REVEGETATION PLAN

Big McPhee Bridge Replacement
Great Northern Highway SLK 3079.55

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1. PROJECT DESCRIPTION

1.1 Purpose

Main Roads Western Australia (MRWA) has a policy aim to "protect and enhance the environmental values of road reserves". This document has been prepared to ensure compliance with Main Roads' Environmental Policy and Main Roads' statewide Purpose Permit CPS 818/6.

In the process of establishing new roads and upgrading existing roads, there is often a need to undertake revegetation of the road reserve or other affected areas. Where clearing of native vegetation is to occur under Main Roads' statewide Purpose Permit CPS 818/6, a revegetation plan is required for temporary clearing (eg. borrow pits, access tracks, camps etc.). Where the temporary clearing exceeds 0.5ha, the revegetation plan needs to be forwarded to the Department of Environment and Conservation prior to clearing.

This revegetation plan sets out the rehabilitation requirements for clearing of native vegetation associated with the Big McPhee Bridge reconstruction project. The works will be located along the Great Northern Highway SLK 3079.55, Shire of Wyndham East Kimberley.

The purpose of the revegetation plan is to identify effective revegetation practices that help accelerate the natural succession processes that occur following the clearing of native vegetation and soil disturbance.

1.2 Background

Main Roads Kimberley region are required to undertake emergency bridge replacement works to Big McPhee Bridge (B1306) on the Great Northern Highway (H006) at SLK 3079.55. Big McPhee Bridge crosses Big McPhee Creek between Warmun and Kununurra.

The existing bridge has been damaged by flooding on a number of occasions since its construction due to scouring of footings. Rain events which occurred in March 2011 caused severe damage to Big McPhee Bridge and the associated approaches. Full replacement of the bridge has been identified as the best long term solution for this crossing.

Figure 1 below provides a broad locality image of the project area.
Figure 2 provides a close-up aerial image of the project area including the location of the bridge replacement, laydown area and material areas.

