

# NorthLinkWA

Perth-Darwin National Highway

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## Environmental Management Plan

Perth–Darwin National  
Highway

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## 1 BACKGROUND

### 1.1 Proposal Overview

Main Roads Western Australia (MRWA) proposes the construction of the southern terminus of the Perth–Darwin National Highway (hereafter referred to as ‘the proposal’) between Malaga and Muchea, Western Australia. The proposal is the culmination of several decades of planning for the southern terminus of the Perth–Darwin National Highway (PDNH), a key 4,000 km road transport route linking Perth with northern Western Australia and the Northern Territory. MRWA will construct approximately 38 km of new dual carriageway highway to the west of the Swan Valley and will connect the intersection of Tonkin Highway and Reid Highway in the south with Great Northern Highway and Brand Highway in the north.

Beginning at the intersection of Tonkin Highway and Reid Highway, the road will travel north on a new alignment through Whiteman Park towards Gnangara Road before heading northeast through the Gnangara State Forest to Ellenbrook. Skirting the western fringes of Ellenbrook, the road will continue north passing west of Bullsbrook before again turning northeast to cross Muchea Road South and the Midland–Geraldton railway line. The PDNH will connect to Great Northern Highway and Brand Highway on the eastern side of the Muchea town site.

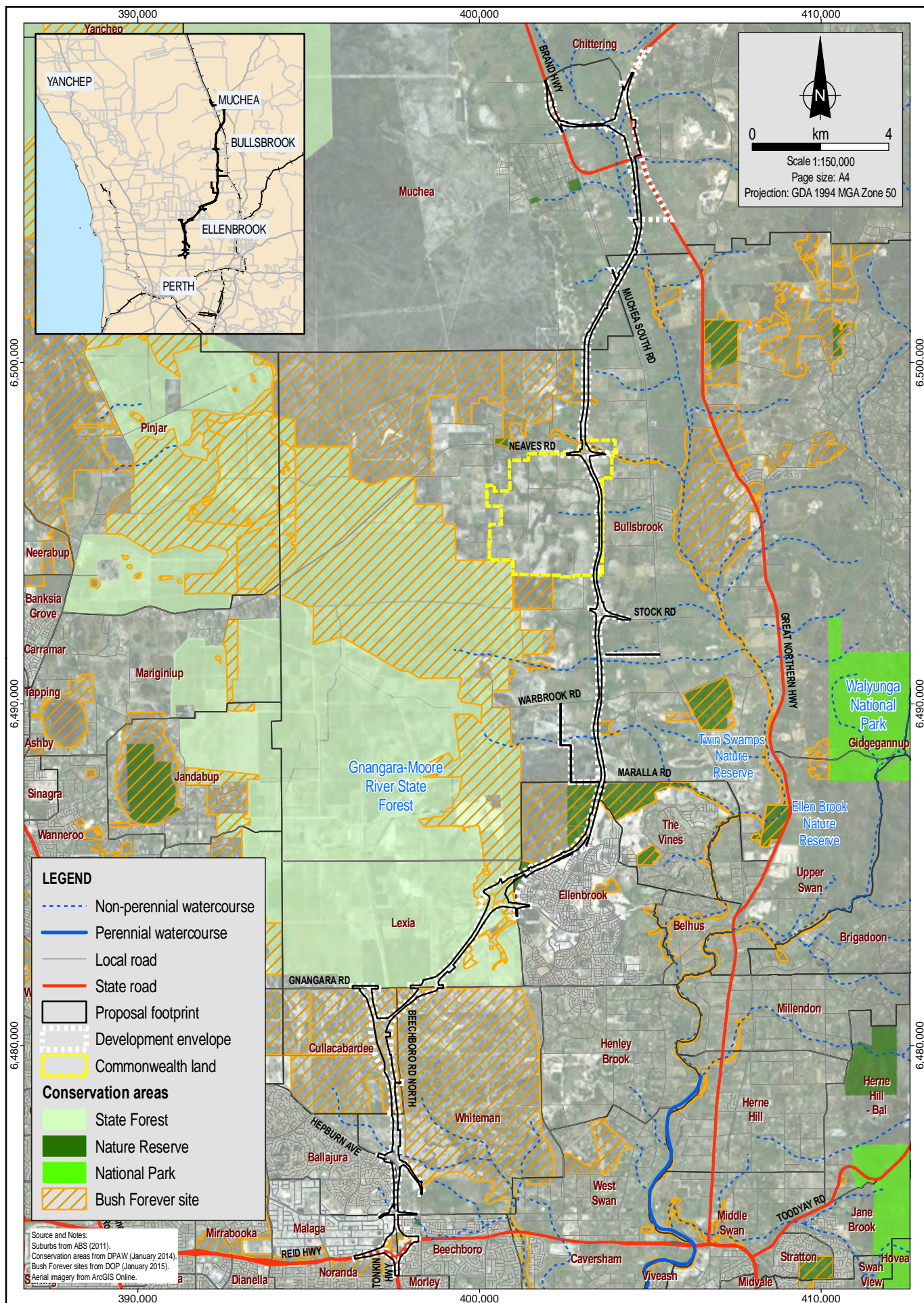
PDNH will be accessible from grade-separated interchanges at the following roads:

- Tonkin Highway and Reid Highway in Malaga.
- Hepburn Avenue in Malaga.
- Gnangara Road in Lexia.
- The Promenade in Ellenbrook.
- Stock Road in Bullsbrook.
- Neaves Road in Bullsbrook.
- Great Northern Highway and Brand Highway in Muchea.

Construction of the proposal is proposed to start in 2016–2017 and is likely to proceed in a staged approach. The staging is not expected to change the overall environmental impacts that form the basis of this document.

The proposal footprint is 746 ha and is contained entirely within the 975 ha development envelope (Figure 1). The maximum width of the road reserve will be approximately 100 m. The number of traffic lanes included in the road design varies from four in each direction between Tonkin/Reid Highway and Hepburn Avenue to two in each direction at the Muchea end. The road reserve widens locally at interchanges and where additional features such as storm water retention basins are required.

The proposal requires clearing of up to 205 ha of native vegetation. The proposal will also impact Black Cockatoos, which includes the Threatened Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii*) and Carnaby's Cockatoo (*Calyptorhynchus latirostris*). Approximately 201.8 ha of Carnaby's Cockatoo and 120.1 ha of Forest Red-tailed Black Cockatoo foraging habitat will be impacted including 58.6 ha of Black Cockatoo roosting habitat and 120.1 ha of potential Black Cockatoo breeding habitat.





## 1.2 Environmental Management Plan Objectives

This Environmental Management Plan (EMP) has been developed with the overall objective of reducing environmental impacts to the extent practicable. The EMP has been developed with the following specific objectives in mind:

- Comply with the requirements outlined in the proposal's Environmental Scoping Document (ESD) (EPA, 2014).
- Articulate the commitments outlined in the proposal's Public Environmental Review (PER) (Coffey, 2015).
- Minimise the extent and impact of vegetation clearing required for the proposal.
- Reduce impact to Black Cockatoo habitat to the extent practicable.
- Maintain the integrity, species diversity, geographic distribution and productivity of vegetation communities.
- Prevent the introduction/spread of weeds and/or *Phytophthora* disease infestations to or from the development envelope.
- Prevent or manage changes to hydrology.
- Minimise or avoid impacts to water quality.
- Minimise disruption to public access and amenity.

## 1.3 Scope of the Environmental Management Plan

The ESD specifically states that an EMP be developed that sets out the framework for short- and long-term mitigation, monitoring, and ongoing management of the relevant impacts of the action, including provisions for independent environmental auditing. For each potential impact, the EMP must state the environmental objectives, performance criteria, monitoring, reporting, corrective action, responsibility and timing for implementation.

This EMP is regarded as a dynamic instrument and will be updated to incorporate significant changes in the way environmental aspects and effects are managed by MRWA as applicable. The strategies identified in this document will undergo periodic review to take into consideration changes as the proposal progresses.

Should any significant changes or amendments be made to this plan it will be revised accordingly to reflect those changes.

This EMP addresses the management of significant environmental impacts potentially associated with construction and operation of the proposal. It applies to all company and contractor operations, labour, plant, materials, supervision, survey and other services necessary for the final design, construction and operation of the proposal footprint occurring within the proposal footprint, as described in Section 1.1. Activities that generally may occur within the proposal footprint include:

- Vegetation removal and topsoil stripping.
- Earthworks.
- Piling and bridge foundations.
- Overpass/bridge construction.
- Stormwater drainage installation.

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- Pavement construction.
- Road surfacing.
- Installation of associated road furniture.
- Relocation of services.
- Modifications to local roads.
- Construction of Principal Shared Path (PSP).
- Construction of noise and visual screen walls.
- Groundwater abstraction.
- Traffic management.

This document provides management measures that minimise the environmental impact of the works and identify those responsible for its implementation. It also sets out a monitoring program to assess the implementation in accordance with MRWA's corporate procedures, AS/NZS ISO 14001:2004 Environmental Management System and approvals.

The expected outcome is continual improvement in environmental performance and reduced environmental risk associated with the proposal footprint.

All proposal employees and contractors shall be aware of this document and its implications for their duties.



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## 2 KEY ENVIRONMENTAL FACTORS

The PER for the proposal assessed the impact associated with the following environmental factors:

- Flora and Vegetation.
- Terrestrial Fauna.
- Hydrological Processes
- Inland Waters Environmental Quality.
- Amenity – Noise and Vibration.
- Rehabilitation and Closure.
- Aboriginal heritage.
- European heritage.
- Matters of National Environmental Significance (MNES) (included under Flora and Vegetation and Terrestrial Fauna).

