.
- Management actions undertaken, including revised or additional actions.

The CAR will also include information on the achievement or not of the environmental objectives (Table 9). If the environmental objectives have not been achieved during the reporting period, CAR will include a description of revised and/or additional management actions to be implemented to achieve the targets, and an analysis of trends.

Condition 11-2 requires mapping to identify the areas rehabilitated. This information will be included in the CAR. The CAR will be submitted in accordance with condition 4-6.

Table 9 Environmental management plan reporting table

Key environmental factor: Flora and Vegetation Rehabilitation Ministerial Statement 1036 conditions 11-1 to 11-6		
Condition environmental objective and management target/completion criterion set in the Condition EMP	Reporting on the management objective and management target/completion criterion for [Month/Year] to [Month/Year].	Status ¹
Condition environmental objectives		
To progressively rehabilitate the areas of native vegetation cleared as a result of implementation of the proposal that are no longer required for construction activities or not required for ongoing operations.	No clearing solely for temporary activities is planned and therefore no actions are required to be taken or specified to meet the environmental objective stated in condition 11-1(1).	Yes/No
To rehabilitate the section of Beechboro Road North from Jules Steiner Memorial Drive to Gnangara Road within twelve months of decommissioning this section of road.	The section of Beechboro Road North from Jules Steiner Memorial Drive to Gnangara Road was rehabilitated within twelve months of decommissioning this section of road.	Yes/No
Management targets		
Management target 1	Rehabilitation of the redundant section of Beechboro Road North has commenced within 12 months of decommissioning.	Yes/No
Management target 2	After three years, the rehabilitation site meets the completion criteria using locally native species.	Yes/No
Completion criteria		
Completion criterion 1	Total native species richness across the rehabilitation site has a minimum of 46 native species.	Yes/No
Completion criterion 2	Average native species per quadrat has a minimum of 26 native species per 100 m ² .	Yes/No
Completion criterion 3	Tree species richness across the rehabilitation site includes the following five tree species: <ul style="list-style-type: none"> • <i>Banksia attenuata</i>. • <i>Banksia menziesii</i>. • <i>Corymbia calophylla</i>. • <i>Eucalyptus marginata</i> subsp. <i>thalassica</i>. • <i>Eucalyptus tottiana</i>. 	Yes/No



Key environmental factor: Flora and Vegetation Rehabilitation Ministerial Statement 1036 conditions 11-1 to 11-6		
Condition environmental objective and management target/completion criterion set in the Condition EMP	Reporting on the management objective and management target/completion criterion for [Month/Year] to [Month/Year].	Status ¹
Completion criterion 4	Average native shrub species richness per quadrat has a minimum of nine species.	Yes/No
Completion criterion 5	Foliage cover of native species averages a minimum of 50% across the rehabilitation site.	Yes/No
Completion criterion 6	Weed cover averages a maximum of 10% across the rehabilitation site.	Yes/No
Completion criterion 7	No plants listed as declared pests under section 22(2) of the <i>Biosecurity and Agriculture Management Act 2007</i> or Weeds of National Significance are present within the rehabilitation site.	Yes/No

Notes:

1. The status of achievement of the condition environmental objectives is indicated as follows:

Yes - condition environmental objective achieved.

No - condition environmental objective not achieved.

3.6.2 Reporting on Management Actions not Implemented or Exceedance of the Management Targets

In the event that the management target is exceeded (or not met), the CEO of the Department of Water and Environmental Regulation (DWER) will be advised in writing within seven days of identification of the exceedance.

A report will be provided to the CEO of the DWER within 60 days of a management target not being met including details on:

- The cause for failure to implement management actions and/or management targets to be exceeded.
- Findings of the investigation to determine potential environmental harm or alteration of the environment that occurred due to failure to implement management actions.
- Details of revised and/or additional management actions to be implemented to prevent exceedance of the management targets and/or ensure the implementation of management actions.
- Relevant changes to the proposal activities.
- Measures implemented to prevent, control or abate environmental harm which may have occurred.

4 ADAPTIVE MANAGEMENT AND REVIEW OF THE EMP

4.1 Adaptive Management

MRWA will implement adaptive management to respond to any issues identified in the implementation of management measures, monitoring and evaluation against the management targets/completion criteria, to more effectively meet the environmental objectives.