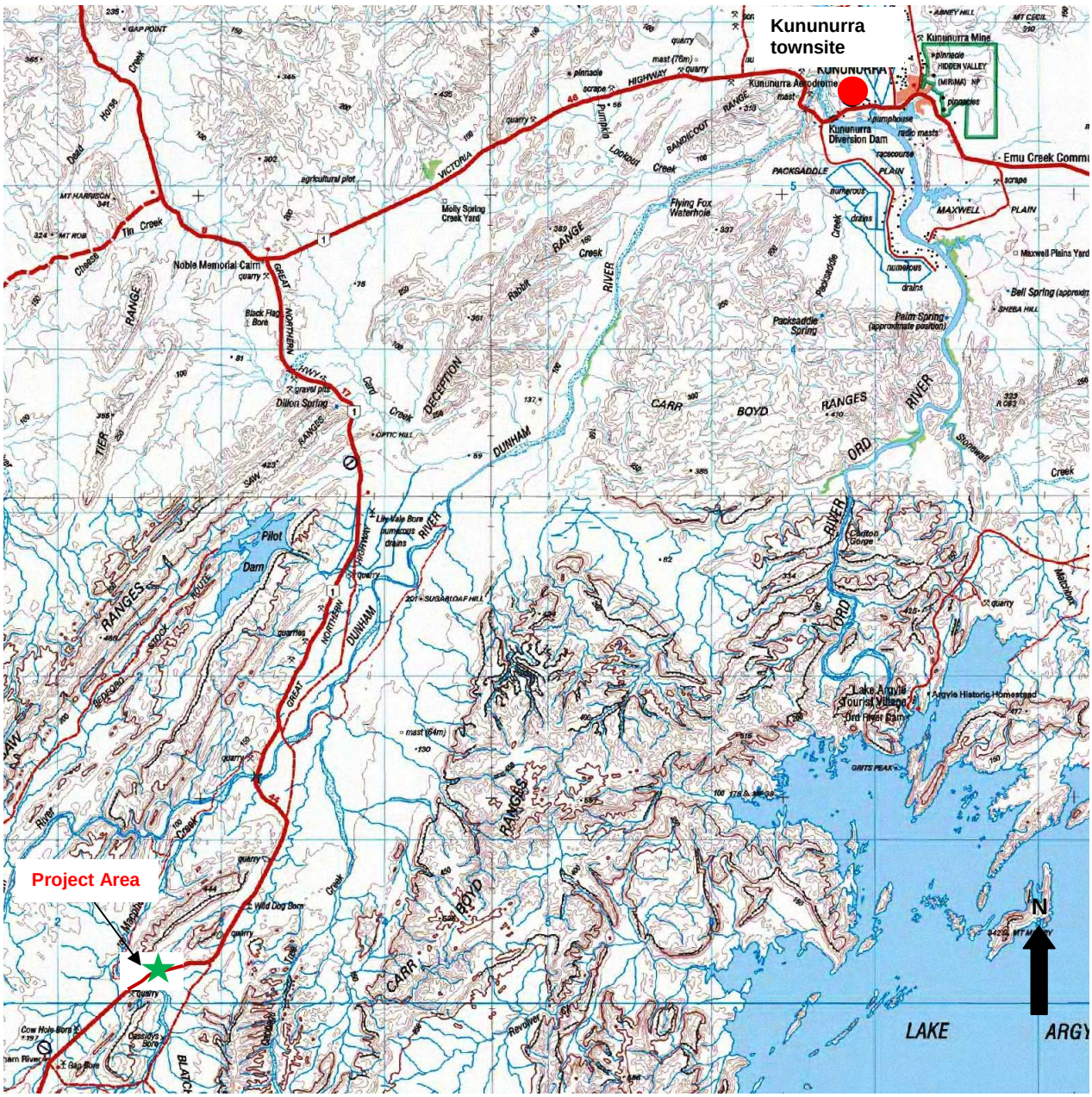

Figure 1…Broad Locality Image of the Project Area

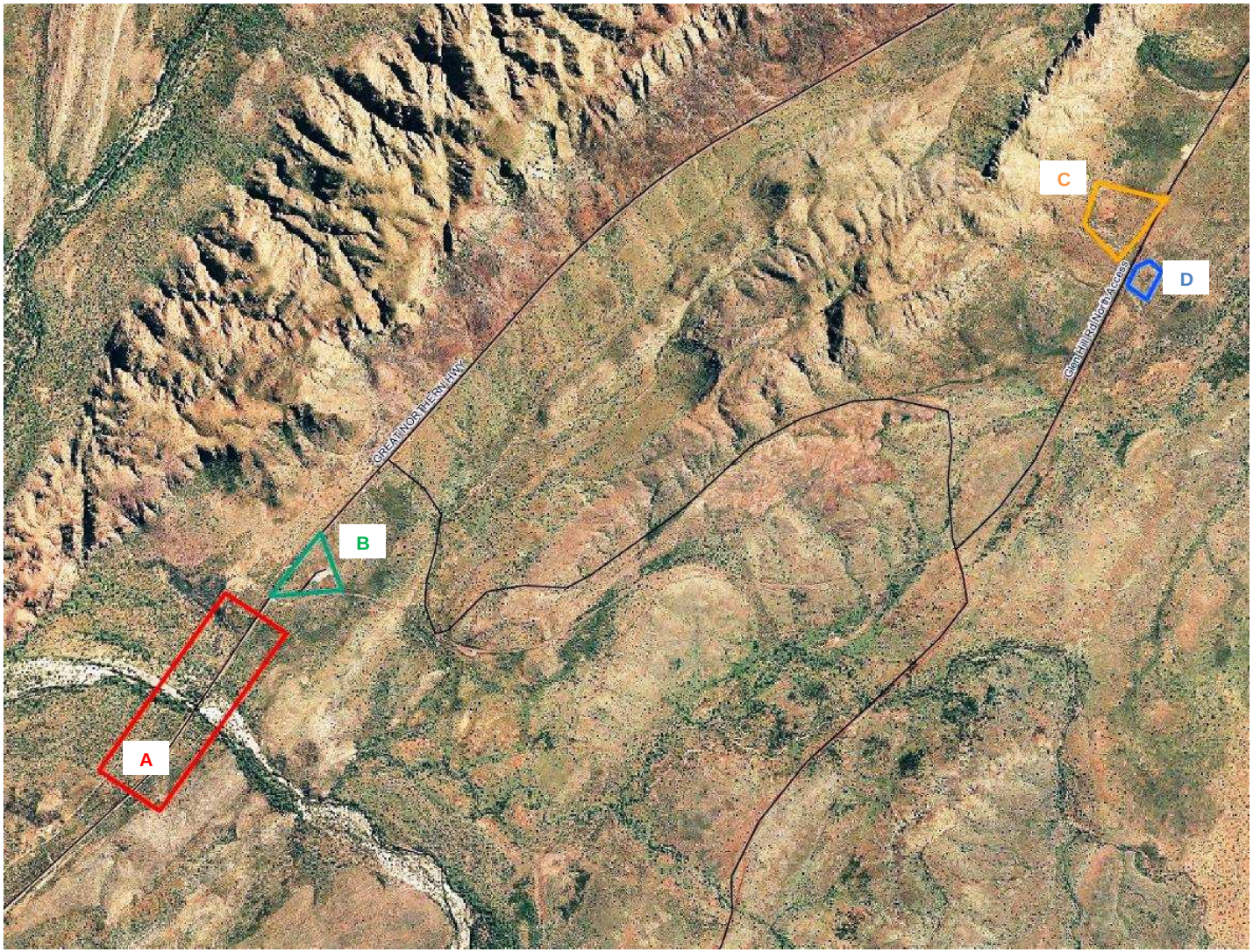

Figure 2…Close-up Image of the project area – Location of Bridge Replacement, Laydown Area and Material Areas

Coordinates of Clearance Areas (MGAZ52)

A – Bridge Corridor

E0424775	N8201229.6
E0425469.1	N8202199.8

B – Laydown Area

E0425546.9	N8202291.9
E0425940.7	N8202328.6
E0425819.7	N8202641.4

C – Material Area

E0429999	N204319
E0430069	N8204553
E0430185	N8204129
E0430402	N8204468
E0430455	N8204474

D – Material Area

E0430235	N8203988
E0430285	N8204093
E0430340	N8203914
E0430421	N8204066
E0430358	N8204124

1.3 Previous Assessment Work

GHD (December 2011) Report for Great Northern Highway SLK 3079.55 Big McPhee Bridge Replacement Environmental Impact Assessment and Environmental Management Plan.

1.4 Project Description

The proposed bridgeworks will consist of:

- Demolition of the existing single lane bridge;
- Installation of piles and construction of bridge pier footings;
- Construction of new 2 lane bridge and approach road works on the same road alignment;
- Construction of rockwork guide-banks at both bridge abutments; and,
- Extraction of materials from nominated material areas.

Approximately 6.4 hectares of native vegetation will be temporarily cleared for construction activities associated with Big McPhee Bridge replacement. Clearing is proposed to be undertaken using Main Roads' clearing permit CPS 818/6. Clearing activities are deemed to not be at variance with any of the 10 clearing principles.

The following areas to be rehabilitated are shown in Table 1:

