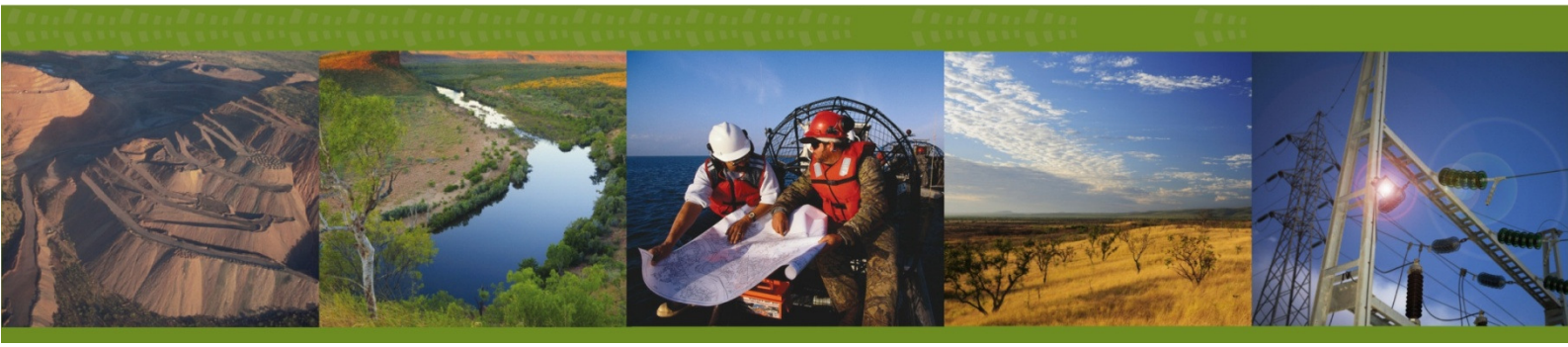
2-2013

Ord River Irrigation Area Offset Management Plan

Department of Primary Industries and Regional Development, Western Australia



Ord River Irrigation Area

Offset Management Plan

Approved by DSEWPaC on

1 February 2013

Prepared for
LandCorp
by Strategen

January 2013

STRATEGEN
environmental consultants

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Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Level 2, 322 Hay Street Subiaco WA
ACN: 056 190 419

January 2013

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1. Introduction

1.1 Project background

The Western Australian Minister for State Development intends to develop an area of land for irrigated agriculture across the Weaber Plain in the Kimberley region of Western Australia, approximately 30 km northeast of Kununurra and adjoining the existing Ord River Irrigations Area (the Project). Figure 1 shows the Project Area including the Development Area and the Buffer Area. Key components or environmental aspects of the Project relevant to the Offset Management Plan include:

- irrigation with 80 to 120 GL/yr of water sourced from Lake Argyle
- clearing of approximately 9260 ha of vegetation including 8205 ha for farmland
- upgrading and extending the existing Weaber Plain Road and the construction of new minor roads to service the agricultural lots
- construction of the M2 irrigation channel extending from the existing M1 channel and smaller distribution channels to service agriculture lots
- approximately 11 470 ha of vegetation will be set aside and managed as an environmental buffer to protect Aboriginal Culture Heritage, as well as watercourse and surrounding conservation reserves
- approximately 105 ha may be cleared in the Buffer Area for sourcing of raw materials
- stormwater discharges into the Border Creek/Keep River system.

1.2 Ord Final Agreement

The Ord Final Agreement (OFA) is an Indigenous Land Use Agreement (ILUA) between the Miriuwung and Gajerrong people, the West Australian Government, and private sector interests in industry and development. The OFA was registered in 2006 with the National Native Title Tribunal after several years of negotiation.

The OFA was reached to resolve native title and Aboriginal heritage issues between the State and the Miriuwung and Gajerrong people as a result of the expansion of the Project.

The Miriuwung and Gajerrong people are represented by the Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (MG Corporation), which is based in Kununurra and was incorporated on 2 February 2006 to receive and manage benefits to be transferred under the OFA.