Management measures are proposed for each of these factors in the EMP. Management measures for dust were also included due to the nature of construction activities.

Table 2.1 summarises the existing environmental values, potential impacts, proposal commitments and the key management strategies to achieve these commitments, and residual impacts for each of the environmental factors assessed in the PER.

**Table 2.1 Summary of key environmental values and potential impacts**

Factor	Key environmental values	Potential impacts
Flora and vegetation	<p>Flora and vegetation values within and in close proximity to the proposal footprint:</p> <ul style="list-style-type: none"> <li>• 485 native taxa representing a high diversity of flora on the Swan Coastal Plain (SCP).</li> <li>• 205 ha native vegetation (in degraded to pristine condition) within the proposal footprint.</li> <li>• Two Threatened and eight Priority listed flora.</li> <li>• 13 significant flora of the Perth Metropolitan region.</li> <li>• 60 vegetation associations and five mapping units.</li> <li>• Four Threatened Ecological Communities (TECs) (Mound Springs SCP, Claypans of the SCP, SCP02 and SCP20a).</li> <li>• Five Priority Ecological Communities (PECs) (SCP21c, SCP22, SCP23b, SCP24 and Banksia Woodlands SCP).</li> <li>• Ecological linkages (Gaston Road, Bullsbrook; Raphael Road, Bullsbrook; Maralla Road Nature Reserve; Rocla mining lease area; Cullacabardee; Reid Highway).</li> <li>• Approximately 361.5 ha of Groundwater Dependent Ecosystems (GDEs) (i.e. geomorphic wetlands supporting intact native vegetation).</li> <li>• 13 Conservation areas within the proposal footprint, including: <ul style="list-style-type: none"> <li>– Two Class A Nature Reserve's (46919 and 46920).</li> <li>– Gngangara-Moore River State Forest No. 65.</li> <li>– Nine Bush Forever sites (97, 100, 192, 198, 300, 304, 307, 399 and 480).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Construction phase impacts: <ul style="list-style-type: none"> <li>– Permanent loss of native vegetation.</li> <li>– Permanent loss of GDEs.</li> <li>– Permanent loss of native vegetation within conservation areas.</li> <li>– Permanent loss of TECs and PECs.</li> <li>– Permanent loss of Threatened and Priority listed flora.</li> <li>– Spread of introduced weeds.</li> <li>– Spread of <i>Phytophthora</i> Dieback.</li> <li>– Fragmentation of native vegetation.</li> </ul> </li> <li>• Operation phase impacts: <ul style="list-style-type: none"> <li>– Spread of introduced weeds.</li> <li>– Spread of <i>Phytophthora</i> Dieback.</li> <li>– Vegetation degradation from uncontrolled access to remnant vegetation.</li> <li>– Increase in fires.</li> </ul> </li> </ul>

Factor	Key environmental values	Potential impacts
Terrestrial fauna	<p>Fauna and habitat values within and in close proximity to the proposal footprint:</p> <ul style="list-style-type: none"> <li>• 159.3 ha of natural fauna habitats (Banksia Woodland, Eucalypt/Corymbia Woodland, Dampland and Wetland).</li> <li>• 97 fauna recorded, including one fish, six amphibians, 19 reptiles, 62 birds and nine mammals.</li> <li>• Four species of conservation significant fauna: <ul style="list-style-type: none"> <li>– Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) (Endangered, Schedule 1).</li> <li>– Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) (Vulnerable, Schedule 1).</li> <li>– Australian Bustard (<i>Ardeotis australis</i>) (Priority 4).</li> <li>– Southern Brown Bandicoot (Priority 5) (<i>Isodon obesulus fusciventer</i>).</li> </ul> </li> <li>• Seven species of conservation significance are considered likely to occur: <ul style="list-style-type: none"> <li>– Great Egret (<i>Ardea alba</i>) (Migratory, Schedule 3).</li> <li>– Cattle Egret (<i>Ardea ibis</i>) (Migratory, Schedule 3).</li> <li>– Rainbow Bee-eater (<i>Merops ornatus</i>) (Migratory, Schedule 3).</li> <li>– Western Carpet Python (<i>Morelia spilota imbricata</i>) (Schedule 4).</li> <li>– Jewelled Sandplain Ctenotus (<i>Ctenotus gemmula</i>) (Priority 3).</li> <li>– Black-striped Snake (<i>Neelaps calonotos</i>) (Priority 3).</li> <li>– Western Brush Wallaby (<i>Macropus irma</i>) (Priority 4).</li> </ul> </li> <li>• Ecological linkages important for fauna (Maralla Road Nature Reserve, Cullacabardee Nature Reserve and Reid Highway).</li> </ul>	<ul style="list-style-type: none"> <li>• Construction phase impacts: <ul style="list-style-type: none"> <li>– Habitat loss due to vegetation clearing.</li> <li>– Habitat fragmentation due to vegetation clearing.</li> <li>– Disturbance to waterbirds (including migratory species) from impacts to wetlands.</li> <li>– Fauna mortalities primarily due to clearing activities.</li> <li>– Feral predation of displaced fauna by Red Foxes and Cats.</li> <li>– Accidental fire during construction activities.</li> <li>– Light and noise as a result of machinery and construction activities.</li> </ul> </li> <li>• Operation phase impacts: <ul style="list-style-type: none"> <li>– Habitat fragmentation.</li> <li>– Severing of ecological connectivity.</li> <li>– Fauna mortalities from fauna/vehicle interactions.</li> <li>– Feral predation by Red Foxes and Cats.</li> <li>– Habitat degradation, edge effects, weeds, dieback, changed hydrology, rubbish and vehicle tracks.</li> <li>– Increased risk of bushfires due to greater human access to areas of vegetation.</li> <li>– Light and noise as a result of vehicles along the PDNH.</li> </ul> </li> </ul>



Factor	Key environmental values	Potential impacts
Hydrological processes and inland waters environmental quality	<p>Major surface water features within and in close proximity to the proposal footprint:</p> <ul style="list-style-type: none"> <li>• Ellen Brook.</li> <li>• Five Environmental Protection Policy lakes (EPP Lakes) (439, 440, 441, 450 and 453).</li> <li>• Fifty-two geomorphic wetlands, including 20 conservation category wetlands (CCWs), 11 resource enhancement wetlands (REW) and 21 multiple use wetlands (MUW).</li> <li>• Seven occurrences of Mound Springs SCP TEC.</li> <li>• 12.5 km of the proposal footprint occurs within the Gngangara Underground Water Pollution Control Area, including 12 km within the Priority 1 area and 0.5 km within the Priority 3 area.</li> <li>• Eight Wellhead Protection Zones (WHPZ) occur within the proposal footprint.</li> </ul> <p>Other key values include Twins Swamps and Ellen Brook Nature Reserves (2.6 km and 5 km from the proposal footprint respectively).</p>	<p>Construction phase impacts:</p> <ul style="list-style-type: none"> <li>• Altered surface water runoff volumes from vegetation clearing.</li> <li>• Altered surface water flow from earthworks and crossing/impounding of waterways and wetlands.</li> <li>• Temporary changes to local groundwater levels as a result of drawdown of local aquifers during construction.</li> <li>• Altered groundwater flow paths associated with subsurface compaction.</li> <li>• Altered water quality, associated with: <ul style="list-style-type: none"> <li>– Liberation of sediments during ground disturbing activities.</li> <li>– Disturbance to potential acid sulfate soils (ASS).</li> <li>– Accidental spills and releases.</li> </ul> </li> </ul> <p>Operation phase impacts:</p> <ul style="list-style-type: none"> <li>• Altered surface water runoff volumes from road surface.</li> <li>• Changes to local groundwater levels associated with infiltration basins.</li> <li>• Altered water quality associated with road runoff and accidental spills and releases.</li> </ul>

Factor	Key environmental values	Potential impacts
Amenity (noise and vibration)	<p>Noise monitoring was conducted at eight sites between Bayswater and Muchea.</p> <ul style="list-style-type: none"><li>Existing daytime noise levels were highest at the Stock Road West site in Bullsbrook (54.2 dB LA<sub>eq(Day)</sub>) and lowest at the Cootha Court site in Ballajura.</li><li>At night, noise levels were highest at Mitra Loop in Beechboro (52.8 dB LA<sub>eq(Night)</sub>) and lowest at sites in Cootha Court in Beechboro and Strachan Road in Bullsbrook (43.2 dB LA<sub>eq(Night)</sub>). It is assumed for this proposal that daytime traffic noise levels will be more than 5 dB above the night time traffic noise levels.</li></ul>	<p>Construction and operations phase impacts:</p> <ul style="list-style-type: none"><li>Sleep disturbance.</li><li>Hearing impairment.</li><li>Community annoyance.</li><li>Reduced amenity.</li><li>Reduced learning capacity.</li><li>Changed behaviour in the use of public areas.</li><li>Hearing protection requirement.</li><li>Vibration, leading to structural damage (only expected during construction).</li></ul>