Table 1…Revegetation area details

Temporary clearing extent	6.4ha
Other revegetation	Nil

1.5 Existing vegetation

Table 2 below outlines vegetation type, extent and conservation status (after Shepherd *et al.*, 2002) for Big McPhee Bridge Replacement.

Table 2...Vegetation type, extent and conservation status (after Shepherd et al., 2002) for Big McPhee Bridge Replacement.

Vegetation Association Number	Association Description	% Remaining
59	*Grasslands, high grass savannah sparse tree: bauhinia & coolabah over Mitchell, blue and tall upland grasses*	99.69
808	*Grasslands, curly spinifex, low tree savannah; snappy gum over curly spinifex*	100
817	*Grasslands, high grass savannah low tree; terminalia (Terminalia spp.) over upland tall grass and blue grass*	100

A number of species recorded in each of the vegetation communities were dominant. Table 3 on the following page lists the dominant species of each vegetation association present in the project area. Dominant species in each of the associations typically account for in excess of 90% of the relative coverage and therefore account for in excess of 90% of community structure.

The replacement of dominant species through rehabilitation practices outlined in this report would presumably result in the return of a virtually complete structure of natural communities despite dominant species representing, at times, a small proportion of the species richness recorded for the community. This indicates that it is imperative that dominant species be specifically targeted for revegetation if a community is to be established that will satisfy the completion criteria (Section 6.2).