1.2.1 Establishment of conservation reserves

The OFA agreement also identified eight areas that will be reserved for conservation totalling approximately 188 200 ha, of which six areas totalling approximately 154 075 ha are located in WA with the remainder occurring in the Northern Territory. This reservation involves the protection of vegetation and fauna habitat in following six areas across the East Kimberley (Figure 1):

- Ningbing Range Conservation Area (Mijing Conservation Park)
- Weaber Range Conservation Area (Jemandi-Winingim Conservation Park)
- Pincombe Range Conservation Area (Goomiyig Conservation Park)
- Mt Zimmerman Conservation Area (Barrberrm Conservation Park)
- Packsaddle Swamp Conservation Area (Darram Conservation Park)
- Livistona Range Conservation Area (Ngamoowalem Conservation Park)

These six conservation reserves are currently jointly vested in the Conservation Commission and MG Corporation as section 5(1)(h) reserves for the purpose of 'Conservation and Aboriginal Uses' as an interim arrangement.

They will be transferred to freehold land to the MG Corporation and be managed as conservation parks under the *Conservation and Land Management Act 1984* (CALM Act). As part of the implementation of the OFA the reserves are managed through a formal partnership between the Director General of DEC and the MG Corporation in accordance with the CALM Act. Specifically, the *Yoorrooyang Dawang Proposed Conservation Parks Draft Management Plan* (DEC 2011, pp. 12-13) identifies that they should be managed for conservation parks, consistent with section 56 of the CALM Act and for the following objectives:

4(a)	(i)	the preservation and promotion of the Aboriginal cultural and heritage values of the land
	(ii)	the preservation and promotion of the natural and environmental values of the land, including indigenous flora and fauna
	(iii)	the preservation and promotion of the archaeological values of the land
	(iv)	the provision of recreational facilities and facilitation of recreational activities on the land, including the regulation of public access to the land to fulfil so much of the demand for recreation by members of the public as is fitting having regard to the matter set out in clauses 4(a)(i), 4(a)(ii), 4(a)(iii) and 4(a)(v)
	(v)	access to and use of the land by the Miriuwung and Gajerrong peoples from time to time in accordance with Miriuwung and Gajerrong culture
	(vi)	the use of the land by the Miriuwung and Gajerrong peoples from time to time consistent with the matters set out in clauses 4(a)(i), 4(a)(ii), 4(a)(iii) and 4(a)(v)
	(vii)	employment, service provision and training opportunities for the Miriuwung and Gajerrong peoples in the administration, management and control of the land from time to time in accordance with Schedule 2
	(viii)	commercial opportunities for the Miriuwung and Gajerrong peoples and the MG Corporation consistent with the management of the land for the purposes of 'conservation park'
	(ix)	the implementation, monitoring, assessment and audit of the effectiveness of the management plan
	(x)	the provision, construction, repair, maintenance and replacement of build.

Yoorooyang Dawang Proposed Conservation Parks Draft Management Plan (DEC 2011) also details the roles of DEC, the MG Corporation and other government agencies and stakeholders in terms of managing these conservation reserves (Appendix 1).