Factor	Key environmental values	Potential impacts
Rehabilitation	<ul style="list-style-type: none"><li>• The revegetation strategy considers the existing landscapes of the proposal footprint.</li><li>• Provide a landscape consistent with the vegetation types and classes of the proposal footprint.</li><li>• Provide an urban experience for road users, creating a 'journey' through the road corridor.</li><li>• Provide a road corridor development with high quality urban design and aesthetic structures.</li><li>• Provide a soft landscaped road alignment in keeping with the varied site context of the corridor.</li><li>• Provide landscape and urban design treatments that are sustainable and maintainable.</li><li>• Provide landscape and urban design treatments that provide amenity for adjoining landholders and provide management of the roadways visual impacts.</li></ul>	<p>Failure to rehabilitate or poor site rehabilitation can have a number of impacts on the environment, including:</p> <ul style="list-style-type: none"><li>• Reduction in the quality and quantity of habitats.</li><li>• Reduction in ecosystem functions.</li><li>• Impacts to adjacent natural vegetation and in the economic value of sites.</li><li>• Contaminated water from road runoff into swales.</li></ul>



Factor	Key environmental values	Potential impacts
Aboriginal heritage	<p>Archaeological and ethnographic heritage within the development envelope:</p> <ul style="list-style-type: none"> <li>Registered sites: <ul style="list-style-type: none"> <li>Bennett Brook in Toto (ID 3692) (Mythological site).</li> <li>Temporary camp (ID 20058) (Camp site).</li> <li>NOR/02 Lightning Swamp (ID 21393) (Ceremonial, Mythological site).</li> <li>Chandala Brook (ID 21620) (Mythological site).</li> </ul> </li> <li>Lodged sites: <ul style="list-style-type: none"> <li>Ellen Brook, Upper Swan (ID 3525).</li> </ul> </li> </ul> <p>Newly identified sites adjacent to the development envelope:</p> <ul style="list-style-type: none"> <li>NorthLink 14-01.</li> <li>NorthLink 14-02.</li> </ul>	<p>Disturbance and clearance of Aboriginal Heritage values in proposal footprint associated with:</p> <ul style="list-style-type: none"> <li>Bennett Brook in Toto (ID 3692).</li> <li>Temporary camp (ID 20058).</li> <li>NOR/02 Lightning Swamp (ID 21393).</li> <li>Chandala Brook (ID 21620).</li> </ul>
European heritage	<p>Two Management Category No. 5 places on the Shire of Chittering's Heritage List identified within the proposal footprint:</p> <ul style="list-style-type: none"> <li>Muchela – No. 30 Brand Highway, Muchea.</li> <li>Drainage/Irrigation Channel – association with early drainage practices in the Muchea district.</li> </ul> <p>One Place registered on the National Estate List of Classified Places (the National Trust):</p> <ul style="list-style-type: none"> <li>Ellenbrook Estate Area.</li> </ul> <p>One place not listed on any statutory lists but potentially subject to the Government Heritage Property Disposal Process:</p> <ul style="list-style-type: none"> <li>Forestry Department's Divisional Headquarters and Fire Lookout.</li> </ul>	<p>Disturbance to and clearance of European heritage values in the proposal footprint associated with:</p> <ul style="list-style-type: none"> <li>Muchela – No. 30 Brand Highway, Muchea.</li> <li>Drainage/Irrigation Channel, Muchea South Road, Muchea.</li> <li>Ellenbrook Estate Area.</li> <li>Forestry Department's Divisional Headquarters and Fire Lookout.</li> </ul>

Factor	Key environmental values	Potential impacts
Matters protected under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	<p>Matters of National Environmental Significance under the EPBC Act:</p> <ul style="list-style-type: none"> <li>Two species of conservation significant fauna were recorded: <ul style="list-style-type: none"> <li>Carnaby's Cockatoo <i>Calyptorhynchus latirostris</i> (Endangered, Schedule 1).</li> <li>Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) (Vulnerable, Schedule 1).</li> </ul> </li> <li>Six species of conservation significance are considered likely to occur: <ul style="list-style-type: none"> <li><i>Caladenia huegelii</i> (Endangered).</li> <li><i>Darwinia foetida</i> (Critically Endangered).</li> <li><i>Grevillea curviloba</i> subsp. <i>incurva</i> (Endangered).</li> <li>Great Egret (<i>Ardea alba</i>) (Migratory, Schedule 3).</li> <li>Cattle Egret (<i>Ardea ibis</i>) (Migratory, Schedule 3).</li> <li>Rainbow Bee-eater (<i>Merops ornatus</i>) (Migratory, Schedule 3).</li> </ul> </li> <li>Two TECs (Claypans of the SCP and Mound Springs SCP) were recorded.</li> </ul> <p>Environmental impacts to Commonwealth land:</p> <ul style="list-style-type: none"> <li>No conservation significant flora was recorded or is expected to occur.</li> <li>1.9 ha of Wetland habitat, classified as potential breeding habitat for Black Cockatoos.</li> <li>26 potential breeding trees.</li> <li>No critical habitat exists on the Commonwealth Land for conservation significant fauna other than the Black Cockatoos.</li> <li>Two CCWs (0.42 ha) are present.</li> </ul>	<p>Matters of National Environmental Significance under the EPBC Act:</p> <ul style="list-style-type: none"> <li>Loss of Critical habitat for <i>Caladenia huegelii</i> and <i>Grevillea curviloba</i> subsp. <i>Incurve</i>.</li> <li>For Black Cockatoos: <ul style="list-style-type: none"> <li>Loss of breeding, foraging and roosting habitat.</li> <li>Increased occurrence of vehicle collisions.</li> <li>Habitat degradation.</li> </ul> </li> <li>Commonwealth lands: <ul style="list-style-type: none"> <li>Clearing of Conservation Category Wetlands.</li> <li>Loss of fauna habitat and Black Cockatoo habitat.</li> <li>Impact to water bores.</li> </ul> </li> </ul>

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## 3 REGULATORY FRAMEWORK

This proposal is being undertaken in accordance with the requirements of the following Australian Commonwealth and Western Australian State legislation:

- Commonwealth Legislation
  - *Native Title Act 1993.*
  - *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- State Legislation
  - *Metropolitan Water Supply Sewerage and Drainage Act 1909* and 1981 by-laws.
  - *Rights in Water and Irrigation Act 1914.*
  - *Main Roads Act 1930.*
  - *Wildlife Conservation Act 1950.*
  - *Bushfires Act 1954.*
  - *Aboriginal Heritage Act 1972* (AH Act).
  - *Waterways Conservation Act 1976.*
  - *Conservation and Land Management Act 1984.*
  - *Environment Protection Act 1986* (EP Act) and Environmental Protection Regulations 1987.
  - *Heritage of Western Australia Act 1990.*
  - *Land Administration Act 1997.*
  - *Contaminated Sites Act 2003.*
  - *Planning and Development Act 2005.*
  - *Biosecurity and Agricultural Management Act 2007.*



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## 4 ENVIRONMENTAL MANAGEMENT STRATEGIES

Where impacts were determined to have a significant effect on the environment, mitigation and management measures were developed.

Details of mitigation measures to be implemented during the proposal's construction and operation phase, those responsible for, and timing of implementation of these measures, are provided in the following sections, as well as performance criteria, details of monitoring and corrective action.

Prior to construction, this EMP will be revised to reflect the final design, environmental commitments, conditions as per relevant regulatory approvals and construction methods. The EMP will be expanded to include as a minimum the following sub-plans:

- Weed and Dieback Management Plan.
- Drainage Management and Monitoring Plan.
- Wetland Management and Monitoring Plan.
- ASS Management Plan.
- Emergency Response Plan.
- Revegetation Plan.
- Construction Noise and Vibration Management Plan (for out of hours work).

The following sections set out the potential impacts, mitigation measures and responsibilities for each of the factors identified in Table 2.1.

## 4.1 Vegetation and Flora

The EPA's objective in respect of vegetation and flora is to maintain representation, diversity, viability and ecological function at the species, population and community level.

**Table 4.1 Management of vegetation and flora during construction**

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>• Permanent loss of native vegetation.</li> <li>• Permanent loss of GDEs.</li> <li>• Permanent loss of native vegetation within Bush Forever sites.</li> <li>• Permanent interruption of ecological linkage networks.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a detailed infrastructure plan for each stage of the development prior to construction to ensure the proposal is designed within the approved development boundary and identifies areas of native vegetation to be retained</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> <li>• Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• Disturbance will be restricted to the proposal footprint, in accordance with the detailed infrastructure plan/s.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• Staged clearing and revegetation (where applicable) in accordance with infrastructure plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• Design and implementation of culverts in line with drainage strategy to maintain water flows for GDEs adjacent to the proposal footprint.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• Record the location, size (in ha) and date on which native vegetation clearing is completed.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction Manager.</li> <li>• Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>• Trees to be removed shall be felled in a manner such that they fall within the approved clearing area.</li> </ul>	<ul style="list-style-type: none"> <li>• All personnel.</li> </ul>
	<ul style="list-style-type: none"> <li>• Utilise existing or proposed cleared areas for temporary construction purposes, such as tracks, offices, stockpiling and laydown areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction Manager.</li> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• Cleared vegetation suitable for reuse will be mulched and reused within the soft landscaping works where suitable.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>• Prepare and implement a Revegetation Management Plan (to be developed).</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Management Representative.</li> </ul>