Table 3…Approximate coverage for dominant species in project area

Vegetation Association No. 59		Vegetation Association No. 817		Vegetation Association No. 808	
SPECIES	**REL. COVERAGE %**	**SPECIES**	**REL. COVERAGE %**	**SPECIES**	**REL. COVERAGE %**
Acacia cyperophylla	5	*Eucalyptus camaldulensis*	5	*Eucalyptus camaldulensis*	2
Acacia lysiphloia	5	*Melaleuca argentea*	10	*Melaleuca argentea*	10
Corymbia dichromophloia	1	*Digitaria bicornis*	5	*Digitaria bicornis*	5
Calytrix exstipulata	2	*Eulalia aurea*	5	*Eulalia aurea*	5
Aristida spp.	10	*Terminalia canescens*	2	*Terminalia canescens*	2
Heteropogon contortus	10	*Terminalia hadleyana*	2	*Terminalia hadleyana*	2
Schizachyrium fragile	10	*Acacia oligoneura*	10	*Acacia oligoneura*	10
Cyperus pulchellus	10	*Grewia agrifolia*	10	*Grewia agrifolia*	10
Eucalyptus brevifolia	1	*Exocarpus latifolius*	2	*Exocarpus latifolius*	10
Acacia colei	10	*Corymbia grandifolia*	5	*Corymbia grandifolia*	2
Dodonaea physocarpa	5	*Tephrosia leptoclada*	5	*Tephrosia leptoclada*	5
Terminalia canescens	2	*Tephrosia laxa*	5	*Tephrosia laxa*	5
Triodia - spinifex	20	*Tephrosia simplicifolia*	5	*Tephrosia simplicifolia*	5
Grevillea agrifolia	5	*Triodia*	25	*Triodia*	25
TOTAL	***96***	***TOTAL***	***96***	***TOTAL***	***98***

It must be considered that it may not be possible to revegetate with some of the dominant species listed in Table 3. This may occur for numerous reasons including, lack of available seed, inability for seed to germinate, drought. However, it is acknowledged that every effort be made to return these species to rehabilitated areas through effective site preparation, weed control, maintenance and monitoring.

1.6 Weeds

The EPBC Act Protected Matters search undertaken for the project indicated that three invasive plant species or species habitat may occur in the vicinity of the Project Area:

- *Urochloa [Brachiaria] mutica* (Paragrass);
- *Cenchrus cilliaris* (Buffel Grass); and,
- *Parkinsonia aculeata* (Parkinsonia).

The NatureMap search indicates a further two weed species known to occur within 15km of the Project Area:

- *Aerva javanica* (Kapok Bush); and,
- *Paspalum notatum*.

Of the weed species present, or likely to be present, Parkinsonia is indicated to be a weed of National Significance (WONS), and rated as a Declared Plant with control class codes P1 and P4 relevant to any plants potentially found in the Project Area.

2. SITE PREPARATION

2.1 Vegetation clearing, mulching and re-use

All vegetation will be cleared from the works area and non-weed infested vegetation will be stockpiled. Stockpiled vegetation will not be placed on the very edge of the approved cleared area in order to prevent machinery going outside the cleared area to push the stockpile forward again. Weed infested vegetation will be disposed of at an appropriate site. Burning of the cleared vegetation will not be permitted.

2.2 Topsoil stripping and re-use

Topsoil will be stripped to a maximum depth of 100 mm. Topsoil will be stored in a weed free (as far as possible) area, as close as possible to the area to be rehabilitated. The topsoil will be placed in windrows of less than 1.5m in height and reinstated as soon as possible, to prevent deterioration to the in-situ seeds and maintain seed viability.

3. WEED CONTROL

Weeds can out-compete the local native species and reduce the habitat value. The following management procedures will be implemented to minimise the potential for spread of Declared Plants and environmental weeds:

- Adequate control measures will be incorporated to ensure weeds are killed or not transported to other areas. Control measures include removal of weeds to an approved dump site or treatment of weeds such as using herbicide spraying;
- Herbicide spraying shall only be carried out by licensed operators and herbicide shall be mixed and applied in accordance with manufacturer's instructions;
- Any observed Declared Plant infestations shall be treated prior to clearing if an effective control is available;
- Where practicable, weeds should not be removed when they are in flower or seeding;
- Minimum clearing footprints will be utilised where practicable to avoid creating conditions suitable for weed proliferation;

- Measures to prevent plants, seeds and topsoil being moved to non-infested areas will be implemented;
- All machinery shall be free of built up soil and vegetative material before entering and leaving the site to help minimise the transportation of weeds and their seeds;
- No weed-infested soil material or road-building material shall be imported into the area as fill;
- Exposed areas such as bare batters and borrow pits shall be promptly rehabilitated to reduce the ingress of weeds;
- Where works are adjacent to good quality vegetation, weeds within the project area will be removed or killed once a year for up to three years.

4. REVEGETATION THROUGH REGENERATION

4.1 Revegetation objectives

The revegetation objectives are to:

- Ensure roadside stability and minimise ongoing maintenance;
- Ensure that conservation values and biodiversity are protected; and
- Ensure local amenity and aesthetics are enhanced.