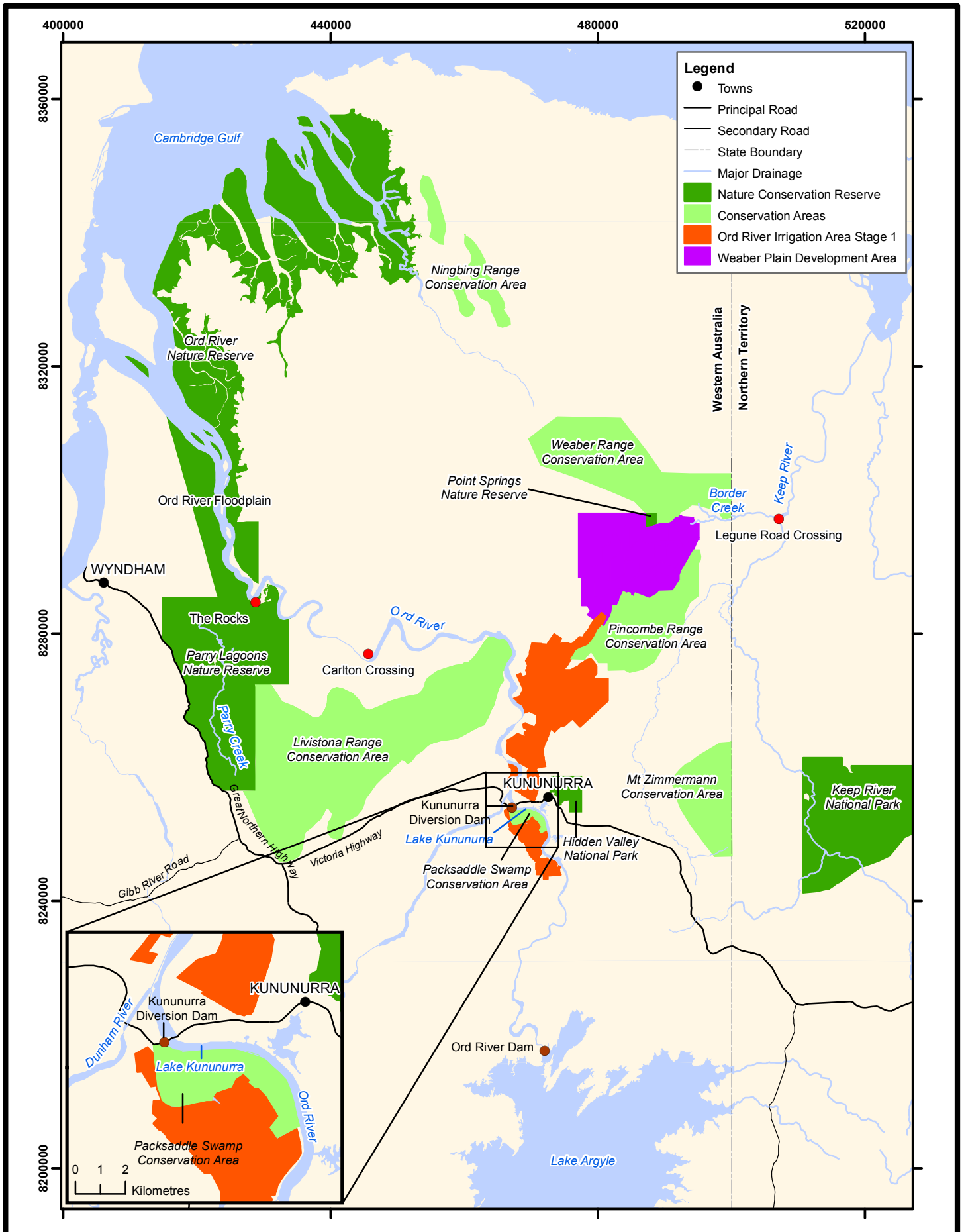

Figure 1
Regional location of the Ord River Irrigation Area - Weaber Plain Development Project

Regional Map

Source: ESRI 2008

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Scale
0 10 20 30 40
Kilometres

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1:750,000 at A4

Coordinate System: GDA 1994 MGA Zone 52
Date: 26/07/2012
Author: jcrute

Source: Geoscience Australia 2006, Client 2010.
Note that positional errors may occur in some areas