Potential adaptive management actions include:

- If topsoil is not available for rehabilitation work:
 - Direct seed at 4.5 kg/ha in May to June (in addition to tube stock planting).
 - Species mix to be determined in consultation with DBCA.
- Plant growth not sufficient to meet completion criteria:
 - Evaluate cause for failure.
 - Supplementary planting of tube stock or direct seeding.
 - Conduct further weed control.
 - Use *Phytophthora cinnamomi* resistant plant species.
- Weed cover is greater than 10% or declared pests present:
 - Conduct weed control to achieve target.

4.2 Review

This plan will be reviewed as required to determine if management actions require revision. Potential reasons or triggers for revising management actions include:

- Changes to construction methods and timing.
- Trigger of early warning indicators (as specified in Table 8).
- New or revised information becoming available about relevant revegetation techniques.

If it is identified that an area of native vegetation is required to be temporarily cleared, this plan will be reviewed and revised accordingly.

The implementation of this plan will be audited.

The latest version of this plan shall be implemented once the CEO of the DWER has confirmed in writing that it satisfies the requirements of condition 7-2.



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5 STAKEHOLDER CONSULTATION

MWRA consulted with stakeholders while developing this plan. This section provides a summary of consultation that occurred. The comments raised during consultation with stakeholders were considered in developing this plan.

DPAW was consulted in accordance with condition 11-4.

Table 10 presents a summary of consultation and MRWA's response.

Table 10 Stakeholder consulted, comments and responses

Date	Organisation	Summary of consultation	MRWA response to comment/concern
25 Oct 2016	DPAW	MRWA met with DPAW to discuss flora and vegetation progressive rehabilitation plan.	MRWA has considered DPAW's comments and amended the Condition EMP where appropriate.



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6 REFERENCES

- Coffey. 2015a. Public Environmental Review: Perth–Darwin National Highway (Swan Valley Section). Volume 1. Main Text. September. Prepared for NorthLink WA by Coffey Environments Australia Pty Ltd. Burswood. Western Australia.
- Coffey. 2015b. Level 2 Flora and Vegetation Assessment: Perth–Darwin National Highway. May. Prepared for NorthLink WA by Coffey Environments Australia Pty Ltd. Burswood. Western Australia.
- DER. 2016. A guide to preparing revegetation plans for clearing permits under Part V of the Environmental Protection Act 1986. (Draft released for consultation). October. Department of Environment Regulation, Western Australia.
- EPA. 2006. Guidance for the Assessment of Environmental Factors No. 6: Rehabilitation of Terrestrial Ecosystems. June. Environmental Protection Authority, Western Australia.
- EPA. 2015. Environmental Assessment Guideline for Environmental principles, factors and objectives. EAG 8. January. Environmental Protection Authority, Western Australia.
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- Hedde, E. M., Loneragan, O.W., and Havel, J.J. 1980. Vegetation Complexes of the Darling System. In: Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Land Management.
- MRWA. 2004. Environmental Guideline: Revegetation Planning and Techniques. Document No. 6707/031. May. Prepared by Main Roads Western Australia.
- MRWA. 2013. Environmental Guideline: Vegetation Placement within the Road Reserve. Document No. 6707/022. November. Prepared by Main Roads Western Australia.
- Terratree. 2014. Phytophthora Dieback Linear Assessment Perth Darwin National Highway Project Corridor. Prepared for Coffey. November. Terratree Pty Ltd. Fremantle. Western Australia.



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APPENDIX A

Flora and Vegetation Rehabilitation Monitoring Method





FLORA AND VEGETATION REHABILITATION MONITORING METHOD

The following monitoring method has considered the following standard and guidelines in the preparation of this documents:

- Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004).
- Guidance for the Assessment of Environmental Factors: Rehabilitation of Terrestrial Ecosystems (EPA, 2006).
- Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA and DPAW, 2015).

Method

Six monitoring plots will be located within the rehabilitation site in the redundant section of Beechboro Road North from Jules Steiner Memorial Drive to Gngangara Road. All monitoring will be undertaken by an experienced botanist.

- Quadrats of 10 x 10 m will be established within the rehabilitation site and within each plot the following parameters will be recorded:
 - Native vegetation cover (%).
 - Native species richness.
 - Weed vegetation cover (%).
 - Weed species richness.
 - Number and identification of individual weed species.
 - Bare ground (%).
 - Plant deaths.
 - Vegetation condition (general discussion on health and appearance of plants within the quadrat).
- A photo will be taken at the northeast corner of each quadrat, looking toward the southwest corner.