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Permanent loss of TECs and PECs.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure all operators are inducted prior to any clearing including an overview of known TECs and PECs.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Avoid Commonwealth TECs, Mound Springs SCP and Claypans of the SCP.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Finalisation of design will endeavour to further avoid and minimise the impacts to State TECs and PECs within the proposal footprint.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Disturbance will be restricted to the proposal footprint, in accordance with the detailed infrastructure plan/s.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Maintain a vegetated buffer of a minimum of 50 m (where possible) around known locations of threatened flora.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Clearly demarcate/fence TECs and PECs to be retained (i.e. those adjacent/within 50 m of the proposal footprint) to avoid accidental disturbance.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
<ul style="list-style-type: none"> <li>Permanent loss of threatened and priority listed flora.</li> </ul>	<ul style="list-style-type: none"> <li>Targeted surveys for Threatened and Priority listed flora will be undertaken prior to vegetation clearing to clearly define population boundaries, and to identify any additional populations within and adjacent to the proposal.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Maintain a vegetated buffer of a minimum of 50 m (where possible) around known locations of threatened flora.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Clearly demarcate/fence Threatened and Priority flora to be retained (i.e. those adjacent/within 50 m of the proposal footprint) to avoid accidental disturbance.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Ensure all operators are inducted prior to any clearing including an overview of threatened and priority flora, and a notification process if such flora is sighted.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>



Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>• Spread of introduced weeds.</li> <li>• Spread of <i>Phytophthora</i> Dieback.</li> <li>• Edge effects from introduced weeds.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and implement a weed and dieback hygiene management plan prior to construction which outlines: <ul style="list-style-type: none"> <li>– A risk assessment of potential sources and activities.</li> <li>– The identification of ‘protectable’ areas adjacent to the proposal footprint.</li> <li>– Requirements for hygiene washdown locations that consider risk in the surrounding landscape.</li> <li>– A program to monitor and report on compliance with the hygiene protocols prescribed in this management plan.</li> <li>– Quarterly auditing of washdown sites to identify weed incursions.</li> <li>– Regular visual monitoring at strategic locations along the proposal footprint (i.e. in association with native vegetation, including buffers around surrounding sensitive receptors like TECs) to identify and ameliorate weed incursions.</li> <li>– An auditable hygiene inspection form will be prepared to detail inspection results at the hygiene locations.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>• Ensure that topsoil and mulch is not transported across dieback management boundaries (for example, topsoil from uninterpretable areas will not be transported and used within dieback unfested areas).</li> </ul>	<ul style="list-style-type: none"> <li>• Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• Develop and implement a monitoring program to monitor the condition of environmentally significant vegetation along the edge of the proposal footprint (i.e. TECs, PECs and threatened flora buffers), including the presence of significant environmental weeds (i.e. WONS and Declared Pests).</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Management Representative.</li> </ul>

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Vegetation degradation from uncontrolled access to remnant vegetation.</li> <li>Edge effects from refuse.</li> </ul>	<ul style="list-style-type: none"> <li>Install a temporary fence along environmentally sensitive areas to reduce the risk of unauthorised or illegal access impacting on sensitive features. The environmentally sensitive areas include Department of Parks and Wildlife (DPAW) managed lands, Cullacabardee, Whiteman Park, Lexia wetlands, Dick Perry Reserve and locations of threatened and priority listed flora and ecological communities.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Machinery or vehicles are not to move outside the proposal footprint, except on existing tracks or designated side tracks.</li> </ul>	<ul style="list-style-type: none"> <li>All personnel.</li> </ul>
	<ul style="list-style-type: none"> <li>Ensure no unauthorised access occurs within the adjacent native vegetation and onto private land during the construction phase of the proposal.</li> </ul>	<ul style="list-style-type: none"> <li>All personnel.</li> </ul>
	<ul style="list-style-type: none"> <li>Develop and implement a monitoring program to monitor the condition of environmentally significant vegetation along the edge of the proposal footprint (i.e. TECs, PECs and threatened flora buffers), including evidence of any unauthorised vehicle movements and presence of any refuse during construction.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
<ul style="list-style-type: none"> <li>Increase in wildfires.</li> </ul>	<ul style="list-style-type: none"> <li>Manage the risk of fire during construction through the implementation of a fire management plan (to be developed) in accordance with Main Roads Operational Guideline 94. This is likely to include hot work permits; obeying total fire bans (including vehicle movement bans); ensuring the serviceability of all equipment and plant (including spark arrestors on exhausts); induction of personnel; prevention of unauthorised access to the construction area and ensuring the work site is kept clean.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>

## 4.2 Fauna

The EPA's objective in respect of fauna is to maintain representation, diversity, viability and ecological function at the species, population and assemblage level.

**Table 4.2 Management of fauna during construction**

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Habitat loss due to vegetation clearing.</li> <li>Removal of Black Cockatoo habitat.</li> <li>Habitat fragmentation due to vegetation clearing.</li> <li>Habitat degradation.</li> </ul>	<ul style="list-style-type: none"> <li>Reduce clearing during final design where practicable without impacting on critical design factors (e.g. safety). Particularly in areas such as Maralla Road Bushland and Cullacabardee Bushland where ecological connectivity is paramount.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Develop a detailed infrastructure plan for each stage of the development prior to construction to ensure the proposal is designed within the approved development boundary and identifies areas of habitat/native vegetation to be retained (particularly Black Cockatoo habitat).</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Demarcate the clearing area, including all known potential Black Cockatoo breeding and foraging habitat to be retained, prior to the commencement of proposal activities and native vegetation clearing.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Ensure all operators are inducted prior to any clearing including an overview of native fauna and associated issues.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Seek to retain and translocate hollow logs where practicable for translocation to surrounding habitats.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>A total of 21 fauna underpasses and two bridges to be constructed in key locations along the alignment.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Prepare and implement a Revegetation Management Plan (to be developed). This plan will include the revegetation of designated areas/corridors to maintain ecological linkages, especially along the Reid Highway section of the proposal footprint.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> <li>Environmental Management Representative.</li> </ul>
Fauna mortalities primarily due to clearing activities.	<ul style="list-style-type: none"> <li>A 40 km/h speed limit will be enforced within the construction zone to mitigate animal strikes.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Fauna spotters will be present during the clearing of native vegetation to help translocate any fauna to adjacent suitable habitat and minimise any mortalities.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>

Potential impact	Proposed mitigation measure	Responsibility
	<ul style="list-style-type: none"> <li>Clearing to occur outside of spring wherever possible, to minimise impacts to the breeding cycle of resident fauna e.g. nesting birds.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>All fauna injured during the construction period will be taken to an authorised veterinarian or wildlife carer.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Fauna warning signs will be installed in areas where intact areas of native vegetation occur next to the roadside.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Install temporary/permanent fauna fencing during construction in areas adjacent to native vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Fauna escape ramps will be installed a minimum of every 200 m in sections containing fauna fencing. Fauna escape ramps are one-way devices that allow trapped animals safe egress from the road reserve. The ramps are required to be a 1,500 mm high to prevent fauna access in the wrong direction.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> <li>Project Manager.</li> </ul>
Feral predation.	<ul style="list-style-type: none"> <li>A trapping and translocation program will be conducted for ground dwelling fauna in areas of native vegetation prior to clearing. Fauna will be released in comparable habitat outside of the construction footprint.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Install furniture (objects to provide shelter) in fauna underpasses to reduce risk of predation.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Prepare and implement a Revegetation Management Plan (to be developed). This will include revegetating as close to fauna underpasses as possible to reduce risk of predation.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
Altered fire regimes.	<ul style="list-style-type: none"> <li>Manage the risk of fire during construction through the implementation of a fire management plan (to be developed) in accordance with Main Roads Operational Guideline 94. This is likely to include hot work permits; obeying total fire bans (including vehicle movement bans); ensuring the serviceability of all equipment and plant (including spark arrestors on exhausts); induction of personnel; prevention of unauthorised access to the construction area and ensuring the work site is kept clean.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>



Potential impact	Proposed mitigation measure	Responsibility
Light, noise and vibration as a result of machinery and construction activities.	<ul style="list-style-type: none"> <li>Direct lights towards construction activities to limit the amount of light spill to surrounding habitats.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Where possible low-level lighting will be used during the construction phase of the proposal. Artificial screening will be employed along areas adjacent to native vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>

**Table 4.3 Management of fauna during operation**

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Habitat fragmentation.</li> <li>Fauna mortalities from fauna/vehicle interactions.</li> </ul>	<ul style="list-style-type: none"> <li>Fauna fencing will be installed on both sides of the road in areas north of Hepburn Avenue along the alignment to a minimum of 100 m north of Maralla Road to restrict fauna access to the road. The fauna fence design will be consistent with MRWA Drawing No. 200331-110 (1,800 mm high and dug into the ground 500 mm).</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Fauna escape ramps will be installed a minimum of every 200 m in sections containing fauna fencing. Fauna escape ramps are one-way devices that allow trapped animals safe egress from the road reserve. The ramps are required to be a 1,500 mm high to prevent fauna access in the wrong direction.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>A total of 21 fauna underpasses and two bridges are planned to be constructed in key locations along the alignment.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>A fauna underpass monitoring program will be developed.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
Light, noise and vibration as a result of operational activities.	<ul style="list-style-type: none"> <li>The road lighting will comply with AS 1158 Road Lighting and will attempt to minimise impacts from light pollution.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>

## 4.3 Hydrological Processes and Inland Waters Environmental Quality

The EPA's objectives in respect of hydrological process and inland waters quality are:

- To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance are protected.
- To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.