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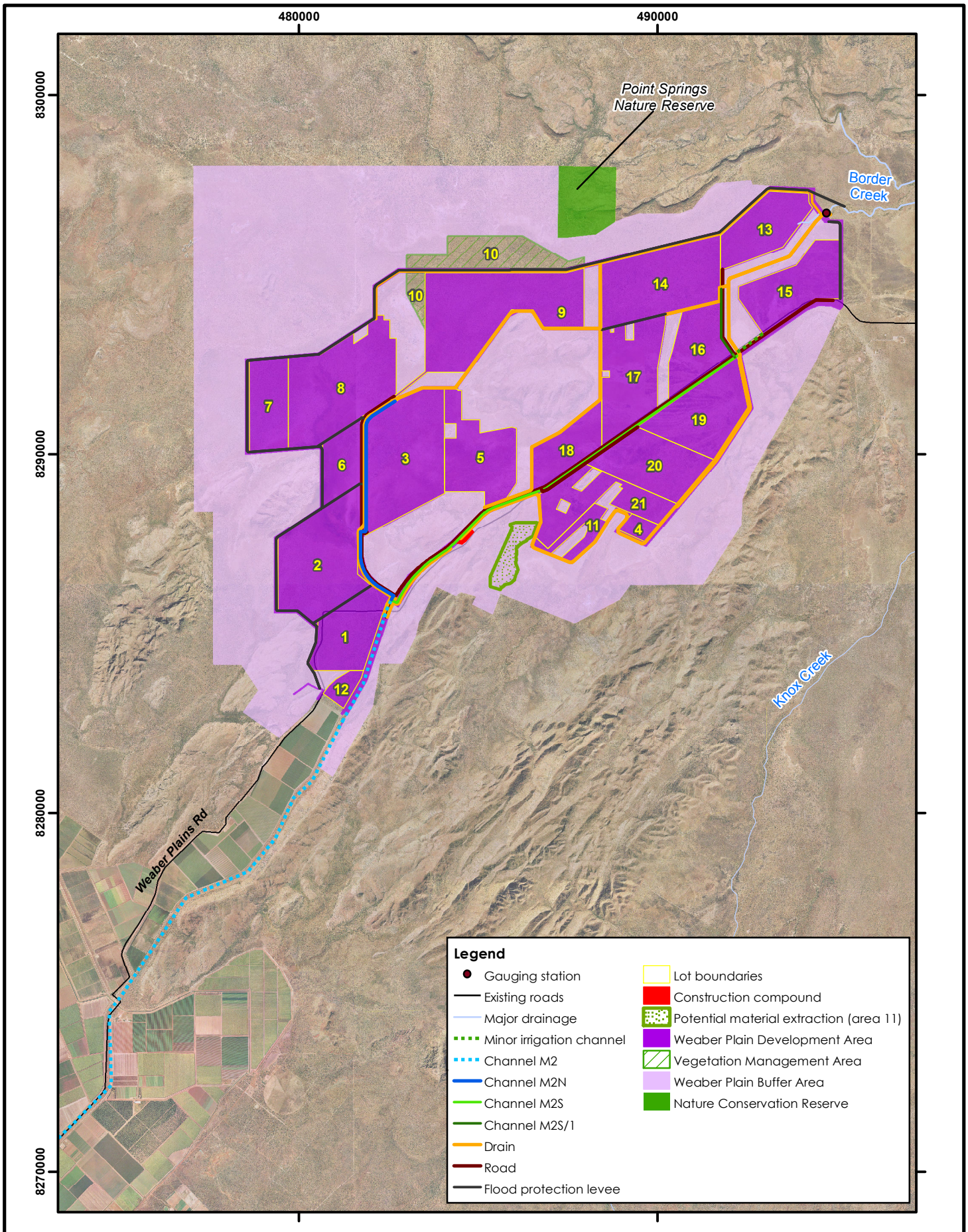

Figure 2 Weaber Plain Project Area

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Scale
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Kilometres

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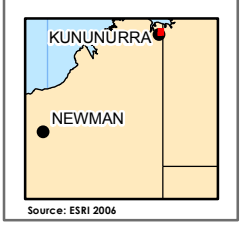
at A4

Coordinate System: GDA 1994 MGA Zone 52
Date: 22/08/2012
Author: JCrute

Source: Roads and rivers: Geoscience Australia, 2006. Aerial image: Client. Weaber Plain Project Design: McMullenNolan 07/12/2011 and 03/04/2012. Note that positional errors may occur in some areas

Regional



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2. Environmental approval

2.1 WA Government approval

The WA Minister for Environment authorised the implementation of the M2 Project (Ord stage 2) through the release of Statement 585 (February 2002), which was re-issued as Statement 830 (May 2010) with minor changes. This Statement outlines a number of commitments to be given effect during implementation of the Project.

2.2 Australian Government approval

The Project was referred under the *Environment Protection Biodiversity and Conservation Act 1999* (EPBC Act) to the Australian Government Minister for Environment Protection, Heritage and the Arts (the Minister) on 14 May 2010. The Minister determined on 11 June 2010 that the Project was a controlled action and required approval under the EPBC Act as the Project was considered to have potential to have a significant impact on the following Matters of National Environmental Significance (Matters of NES) protected under Part 3 of the EPBC Act:

- wetlands of international importance (sections 16 and 17B of the EPBC Act)
- listed Threatened species and communities (sections 18 and 18A of the EPBC Act)
- listed Migratory species (sections 20 and 20A of the EPBC Act).

The Minister determined that the Project required an Environmental Impact Statement (EIS). The Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) (formerly Department of the Environment, Water, Heritage and the Arts [DEWHA]) finalised guidelines for the content of the draft EIS on 2 August 2010. Following completion of the EIS process the Minister approved the Project, subject to conditions (EPBC 2010/5491), issued on 13 September 2011.