4.2 Required vegetation cover

The roadside vegetation should be similar in structure and content to comparable naturally occurring vegetation in the local area and will reflect the vegetation communities present in the road reserve and adjacent bushland. The width of the vegetation setbacks and clearances will be appropriate for the specific location and will be dependent on an assessment of the road design speed, road alignment and the roadside batter slopes.

4.3 Revegetation Techniques

The following rehabilitation works shall be undertaken on areas of disturbed earth requiring rehabilitation:

- Topsoil will be uniformly respread to a minimum depth of 100mm over the area; and
- Area to be ripped to a minimum depth of 200mm deep with rip lines approximately 300mm apart. Where slopes are present, rip lines shall be along contours.

The following rehabilitation work shall be undertaken at borrow/gravel pits:

- Overburden and then topsoil shall be uniformly and evenly spread over the disturbed areas of the pit. Depending on the slope of drainage lines within the pit, it may be necessary to form small swales from the topsoil to reduce erosion velocities and encourage the deposition of seeds.
- The existing pit floor shall be ripped to a depth of 300 – 500mm deep with rip lines between 500 - 800mm apart, if the material in the floor of the pit is able to be ripped. The whole area of the pit, including drainage lines, shall be ripped.
- All stockpiled vegetation shall be spread along the contour and pit floor to help promote seed deposition and further reduce erosion velocities.

4.4 Timing and Staging of Revegetation Works

Clearing of vegetation will commence around April/May 2012. Clearing activities will continue for 4-6 weeks approx. Once bridge replacement works are complete (expected October 2012) all temporarily cleared areas will be rehabilitated. Rehabilitation of cleared areas is anticipated to commence October/November 2012 prior to the wet season commencing.

5. VEGETATION ESTABLISHMENT PERIOD

The vegetation establishment period will be for at least five years following the completion of the works. During this period, the maintenance and monitoring will be undertaken, see Section 6.

6. ONGOING MAINTENANCE AND MONITORING

Maintenance and monitoring of the project shall be ongoing to measure regeneration effectiveness and to control weeds.

6.1 Maintenance and Monitoring

After rehabilitation activities are undertaken, rehabilitated areas will be inspected for a minimum of five years following completion of works. Monitoring of the rehabilitation activities will determine if follow up seeding will be required.

If required, follow up herbicide applications will occur on problem weeds for up to three years after topsoil respread or planting/seeding. This herbicide will be spot sprayed on the weeds by hand to avoid overspray onto native plants and will allow these plants to develop without competing with weeds.

Monitoring will essentially involve visual assessment to ensure the rehabilitation works have been implemented as planned. Table 6 shall be used as the monitoring guide to assess the success or otherwise of the revegetation / rehabilitation plan.

Table 6: Revegetation Monitoring Guide

Criterion	Target	After six months	After one year	After three years
Mean vegetation foliage cover (%) excluding weeds.	>50	0	20	40
Mean number of stems (excluding weed species) / ha within each rehabilitated area	100 stems / ha	400 stems / ha	300 stems / ha	200 stems / ha
Mean weed foliage cover (%).	<20	<20	<20	<20
Amount of bare soil areas >4m2 (%).	<30	<100	<80	<70

6.2 Completion Criteria

Completion criteria for target species, composition and structure is outlined in Table 7 below. Rehabilitation performance against the completion criteria will determine if supplementary seeding is required.

Table 7: Completion Criteria for Target Species, Composition and Structure

Criteria	Standard – 1 year	Standard – 5 years
Species Diversity	Floristic composition of species to be at least 50% of adjacent, undisturbed vegetation community / communities. Little to no weeds present	Floristic composition of species to be at least 80% of adjacent, undisturbed vegetation community / communities. Little to no weeds present
Vegetative Cover	A minimum of 50% projected foliage cover in the lower stratum (excluding any weeds) over any treated area of 1000m2 area.	A minimum of 80% projected foliage cover in the lower stratum (excluding any weeds) over any treated area of 1000m2 area.
Plant Density	Plant density within rehabilitated areas to be at least 50% of the density of vegetation community directly adjacent to disturbance area.	Plant density within rehabilitated areas to be at least 80% of the density of vegetation community directly adjacent to disturbance area.
Plant Structure	Percentage of each plant species should be at least 50% of approximate composition outlined in Table 3.	Percentage of plant species should be at least 80% of approximate composition outlined in Table 3.