**Table 4.4 Management of hydrological processes and inland waters quality during construction**

Potential impact	Proposed mitigation measure	Responsibility
Localised increase in stormwater runoff from cleared catchments, liberation of exposed soils and changes to surface water drainage patterns.	• Preparation and implementation of a Drainage Management and Monitoring Plan (to be developed).	• Construction Manager.
	• Provision of bridge crossings over Ellen Brook, built outside the low flow channel.	• Project Manager.
	• Construction of bridges at Ellen Brook during periods when Ellen Brook is at low flow and bridge footings will be piled.	• Construction Manager.
Short-term lowering of groundwater levels in the immediate vicinity of any dewatering/construction water abstraction and any associated oxidations of potential ASS, altering the condition and health of the Gnangara Mound, Ellen Brook, Mound Springs SCP TEC, Claypans of the SCP TEC and surrounding wetlands.	• The road surface will be constructed above the design maximum groundwater level.	• Construction Manager.
	• Following final design and identification of sources of construction water (where not in accordance with an existing bore/licence) an investigation into dewatering and construction water requirements will be undertaken.	• Project Manager.
	• Site and operate construction water abstraction bores such that drawdown impacts to environmentally sensitive receptors are within the usual seasonal variations of groundwater levels for those receptors unless further studies into those receptors' ecological water requirements show impacts to be insignificant.	• Construction Manager. • Environmental Management Representative.
	• Where practical, construction of bridge footings will be scheduled during summer to avoid dewatering requirements. If dewatering is required, dewatering methods (e.g. well-point spears) that minimise the radius of influence on sensitive receptors (e.g. wetlands) will be utilised.	• Project Manager.
	• Undertake dewatering and the sourcing of construction water in accordance with approved licences and associated dewatering management plan and/or groundwater license operating strategy.	• Project Manager. • Construction Manager.

Potential impact	Proposed mitigation measure	Responsibility
	<ul style="list-style-type: none"> <li>Preparation and implementation of a Drainage Management and Monitoring Plan, including a groundwater monitoring procedure (to be developed).</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Preparation and implementation of a Wetland Management and Monitoring Plan (to be developed).</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Undertake a detailed ASS investigation following detailed design and the definition of likely soil disturbance.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Preparation and implementation of an ASS Management Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
Direct loss (i.e. filling and impounding) of wetlands.	<ul style="list-style-type: none"> <li>Develop a detailed infrastructure plan for each stage of the development prior to construction to ensure the proposal is designed within the approved development boundary, has endeavoured to avoid and minimise impacts to CCW and REWS, and identifies areas of CCW and REW to be retained</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Disturbance will be restricted to the clearing boundary, as detailed in the infrastructure plan/s.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Preparation and implementation of a wetland management and monitoring plan.</li> <li>Where any wetland is to be impacted, the hydrological function of the wetland is to be retained as far as is practicable.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
Water pollution associated with spills and increased levels of TSS in stormwater runoff, altering the condition and health of the Gngara Mound, Ellen Brook, Mound Springs SCP TEC, Claypans of the SCP TEC, Twin Swamps Nature Reserve and surrounding wetlands.	<ul style="list-style-type: none"> <li>A detailed infrastructure plan will be prepared for each stage of the development prior to construction to ensure that the proposal is designed and constructed in accordance with the drainage strategy, including: <ul style="list-style-type: none"> <li>Provision of bioretention basins where the road passes within a WHPZ and within 50 m of a CCW, REW, Mound Springs SCP TEC and/or Claypans of the SCP TEC.</li> <li>Provision of a vegetated retention/detention basin for road runoff within 400 m of the Ellen Brook.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>

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Potential impact	Proposed mitigation measure	Responsibility
	<ul style="list-style-type: none"><li>Construction laydown areas and stockpiles (including storage of hazardous materials and refuelling activities) will be located outside the WHPZs and 50 m from all CCWs and the Mound Springs SCP TEC to mitigate potential water quality impacts.</li></ul>	<ul style="list-style-type: none"><li>Construction Manager.</li></ul>
	<ul style="list-style-type: none"><li>Preparation and implementation of an Emergency Response Plan.</li></ul>	<ul style="list-style-type: none"><li>Construction Manager.</li></ul>
	<ul style="list-style-type: none"><li>Preparation and implementation of a Drainage Management and Monitoring Plan, including a groundwater monitoring procedure.</li></ul>	<ul style="list-style-type: none"><li>Construction Manager.</li></ul>
	<ul style="list-style-type: none"><li>Preparation and implementation of a Wetland Management and Monitoring Plan.</li></ul>	<ul style="list-style-type: none"><li>Environmental Management Representative.</li></ul>
Road embankment will act as a barrier to surface water/ groundwater flows, leading to retention of water upstream and decrease in water received downstream, potentially altering the condition and health of Ellen Brook, Mound Springs SCP TEC and surrounding wetlands.	<ul style="list-style-type: none"><li>A detailed infrastructure plan will be prepared for each stage of the development prior to construction to ensure that the proposal is designed and constructed in accordance with the drainage strategy, including the location of culverts and bridges to maintain surface water flows and any sand drainage layers or sub-surface drainage or other mechanisms to maintain groundwater flow.</li></ul>	<ul style="list-style-type: none"><li>Project Manager.</li></ul>
	<ul style="list-style-type: none"><li>Construction of appropriate drainage management infrastructure in accordance with the detailed infrastructure plan/s.</li></ul>	<ul style="list-style-type: none"><li>Construction Manager.</li></ul>
	<ul style="list-style-type: none"><li>Preparation and implementation of a Wetland Management and Monitoring Plan.</li></ul>	<ul style="list-style-type: none"><li>Environmental Management Representative.</li></ul>

**Table 4.5 Management of hydrological processes and inland waters quality during operation**

Potential impact	Proposed mitigation measure	Responsibility
Localised increase in stormwater runoff from road pavement and temporary changes to groundwater levels in the areas surrounding the infiltration basins.	<ul style="list-style-type: none"> <li>Ongoing implementation of the Drainage Management and Monitoring Plan, including a groundwater monitoring procedure.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
Water pollution from stormwater runoff or vehicle collision and/or spillage of hazardous waste altering the condition and health of the Gngara Mound, Ellen Brook, Mound Springs SCP TEC and surrounding wetlands.	<ul style="list-style-type: none"> <li>Preparation and implementation of an Emergency Response Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Ongoing implementation of the Wetland Management and Monitoring Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Ongoing implementation of the Drainage Management and Monitoring Plan, including a groundwater monitoring procedure.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>



## 4.4 Noise and Vibration

The EPA's objective in respect of noise and vibration is to ensure that impacts are reduced to as low as reasonably practicable.

**Table 4.6 Management of noise and vibration during construction**

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Construction noise and vibration</li> <li>Changes in amenity for local communities.</li> </ul>	<ul style="list-style-type: none"> <li>Prepare and implement a Construction Noise and Vibration Management Plan prior to construction for any out of hour's works (outside of 7am-7pm Monday to Saturday) in accordance with the Environmental Protection (Noise) Regulations 1997, to the satisfaction of DER and relevant local government authorities.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Works will be carried out in accordance with Regulation 13 of the Environmental Protection (Noise) Regulations 1997 and AS2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Use equipment with low noise levels and maintaining noise control devices on equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Use broadband reversing alarms on construction equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Take precautionary measures to avoid vibration damage to buildings near work sites.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Provide a 24-hour noise complaint hotline during construction and maintaining a complaints register.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Obtain necessary approval to work outside of normal working hours, if required.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Schedule site activities to minimise impacts to amenity, including minimising the amount of night time traffic and construction adjacent to residential areas.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Notify public where receptors may be impacted by construction noise and/or vibration, particularly when works will occur outside normal working hours.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Undertake noise and vibration monitoring in response to complaints or at potentially affected locations.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>

**Table 4.7 Management of noise and vibration during operation**

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Road traffic using highway.</li> <li>Changes in amenity for local communities.</li> </ul>	<ul style="list-style-type: none"> <li>Locate the road infrastructure as far to the west within the road reserve as far as is practicable, in the vicinity of Ellenbrook.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Use the quietest practical road surface.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Construct noise walls to a maximum height of 5 m at noise sensitive premises adjacent to the alignment between Reid Highway and Hepburn Avenue to ensure noise levels do not exceed the noise limit of 60 dB <math>L_{Aeq}</math> at these premises.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Construct noise walls to a maximum height of 5 m at noise sensitive premises adjacent to the alignment between Hepburn Avenue and Ellenbrook with the aim to ensure noise levels do not exceed the noise target of 55 dB <math>L_{Aeq}</math> at these premises, as far as is reasonably practicable.</li> <li>Should the construction of noise walls not result in achieving the noise target of 55 dB <math>L_{Aeq}</math> at noise sensitive receptors between Hepburn Avenue and Ellenbrook, efforts will be made to achieve the noise limit of 60 dB <math>L_{Aeq}</math>.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Noise walls will be constructed of material with a surface density exceeding 15 kg/m<sup>2</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Construct a 2.4m high visual screening wall where the road is located within 100 m of residential properties north of Ellenbrook,</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Prepare and implement façade protection packages in consultation with affected parties at identified properties north of Ellenbrook where noise levels are likely to exceed the day limit criteria of 60 dB <math>L_{Aeq}</math>.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>

## 4.5 Rehabilitation

The EPA's objective in respect of rehabilitation is to ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.