2.2.1 Management plans required by EPBC Approval 2010/5491

Approval EPBC 2010/5491 requires the implementation of the following management plans:

- Gouldian Finch Conservation Plan
- Buffer Management Plan
- Weed, Plant pathogen and Pest Management Plan
- Aquatic Fauna Management Plan
- Stormwater and Groundwater Discharge Management Plan
- Groundwater Management Plan
- Decommissioning Plan
- Offset Management Plan.

2.2.2 Requirements of Condition 14 of Commonwealth approval

This Offset Management Plan (OMP) has been prepared to satisfy Condition 14 of Approval EPBC 2010/5491. Table 1 outlines how each of the sections of this condition have been addressed in this plan.

Table 1 EPBC requirements

Item	EPBC Requirement	Section
14A	Details of the direct offsets proposed in the draft Environmental Impact Statement and how these will deliver long-term conservation benefits for relevant terrestrial listed threatened species that would not otherwise be achieved. This must include:	
	i. Mapping of native vegetation habitat suitable for listed threatened species;	Figure 4, Figure 5, Figure 6 and Figure 7
	ii. Details of the area and characteristics of suitable habitat for listed threatened species;	Section 4 and Table 3
	iii. Details of whether the offset site provides the same landscape function and habitat type for the listed species as the habitat cleared or impacted by the Project;	Section 4
	iv. Details of whether the offset site delivers a real conservation outcome that would not have otherwise been achieved (i.e. whether it was to be protected regardless of the action);	Section 4.3
	v. Steps that will be taken to ensure that any direct offset site will be protected in perpetuity for the conservation purposes and details of evidence that will be provided to the Department that conservation covenants have been entered into;	Section 1.2.1 Appendix 2
	vi. Provision of ongoing management of the offset site, including details of funding mechanisms.	Section 1
14B	Details of alternative direct or indirect offsets if the proposed offsets do not satisfy the requirements listed in Condition 14A	Section 1
14C	Funding of research activities, agreed by the **Department,** to an amount of no less than $150,000 per year for 10 years, for the management, monitoring and/or improved protection of the critically endangered Speartooth Shark (*Glyphis glyphis*), the endangered Northern River Shark (*Glyphis garricki*), the vulnerable Dwarf Sawfish (*Pristis clavata*). The proposed research activities must be developed in consultation with the **Sawfish and Glyphis Recovery Team.** Research activities must be approved and the first yearly payment must be provided within 18 months of the date of the approval decision.	Section 5

2.3 Purpose and scope of this document

This OMP outlines the potential and residual impacts (following application of management measures) of the project on the following species that may require offsetting:

- Gouldian Finch (*Erythrura gouldiae*)
- Northern Quoll (*Dasyurus hallucatus*)
- Red Goshawk (*Erythrotiorchis radiates*)
- Crested Shrike-tit (northern) (*Falcunculus frontatus whitei*)
- Speartooth shark (*Glyphis Glyphis*)
- Northern River Shark (*Glyphis garricki*)
- Freshwater Sawfish (*Pritis Microdon*)
- Dwarf Sawfish (*Pristis clavata*).

Sections 4 of this document describe the detailed habitat mapping of the terrestrial fauna species described above over the Development Area and six conservation reserves established under the OFA (as shown in Figure 3) to determine whether the conservation reserves and restoration of the Buffer Area meet the requirements of the offsets for each of the identified terrestrial fauna species.

The provision of offsets for aquatic fauna species is provided in Section 5.