Species List

The following species list is the recommended species to be planted in the rehabilitation site. The tree and low woodland species will be planted from tubestock. It is assumed that the remaining species will come from the seed bank within the topsoil. These are found in the reference sites adjacent to the rehabilitation site.

- Mid trees:
 - *Corymbia calophylla*.
 - *Eucalyptus marginata* subsp. *thalassic*.

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- *Eucalyptus todtiana*.
 - Low woodland:
 - *Banksia attenuata*.
 - *Banksia menziesii*.
 - Mid shrubland:
 - *Acacia sessilis*.
 - *Allocasuarina humilis*.
 - *Astroloma xerophyllum*.
 - *Calytrix fraseri*.
 - *Conospermum stoechadis* subsp. *stoechadis*.
 - *Jacksonia floribunda*.
 - *Stirlingia latifolia*.
 - *Xanthorrhoea preissii*.
 - Low shrubland:
 - *Acacia pulchella* var. *pulchella*.
 - *Beaufortia elegans*.
 - *Bossiaea eriocarpa*.
 - *Calytrix angulate*.
 - *Calytrix flavescens*.
 - *Conostephium minus*.
 - *Conostephium preissii*.
 - *Eremaea pauciflora* var. *pauciflora*.
 - *Gompholobium tomentosum*.
 - *Hibbertia aurea*.
 - *Hibbertia huegelii*.
 - *Hibbertia hypericoides*.
 - *Hibbertia sericosepala*.
 - *Hibbertia subvaginata*.
 - *Hypocalymma robustum*.
 - *Leucopogon conostephioides*.
 - *Petrophile linearis*.
 - *Philothea spicata*.
 - *Scaevola repens* var. *repens*.
 - *Scholtzia* aff. *involucrata*.



- Herbs:

- *Alexgeorgea nitens*.
- *Amphipogon turbinatus*.
- *Anigozanthos humilis* subsp. *humilis*.
- *Arnocrinum preissii*.
- *Austrostipa compressa*.
- *Burchardia congesta*.
- *Caladenia flava* subsp. *flava*.
- *Calandrinia corrigioloides*.
- *Centrolepis drummondiana*.
- *Crassula colorata* var. *colorata*.
- *Dasypogon bromeliifolius*.
- *Desmocladius flexuosus*.
- *Drosera erythrorhiza*.
- *Drosera macrantha*.
- *Drosera pallida*.
- *Eriochilus dilatatus* subsp. *dilatatus*.
- *Haemodorum spicatum*.
- *Hyalosperma cotula*.
- *Leporella fimbriata*.
- *Levenhookia stipitata*.
- *Lobelia tenuior*.
- *Lomandra caespitosa*.
- *Lomandra hermaphrodita*.
- *Lomandra sericea*.
- *Lomandra suaveolens*.
- *Lyginia barbata*.
- *Lyginia imberbis*.
- *Millotia tenuifolia* var. *laevis*.
- *Patersonia occidentalis* var. *occidentalis*.
- *Phyllangium paradoxum*.
- *Podotheca gnaphalioides*.
- *Pterostylis sanguinea*.
- *Pterostylis* sp. *cauline leaves* (N. Gibson & M.N. Lyons 1490).

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- *Pyrorchis nigricans*.
 - *Quinetia urvillei*.
 - *Schoenus curvifolius*.
 - *Stylidium androsaceum*.
 - *Stylidium araeophyllum*.
 - *Stylidium schoenoides*.
 - *Trachymene pilosa*.
 - *Tricoryne elatior*.
 - *Wahlenbergia preissii*.
 - *Xanthosia huegelii*.

References

- Coffey. 2015. Level 2 Flora and Vegetation Assessment: Perth–Darwin National Highway. May. Report prepared for NorthLink WA by Coffey Environments Australia Pty Ltd. Burswood, Western Australia.
- EPA. 2004. Guidance for the Assessment of Environmental Factors – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51. June. Environmental Protection Authority, Western Australia.
- EPA. 2006. Guidance for the Assessment of Environmental Factors - Rehabilitation of Terrestrial Ecosystems No. 6. June. Environmental Protection Authority, Western Australia.
- EPA and DPAW. 2015. Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment. December. Environmental Protection Authority and Department of Parks and Wildlife, Perth, Western Australia.



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