**Table 4.8 Management of rehabilitation during construction and operation**

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Failure to rehabilitate a proposal site or poor site rehabilitation.</li> <li>Reduction in the quality and quantity of habitats, ecosystem function and adjacent natural vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>A detailed Revegetation Management Plan will be developed and implemented during construction. The plan will outline a clear timeframe for mitigation and management measures, monitoring actions and completion targets.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Retain suitable topsoil for placement on areas where revegetation and landscaping will be undertaken.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager</li> </ul>
	<ul style="list-style-type: none"> <li>Treating or disposing unsuitable topsoil and cleared vegetation during the clearing works.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager</li> </ul>
	<ul style="list-style-type: none"> <li>In the absence of adequate topsoil, suitable growth medium will be used. If additional topsoil is required, materials must be contaminant and weed free.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Implement Weed and Dieback Management Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Conserving and where possible chipping good quality vegetation, during clearing, for reuse as mulch.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager</li> </ul>
	<ul style="list-style-type: none"> <li>Landscaping will be undertaken in accordance with the landscaping types and extent present in the proposal footprint (rural zone, transition zone and urban zone).</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Local provenance native species that represent the floristic formations of the proposal footprint will be selected for revegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Scheduling rehabilitation progressively where practicable. Timing of activities will, however, be dependent on optimal seasons.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>

## 4.6 Aboriginal Heritage

The EPA's objective in respect of Aboriginal heritage is to ensure historical and cultural association are not adversely affected.

**Table 4.9 Management of Aboriginal heritage during construction**

Potential impact	Proposed mitigation measure	Responsibility
Ground Disturbance to Registered Aboriginal heritage sites, including: <ul style="list-style-type: none"> <li>Bennett Brook in Toto (ID 3692).</li> <li>Temporary camp (ID 20058).</li> <li>NOR/02 Lightning Swamp (ID 21393).</li> <li>Chandala Brook (ID 21620).</li> </ul>	<ul style="list-style-type: none"> <li>Obtain a Section 18 consent to disturb prior to disturbing these sites.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Consult with SWALSC and other relevant Aboriginal people before commencing work within the boundaries of Stored (archaeological) place 3552 (otherwise, there are no legal impediments for proposed work at this place).</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Prior to nearby ground disturbance, sites NorthLink 14-01 and NorthLink 14-02 will be clearly delineated using physical markers and/or fencing. Physical barriers may require periodic maintenance to ensure effectiveness.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Induction programmes/materials will alert staff in the area about cultural heritage values and the restrictions in entering or working near sites NorthLink 14-01 and NorthLink 14-02.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Ensure archaeologists and/or appropriately trained members of the Noongar community are present to monitor ground disturbing activities in areas that have high potential for sites with some archaeological integrity.</li> <li>Salvage and manage any Aboriginal Heritage objects identified during ground disturbance according to advice from a Noongar representative.</li> </ul>	<ul style="list-style-type: none"> <li>Project Manager.</li> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>If suspected skeletal remains are found during clearing or earthworks, works shall cease and the incident reported immediately to the WA Police Service and Department of Aboriginal Affairs (DAA). Works will not resume until the Police, DAA and archaeologists are satisfied with the management of the remains.</li> </ul>	<ul style="list-style-type: none"> <li>All personnel.</li> </ul>

## 4.7 European Heritage

The environmental objective in respect of European heritage is to ensure historical and cultural association are not adversely affected.

**Table 4.10 Management of European heritage during construction**

Potential impact	Proposed mitigation measure	Responsibility
Disturbance to European heritage sites: <ul style="list-style-type: none"> <li>• Muchela – No. 30 Brand Highway, Muchea.</li> <li>• Drainage/Irrigation Channel, Muchea South Road, Muchea.</li> <li>• Ellenbrook Estate Area.</li> <li>• Forestry Department's Divisional Headquarters and Fire Lookout.</li> </ul>	<ul style="list-style-type: none"> <li>• A site visit will be undertaken to enable external photographs to be taken of the Ellenbrook Estate Area, Muchela, Drainage/Irrigation Channel that may be subject to the Government Heritage Property Disposal Process (GHPDP).</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• The GHPDP will be complied with by preparing a letter to the State Heritage Office advising of further clearance of the Ellenbrook Estate Area, Muchela, the Drainage/Irrigation Channel and the Forestry Department's Divisional Headquarters' and Fire Lookout site.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• The City of Swan, Shire of Chittering and City of Bayswater will be informed that the proposal is occurring and that it is occurring in close proximity to locally listed heritage places.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• Clarification is required on the status of these places on the Shire of Chittering's Heritage List and what process is required to enable the further clearance of this site.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>• The European Heritage values identified adjacent to the study area will be clearly marked on future mapping for the proposal to ensure that all construction personnel are aware of their location and the need for care during construction or with any future boundary changes.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Management Representative.</li> </ul>



## 4.8 Dust

The environmental objective in respect of dust is to ensure that impacts are reduced to as low as reasonably practicable.

**Table 4.11 Management of dust during construction**

Potential impact	Proposed mitigation measure	Responsibility
<ul style="list-style-type: none"> <li>Annoyance due to dust deposition (soiling of surfaces).</li> <li>Risks of health effects due to increased exposure to PM<sub>10</sub>.</li> </ul>	<ul style="list-style-type: none"> <li>Develop a clearing procedure; with the aim to stage clearing and thus minimise the period of soil exposure between clearing and development/revegetation.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Plan site layout so that machinery and dust causing activities are located away from sensitive receptors, as far as is possible.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Inform the adjoining community about planned activities that may emit significant levels of dust.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Impose and comply with speed limits in construction areas.</li> </ul>	<ul style="list-style-type: none"> <li>All personnel.</li> </ul>
	<ul style="list-style-type: none"> <li>Establish and maintain a complaints procedure and register.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>
	<ul style="list-style-type: none"> <li>Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.</li> </ul>	<ul style="list-style-type: none"> <li>All personnel.</li> </ul>
	<ul style="list-style-type: none"> <li>Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Erect screening around topsoil stockpiles.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>
	<ul style="list-style-type: none"> <li>Employ dust suppression techniques such as water sprays as and where required.</li> </ul>	<ul style="list-style-type: none"> <li>Construction Manager.</li> </ul>

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## 5 PERFORMANCE MONITORING

A monitoring program has been developed in relation to the management strategies and measures listed in Chapter 4. The monitoring program addresses environmental factors to be monitored, performance criteria, frequency of monitoring and corrective actions. The Environmental Management Representative will be responsible for implementing the monitoring program.

Factors to be monitored and performance criteria are detailed in Table 5.1.

**Table 5.1 Performance monitoring**

Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
Flora and vegetation	<ul style="list-style-type: none"> <li>No clearing or disturbance to vegetation outside clearing boundary as outlined in the detailed infrastructure plan/s.</li> <li>Clearing does not exceed: <ul style="list-style-type: none"> <li>205 ha of native vegetation.</li> <li>4.4 ha of State listed TECs (SCP02 and SCP20a).</li> <li>145.5 ha of State listed PECs (SCP21c, SCP22, SCP23b, SCP24 and Banksia on the Swan Coastal Plain).</li> <li>49.6 ha of GDEs.</li> <li>128.5 ha of intact native vegetation within Bush Forever sites.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Ongoing construction area inspections and reports to assess clearing.</li> <li>Review records of the location and size (in ha) of clearing.</li> <li>Site inspections to ensure presence of delineating fencing or tape to indicate clearing boundary and conservation significant vegetation.</li> <li>Reported incident of disturbance to conservation significant native vegetation outside of the clearing boundary.</li> </ul>	<ul style="list-style-type: none"> <li>Weekly during construction.</li> <li>Immediately following reported incident.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate cause.</li> <li>Review management measures.</li> <li>Increase education amongst all personnel.</li> <li>Review use of temporary flagging/fencing to delineate clearing boundary.</li> <li>Rehabilitate areas with native species as soon as possible after incident in accordance with the Rehabilitation Management Plan (to be developed).</li> <li>Improve and implement increased protective measures as necessary.</li> </ul>

Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
Flora and vegetation	No introduction of new significant environmental weeds, or spread of existing significant environmental weeds within the proposal footprint during construction.	<ul style="list-style-type: none"> <li>Regular visual assessment at strategic locations along the proposal footprint (i.e. in association with remnant native vegetation) to identify new areas of weed infestation.</li> <li>Any other monitoring required by the weed and dieback hygiene management plan (to be developed).</li> </ul>	<ul style="list-style-type: none"> <li>Weekly during construction.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>From monitoring identify areas of significant weeds and possible source of infestation.</li> <li>Review treatment program and ensure weeds are eradicated during subsequent weed control event.</li> <li>Implement revised controls if required and monitor area for further weed infestations.</li> </ul>
Terrestrial fauna	<ul style="list-style-type: none"> <li>No clearing or disturbance to habitat/native vegetation outside clearing boundary as outlined in the detailed infrastructure plan/s.</li> <li>Clearing not to exceed: <ul style="list-style-type: none"> <li>201.8 ha of Carnaby's Cockatoo foraging habitat.</li> <li>120.1 ha of Forest Red-tailed Black Cockatoo foraging habitat.</li> <li>120.1 ha of breeding habitat for both Black Cockatoo species.</li> <li>58.6 ha of roosting habitat for both Black Cockatoo species.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Ongoing construction area inspections and reports to assess clearing.</li> <li>Review records of the location and size (in ha) of clearing.</li> <li>Site inspections to ensure presence of fencing and delineating tape maintained.</li> <li>Reported incident of disturbance outside of the approved proposal footprint/development envelope.</li> </ul>	<ul style="list-style-type: none"> <li>Weekly during construction.</li> <li>Immediately following reported incident.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate cause.</li> <li>Review management procedures.</li> <li>Increase education amongst all personnel.</li> <li>Review use of temporary flagging/fencing to delineate clearing boundary.</li> <li>Rehabilitate areas as soon as possible after incident in accordance with the Rehabilitation Management Plan (to be developed).</li> <li>Improve and implement increased protective measures as necessary.</li> </ul>

Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
Hydrological process and inland water quality	<ul style="list-style-type: none"> <li>No clearing or disturbance outside clearing boundary as outlined in the detailed infrastructure plan/s.</li> <li>Clearing not to exceed a maximum of 14.8 ha of CCW and 14.0 ha of REW.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing construction area inspections and reports to assess clearing.</li> <li>Review records of the location and size (in ha) of clearing.</li> <li>Site inspections to ensure presence of fencing and delineating tape maintained.</li> <li>Reported incident of disturbance outside of the approved proposal footprint/development envelope.</li> </ul>	<ul style="list-style-type: none"> <li>Weekly during construction.</li> <li>Immediately following reported incident.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate cause.</li> <li>Review management procedures.</li> <li>Increase education amongst all personnel.</li> <li>Review use of temporary flagging/fencing to delineate boundaries of clearing boundary.</li> <li>Rehabilitate areas as soon as possible after incident.</li> <li>Improve and implement increased protective measures as necessary.</li> </ul>
	<ul style="list-style-type: none"> <li>Adherence with licensing conditions for dewatering.</li> </ul>	<ul style="list-style-type: none"> <li>Monitor compliance of dewatering with relevant permit.</li> </ul>	<ul style="list-style-type: none"> <li>Weekly during dewatering operations.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate potential breach of licensing conditions.</li> <li>Review dewatering activities and program.</li> <li>Report non-adherence to the Department of Water (DOW).</li> <li>Monitor effectiveness of additional control measures following breach.</li> </ul>



Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
	<ul style="list-style-type: none"> <li>No adverse change in the condition of remaining wetlands, Ellen Brook, Mound Springs SCP TEC and Claypans of the SCP TEC (to be defined in Wetland Management and Monitoring Plan).</li> </ul>	<ul style="list-style-type: none"> <li>Visual inspections of sediment traps and silt screens in waterways.</li> <li>Other monitoring as per the requirements of the Wetland Management and Monitoring Plan.</li> <li>The monitoring suite will include water levels, major ions, nutrients (nitrogen, phosphorus), pH, conductivity and dissolved oxygen.</li> </ul>	<ul style="list-style-type: none"> <li>Monthly during construction.</li> <li>Daily silt trap visual inspection during construction.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate potential cause of change in water quality.</li> <li>If change is likely a result of proposal activities, identify possible control measures to remedy (e.g. erosion and scour control).</li> <li>Monitor effectiveness of additional control measures.</li> </ul>
	<ul style="list-style-type: none"> <li>No adverse impact on groundwater quality or availability of the Gngara Mound (to be defined in Drainage Management and Monitoring Plan).</li> <li>Water quality within acceptable limits.</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring as per requirements of the Drainage Management and Monitoring Plan's Groundwater monitoring procedure (to be developed).</li> <li>Water quality information will be collected from groundwater bores installed for the proposal. The monitoring suite will include water levels, major ions, nutrients (nitrogen, phosphorus), pH, conductivity and dissolved oxygen.</li> </ul>	<ul style="list-style-type: none"> <li>Monthly during construction.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate potential cause of change in water quality.</li> <li>If change is likely a result of proposal activities, identify possible control measures to remedy (e.g. erosion and scour control).</li> <li>Monitor effectiveness of additional control measures.</li> </ul>

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Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
	<ul style="list-style-type: none"><li>• No incident of spill or leak of hazardous materials during construction.</li><li>• The ERP is implemented immediately after any incidence of spill/or leak of hazardous material.</li></ul>	<ul style="list-style-type: none"><li>• Ongoing construction area inspections of storage areas containing hazardous materials.</li><li>• Reported incident/s.</li></ul>	<ul style="list-style-type: none"><li>• Weekly during construction.</li><li>• Immediately following reported incident.</li></ul>	<ul style="list-style-type: none"><li>• Environmental Management Representative.</li></ul>	<ul style="list-style-type: none"><li>• Investigate potential cause of incident.</li><li>• Review management procedures.</li><li>• Increase education amongst all personnel.</li><li>• Identify possible control measures to remedy.</li><li>• Monitor effectiveness of additional control measures.</li><li>• Undertake any necessary reporting and remediation in accordance with the ESRP.</li></ul>

Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
Amenity (Noise and vibration)	<ul style="list-style-type: none"> <li>Comply with Regulation 13 of the Environmental Protection (Noise) Regulations 1997 during construction.</li> <li>Vibration will not exceed a particle velocity of 5mm/s during construction.</li> <li>Achieve the noise limits of 60 dB LAeq for brownfields areas between Reid Highway and Hepburn Avenue.</li> <li>Achieve the noise target of 55 dB LAeq for greenfields areas between Hepburn Avenue and Ellenbrook where practicable, while achieving the noise limit of 60 dBLAeq at remaining noise sensitive receptors.</li> <li>Achieve indoor noise targets for eight rural residential properties north of Ellenbrook.</li> </ul>	<ul style="list-style-type: none"> <li>Monitor integrity of machinery and vehicles during pre-starts.</li> <li>Monitor hours of operation during construction.</li> <li>Monitor noise and vibration during construction following complaint.</li> <li>Monitor operational noise levels at noise sensitive premises following construction to confirm operational noise performance criteria have been met.</li> </ul>	<ul style="list-style-type: none"> <li>Upon receipt of complaint.</li> <li>Following completion of operational noise monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> <li>Construction Manager.</li> </ul>	<ul style="list-style-type: none"> <li>Manage complaints and ensure a rapid response occurs.</li> <li>Undertake noise monitoring following complaint.</li> <li>Investigate cause.</li> <li>Review management measures.</li> <li>Increase education amongst all personnel.</li> <li>Identify possible control measures to remedy any exceedance (e.g. additional façade treatments).</li> <li>Monitor effectiveness of additional control measures to confirm operational noise performance criteria have now been met.</li> </ul>

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Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
Rehabilitation	<ul style="list-style-type: none"><li>• All areas of temporary disturbance will be revegetated by the re-establishment of a cover of vegetation suited to the location.</li><li>• Rehabilitation of the road verge will improve the amenity of the site, the stability of unpaved surfaces and promote ecological sustainability.</li></ul>	Site inspections and monitoring in accordance with the revegetation management plan.	Biannually for two years after planting, and then annually for the following three years.	Environmental Management Representative.	<ul style="list-style-type: none"><li>• Undertake actions as per the Revegetation Management Plan.</li><li>• Investigate cause.</li><li>• Improve and implement increased protective measures as necessary.</li><li>• Monitor the success of these actions.</li></ul>

Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
Aboriginal heritage	No unauthorised disturbance of Aboriginal heritage sites.	<ul style="list-style-type: none"> <li>Ongoing construction area inspections and reports to assess clearing.</li> <li>Review records of the location and size (in ha) of clearing.</li> <li>Site inspections to ensure presence of fencing and delineating tape maintained.</li> <li>Reported incident of: <ul style="list-style-type: none"> <li>disturbance outside of the approved proposal footprint in the vicinity of known archaeological sites (NorthLink 14-01 and NorthLink 14-02).</li> <li>discovery of skeletal material/new cultural material during ground disturbing activities.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Weekly during construction.</li> <li>Immediately following reported incident.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental Management Representative.</li> </ul>	<ul style="list-style-type: none"> <li>Cease works immediately.</li> <li>Investigate cause.</li> <li>Seek formal, written advice from the Department of Aboriginal Affairs as to whether Ministerial consent is required under Section 18 of the AH Act.</li> <li>Consult with the South-West Aboriginal Land and Sea Council (SWALSC) and other relevant Aboriginal people will take place.</li> <li>Review management measures.</li> <li>Improve and implement increased protective measures as necessary.</li> <li>Monitor the success of these actions.</li> </ul>

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Environmental factor	Performance criteria	Monitoring	Reporting	Responsibility	Corrective action
Dust	<p>Dust is managed to ensure that impacts to sensitive receivers are minimised as far as is practicable.</p> <p>No significant dust build up on local roads surrounding the project area.</p>	<ul style="list-style-type: none"><li>• Ongoing construction area inspections.</li><li>• Monitor dust following complaint.</li></ul>	<ul style="list-style-type: none"><li>• Weekly.</li><li>• Upon receipt of complaint.</li></ul>	<ul style="list-style-type: none"><li>• Environmental Management Representative.</li><li>• Construction Manager.</li></ul>	<ul style="list-style-type: none"><li>• Manage complaints and ensure a rapid response occurs.</li><li>• Undertake dust monitoring if necessary.</li><li>• Investigate cause.</li><li>• Review management measures.</li><li>• Increase education amongst all personnel.</li><li>• Implement improved control measures as necessary.</li><li>• Monitor effectiveness of additional control measures.</li></ul>



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## 6 ENVIRONMENTAL MONITORING, AUDITING AND REPORTING

### 6.1 Environmental Incident Reporting and Investigation

Environmental incidents shall be reported and investigated in accordance with MRWA Corporate Procedure 6707/042 Environmental Guideline – Environmental Incident Reporting and Investigation (MRWA, 2006). Environmental incident reports are to be filed by Project Manager in line with the following process:

1. Environmental incident occurs.
2. Immediate remedial action: the observer of an incident should undertake any immediate actions to stop, control or contain the incident to prevent further damage.
3. Determine environmental incident category (minor/significant/major).
4. Notify management.
5. Assessment and investigation.
6. Incident report.
7. Corrective and preventative actions – the Environmental Management Representative shall track the progress of agreed corrective and preventative actions.