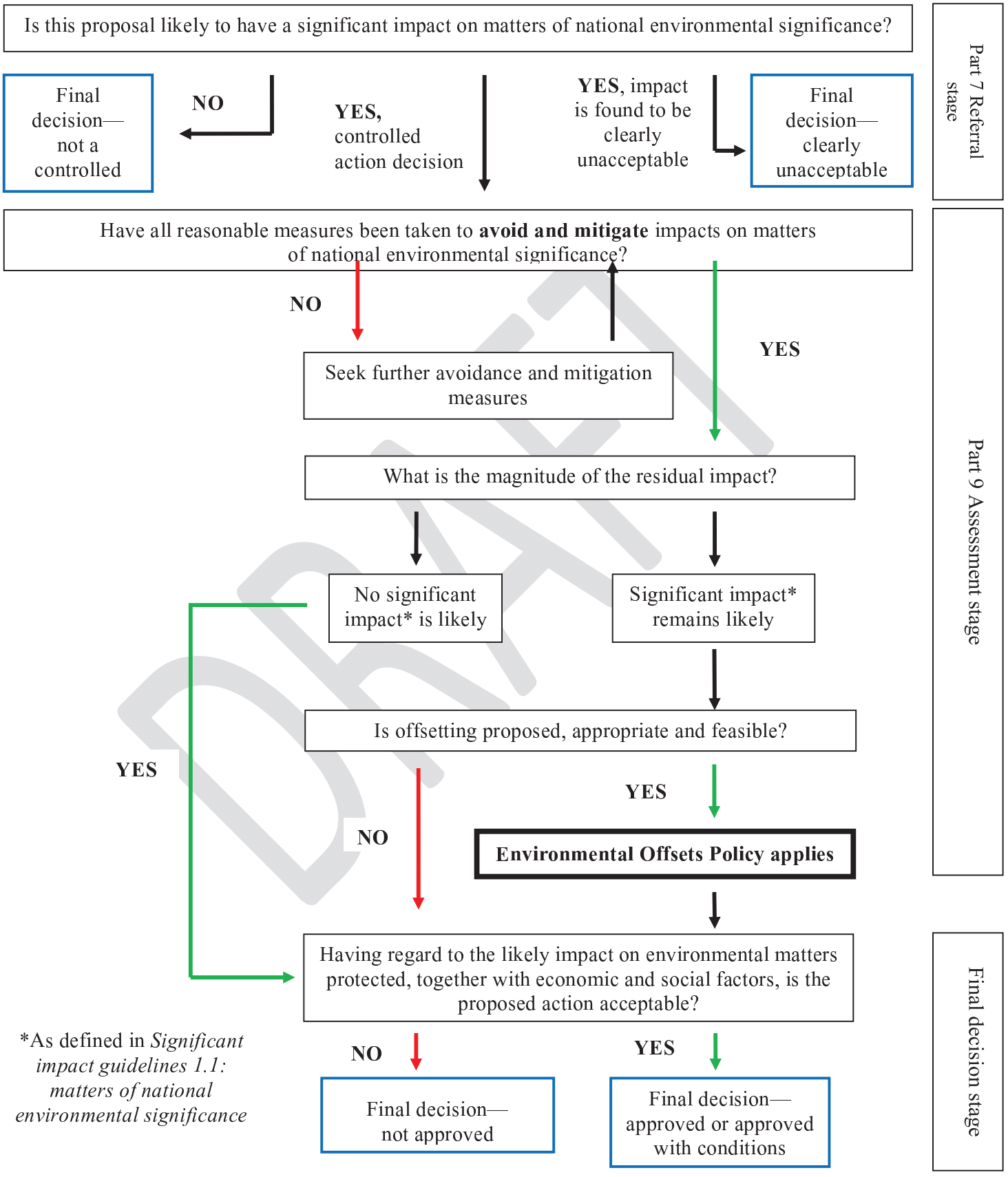

Figure 3 Environmental Offsets policy flow chart (SEWPaC 2011a)

3. Potential impacts and mitigation

3.1 Matters of National Environmental Significance

The EIS process determined that the following eight species, which are listed under the EPBC Act as threatened species (hereafter referred to as threatened species), have the potential of being affected by the Project:

- terrestrial fauna:
  - Gouldian Finch (*Erythrura gouldiae*) Endangered
  - Northern Quoll (*Dasyurus hallucatus*) Endangered
  - Red Goshawk (Erythrotiorchis radiates) Vulnerable
  - Crested Shrike-tit (northern) (*Falcunculus frontatus whitei*) Vulnerable
- aquatic fauna:
  - Speartooth Shark (*Glyphis Glyphis*) Critically Endangered
  - Northern River Shark (*Glyphis garricki*) Endangered
  - Freshwater Sawfish (*Pristis Microdon*) Vulnerable
  - Dwarf Sawfish (*Pristis clavata*) Vulnerable.

3.2 Potential impacts

An assessment of impact to threatened fauna against the Matters of National Environmental Significance Significant impact guideline (2009) is in Appendix 3.

3.2.1 Terrestrial fauna

The main potential impacts identified during the EIS process that have the potential to affect terrestrial threatened species are:

- clearing of approximately 9260 ha of vegetation across the Weaber Plain, which will result in habitat loss and potentially habitat fragmentation for ground dwelling threatened species, and will also affect the water and salt balance of the soil and may result in deterioration of the health of retained vegetation/habitat
- groundwater accretion, which will alter the water and salt balance of the soil and may result in deterioration of the health of retained vegetation/habitat in the Buffer Area
- ground disturbance and human activity in the Project Area, which may potentially lead to the introduction and/or spread of weeds, plant pathogens and pests, which in turn may result in increased competition with and/or predation on native species by introduced species.

3.2.2 Aquatic fauna

The Keep River system (including Border Creek and the Keep River channel and estuary) provides habitat suitable for Threatened, Migratory and Marine species listed under the EPBC Act. These species have the potential to be affected by:

- stormwater drainage and flood-protection infrastructure, which will alter surface water flow regimes and may potentially result in erosion and an altered water balance and hydrograph in the downstream environment
- groundwater accretion, which will alter the water and salt balance of the area and may result in discharge of saline and/or contaminated groundwater to the downstream environment
- the use of chemicals, which may potentially result in deterioration of the quality of the downstream environment through contaminated sediment and runoff transported from the Project Area.

3.3 Mitigation of potential impacts

Key environmental management measures and controls that are relevant to protection of threatened species include:

1. Implementation of Environmental Management Systems which are consistent with ISO14001.
2. Implementation of a revised design that reduces the area to be cleared by approximately 655 ha, provides additional habitat for the Gouldian Finch and provides for changes to cropping strategies in critical areas to help control the accretion of groundwater and any associated salinity.
3. Maintain vegetated corridors within the Development Area to enable the movement of fauna within and across the site.
4. Implementation of a fire management strategy in the Buffer Area to enhance the fauna habitat values to provide for increased carrying capacity of these areas for species including the Gouldian Finch.
5. Implementation of the Gouldian Finch Management Plan, which includes the following key actions:
    - baseline surveys including breeding and non-breeding populations and habitat areas
    - relocation of salvaged potential breeding hollows
    - implement fire management regime
6. Implementation of the Groundwater Management Plan, which includes the following key actions:
    - establishment of Vegetation Management Zones (as outlined in Figure 2) and specific controls through tenure arrangements for farms in areas where salinity risk is the highest
    - ongoing groundwater monitoring and update of the groundwater model based on this data
    - implementation of groundwater control responses in accordance with prescribed triggers and in response to the results of monitoring.
7. Implementation of the Storm Water and Groundwater Discharge Management Plan, which includes the following key actions:
    - establishment of a tailwater management system
    - monitoring of discharges from tailwater management system
    - baseline and ongoing monitoring of water quality and aquatic fauna in the Keep River
    - water quality triggers for management responses which recognise baseline conditions in the Keep River for any discharges to Keep River
    - if excess pumped groundwater requires disposal, no discharge of pumped excess groundwater to Keep River during the dry season or critical low flow periods
    - contingency for flushing of the Keep River if the water quality of the Keep River pools may be adversely affected by stormwater discharge from the Development Area when Keep River flows are inadequate for flushing the pools.

In addition to these mitigation measures, the development of the Buffer Area is also considered to be an offset rather than a mitigation measure. Approximately 11 470 ha of native vegetation will be set aside and managed as an environmental buffer to protect surrounding conservation reserves. The Buffer Management Plan includes destocking, fencing and management of fire in the Buffer Area to further enhance fauna habit value of this area.

3.4 Residual impacts

3.4.1 Terrestrial threatened species

Where a significant residual impact is likely on a threatened species, the environmental offsets policy applies (Figure 3). The key potential impact on threatened terrestrial species (in particular Gouldian Finch) is the loss or alteration of habitat that may occur as a result of clearing for farms and infrastructure. The extent of this impact is described in Table 4.

The area of land which is being cleared for farms and infrastructure was originally pastoral land and was not managed to maintain values for threatened species. The habitat value of the land being cleared for the development would have continued to deteriorate with continued cattle grazing, poor fire management and weed infestations.