### 6.2 Environmental Inspections and Monitoring

Environmental inspections and monitoring are to be undertaken by the Environmental Management Representative (and/or the Construction Manager) in accordance with the tables in Chapter 5. Completed inspection/monitoring reports are to be submitted to the Project Manager, with a copy to the relevant regulators where required. A systematic monitoring and measuring process involving inspection and testing fulfils a threefold purpose:

- Ensure conformity to contractual requirements.
- Ensure environmental performance complies with legislative requirements and in accordance with project requirements.
- Provide an ongoing risk management process and early warnings of hazards.

The environmental monitoring during construction will include:

- Inspections.
- Monitoring.
- Internal and External Auditing.

#### 6.2.1 Inspections

To ensure that the management measures are being adequately implemented during the construction phase, daily and weekly work area inspections will be undertaken. Compliance with management measures will be reported on and non-conformances will be corrected where required.

## **6.2.2 Monitoring**

The Site Environment Officer/Environmental Management Representative is responsible for implementing the Environmental Monitoring Program for the proposal.

## **6.2.3 Internal Audit**

Internal audits (1<sup>st</sup> party audits) will be conducted quarterly against this EMP and the construction EMP during construction.

## **6.2.4 External Audits**

External audits will be undertaken on an annual basis by an independent third party auditor commissioned by Main Roads.

## **6.2.5 Compliance Audits**

A compliance audit against Ministerial conditions will be conducted as required by the conditional approval.

## **6.2.6 Environmental Management Review**

A formal review of the proposal's environmental management procedures and systems will be undertaken annually. The Environmental Management Representative shall report to the Project Manager with recommendations for changes to the system and applicable documentation.

## **6.3 Reporting**

During construction, a monthly environmental report is to be compiled by the Environmental Management Representative by the end of each month, including a summary of all environmental inspections, auditing and monitoring completed. Incidents are to be reported by the Environmental Management Representative at scheduled meetings.

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## 7 ROLES AND RESPONSIBILITIES

This chapter defines key roles and responsibilities for personnel involved in the implementation of the EMP.

### 7.1 Project Manager

The Project Manager is responsible for:

- The overall management and control of the proposal and the EMP.
- Reviewing and approving the EMP.
- Assisting with implementation of the EMP and sub-plans.
- Providing the necessary resources to ensure the EMP is properly implemented.
- Ensuring all personnel are inducted into the proposal's environmental requirements prior to commencement of works on-site.
- Ensuring suppliers are made aware of the environmental objectives pertaining to them through conditions of contract.
- Taking strategic actions to continuously improve the EMP.
- Participating in incident investigations.
- Management, implementation, monitoring and compliance of the EMP and any approval conditions, including construction supervision and performance of all staff, contractors and subcontractors.
- Review of EMP performance and implementation of correction actions, or stop work procedures, in the event of breaches of EMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the proposal.
- Representing the proposal at community meetings.

### 7.2 Construction Manager

The Construction Manager is responsible for:

- Implement all environmental requirements as outlined in the EMP as required to avoid and minimise actual or potential environmental harm on-site.
- Assist Environmental Management Representative in developing and maintaining the EMP various registers and checklists.
- Support Environmental Management Representative in planning and implementing environmental requirements.
- Report any activity that has resulted, or has the potential to result, in an environmental incident immediately to the environmental Management Representative.
- Monitor construction activities to ensure that identified and appropriate control measures are effective and in compliance with the EMP.

- Ensure that all construction personnel and subcontractors are informed of the intent of the EMP and are made aware of the required measures for environmental a compliance and performance.
- Ensure effective communication and dissemination of the content and requirements of the EMP to contractors and subcontractors.
- During construction, maintain traffic safety along access roads, with special emphasis on high trafficked areas.

## **7.3 Environmental Management Representative**

The Environmental Management Representative is response for:

- Preparation and implementation of the EMP on-site.
- Developing sub-plans and monitoring programs required under this EMP.
- Coordinating and managing all the environmental activities during the construction phase.
- Being the primary contact point in relation to the environmental performance of the construction phase.
- Managing procedures and practices for receiving and responding to complaints and inquiries in relation to the environmental performance.
- Report any activity that has resulted in, or has the potential to result in an environmental incident immediately to the Project Manager, Construction Manager and other relevant personnel.
- Considering and advising on matters specified in the conditions of licences and approvals relating to the environmental performance and impacts of the proposal.
- Requiring reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment is likely to occur.
- Identify environmental competence requirements for all staff and ensure delivery of environmental training to personnel within the team.
- Act as main point of contact between the regulatory authorities and the proposal on environmental issues.
- Provision of advice and liaison with the construction teams to ensure that environmental risks are identified and appropriate controls are developed and included within method statements.
- Assistance in the development and delivery of environmental training for site personnel and subcontractors.
- Management of the environmental monitoring program.
- Environmental audit of subcontractors and suppliers.

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## 8 COMMUNITY AND STAKEHOLDER ENGAGEMENT

Main Roads will manage and undertake community consultation during construction with the aim of distributing information about the proposal to the wider community, community reference groups and stakeholders. Details to be communicated to community members include:

- Expected construction timeframes and delays.
- Possible impacts from construction activities and noise.
- Changes in construction hours.
- Changes to traffic/road access.
- Management measures and plans in place to reduce impacts.

A collaborative approach will be used to facilitate communication between MRWA and community members.

During the construction phase of the proposal an engagement strategy will be implemented where community members can voice concerns and gain information about the proposal. Engagement strategies may include the following:

- Distribution of pamphlets and newsletters to residents in close proximity to the development envelope.
- 1800 information line for those who wish to raise concerns or complaints.
- A website detailing progress and expected community impacts.
- Regular community reference group meetings.
- Educational road signs at key intersection prior to construction.

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## 9 EMERGENCY RESPONSE PLAN

Main Roads will develop an Emergency Response Plan (ERP). The ERP will incorporate management measures or processes aimed at reducing the impacts from the release of contaminants, fire and other emergency situations expected during the constructional phase of the proposal. The ERP will require the consultation with the following emergency services to identify the appropriate responses or plans:

- WA Police.
- Department of Fire and Emergency Services.
- Western Power Emergency Response Group.
- DPAW.

The ERP document must include the following sections (at a minimum):

- The purpose of the plan – aim, objectives and extent of the plan.
- A site layout diagram – locations of hazardous materials storage, emergency equipment, emergency muster points and fire breaks.
- Description of potential emergencies – defines possible scenarios, environmental receptors and pathways and appropriate responses.
- Risk assessment – defines incident triggers, expected frequency of incidents and impact thresholds.
- Allocate responsible staff/position and communication register – include a flow chart of the key roles and phone numbers and the level of training for each member. This section will include the phone number of all appropriate emergency services and when they should be contacted.
- Evacuation procedure – steps to be taken if health or lives are at risk.
- Incident investigation – staff need to report all incidents and near misses and a review of procedures taken in an after incident review.

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## 10 GLOSSARY AND DEFINITIONS

Term	Definition
AH Act	<i>Aboriginal Heritage Act 1972</i>
ASS	acid sulfate soil
CCW	conservation category wetland
DAA	Department of Aboriginal Affairs
dB	decibel
dB LA <sub>eq</sub>	Average noise energy
dB LA <sub>eq</sub> (Day)	The average of the hourly LA <sub>eq</sub> levels between 6.00 a.m. and 10.00 p.m.
dB LA <sub>eq</sub> (Night)	The average of the hourly LA <sub>eq</sub> levels between 10.00 p.m. and 6.00 a.m.
DFES	Department of Fire and Emergency Services
development envelope	the area for which Main Roads WA is seeking approval to implement the proposal within
DOW	Department of Water
DPAW	Department of Parks and Wildlife
EMP	Environmental Management Plan
ERP	Emergency Response Plan
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPP Lakes	lakes covered by the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992
ESD	Environmental Scoping Document
GDE	groundwater dependent ecosystem
GHPDP	Government Heritage Property Disposal Process
ha	hectare
ISO 14001	AS/NZS ISO 14001:2004 Environmental management systems—Requirements with guidance for use
MNES	Matters of National Environmental Significance
MRWA	Main Roads Western Australia
MSDS	material safety data sheet
MUW	multiple use wetlands
PDNH	Perth–Darwin National Highway
PEC	Priority Ecological Community
PER	Public Environmental Review

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Term	Definition
PM <sub>10</sub>	particulate matter less than 10 µm in size
proposal	proposed southern terminus of the Perth–Darwin National Highway
proposal footprint	the area required to be disturbed based on the proposal's current design
PSP	Principal Shared Path
REW	resource enhancement wetland
SCP	Swan Coastal Plain
SWALSC	South-West Aboriginal Land and Sea Council
TEC	Threatened Ecological Community
TSS	total suspended solids
WHPZ	Wellhead Protection Zones
WONS	weeds of national significance

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## 11 REFERENCES

- Coffey. 2015. Public Environmental Review: Perth–Darwin National Highway. NorthLink WA. March. Prepared for Main Roads Western Australia on behalf of NorthLink WA by Coffey Environments Australia Pty Ltd, Burswood, Western Australia.
- EPA. 2014. Environmental Scoping Document. March. Perth, Western Australia.
- MRWA. 2006. Environmental Guideline: Environmental Incident Reporting and Investigation. Document No. 6707/042. August. Prepared by Main Roads Western Australia.

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