Potential risks from groundwater rise and weeds are expected to be minor following the implementation of weed management and groundwater management plans.

After the implementation of the above mitigation measures, the residual impact on threatened species is considered to be minor, with the exception of the Gouldian Finch. The Project; however, does not disturb any breeding habitat for the Gouldian Finch.

The design of the development includes fauna corridors and vegetation retention areas to reduce the impact of the Project on threatened species.

In addition, offset measures to significantly improve the quality of foraging habitat in the Buffer Area through new fencing, destocking, implementation of fire management and salvage of hollow logs to be installed for Gouldian Finch nest boxes in the Buffer Area, as specified in the Gouldian Finch Management Plan, is expected to help offset any impact to Gouldian Finches that may arise from clearing associated with the Project.

The six conservation reserves (Figure 1) were created to offset Aboriginal heritage and conservation values of the land affected by the Ord Stage 2 Project.

The DEC has mapped the extent of likely habitat for threatened species within the area to be developed and the areas where offset measures will be applied to satisfy Condition 14 and to assess the values of offsets (Section 4).

3.4.2 Threatened aquatic fauna species

While there is uncertainty regarding the impact on threatened aquatic fauna species, significant impact is not expected given the implementation of management measures. The key residual risk for the Project is from the discharge of stormwater and any excess groundwater (if required) to the Border Creek and Keep River system (in particular the Keep River pools).

The Stormwater and Groundwater Discharge Management Plan (SGDMP) is expected to manage potential impacts to the Border Creek-Keep River system and therefore protect and Matters of NES that inhabit this environment. The SGDMP includes the provision of on-farm tailwater system and ongoing monitoring of stormwater and discharged groundwater together with prescribed triggers and adaptive management responses. The SGDMP specifies compliance requirements for water quality criteria determined in accordance with the ANZECC/ARMCANZ (2000) guidelines.

Condition 14C addresses the uncertainty by requiring an indirect offset for research activities for the management, monitoring and/or improved protection of the critically endangered Speartooth Shark (*Glyphis glyphis*), the endangered Northern River Shark (*Glyphis garricki*), the vulnerable Freshwater Sawfish (*Pritis microdon*) and the vulnerable Dwarf Sawfish (*Pristis clavata*)

4. Threatened terrestrial fauna characteristics and habitat suitability

The suitability and extent of habitat in the Development Area and offset areas and the characteristics of threatened species of interest were determined for use in the assessment of the value of offsets and to satisfy sub-conditions 14Ai & 14Aii.

4.1 Threatened species characteristics

The Gouldian Finch is highly mobile after breeding and may access suitable foraging habitat many kilometres from breeding sites. More detailed information was available for this species than the other three species, for this reason, the analysis of habitat was separated into breeding and non-breeding habitats (Shedley 2012). The Red Goshawk can disperse hundreds of kilometres; however, only the breeding habitat was mapped as very little information was available to determine non-breeding habitat. Similarly for the Crested Shrike-tit (northern), there was very little specific species information available other than remaining in groups about 20 km apart, for these reasons, breeding and non-breeding habitats were combined. Habitat for the ground dwelling Northern Quoll was determined by breeding requirements and also included non-breeding habitat if it adjoined breeding habitat.

The habitat assessments were undertaken based on methodology developed by the DEC and endorsed by DSEWPaC as required under condition 14i and 14ii of EPBC 2010/5491. Species characteristics (Table 2) were used to identify suitable, possible and unsuitable habitat characteristics for each threatened species of interest. (Table 3). Table 5, Table 6, Table 7 and Table 8 detail the extent within each conservation reserve that has been assessed as suitable, possible and unsuitable habitat, or in the case of Gouldian Finch breeding and non-breeding habitat.

Table 2 Species characteristics

Fauna species	Characteristics
Gouldian Finch	Breeding habitat during the dry season is upland (ridges and rocky foothills) grassy *Eucalyptus* and *Corymbia* woodland (*E. tectifica, C. confertiflora, E. brevifolia*) with a ground cover of *Sorghum stipoideum.* Non-breeding habitat during the wet season is lowlands open woodland with a low open understorey and ground cover of dense grasses including *Chrysopogon phallax, Alloteropsis semialata* and *Triodia bitextura.* Mainly feed on annual grasses during the dry season and shift to perennial species during the wet season. They often forage in burnt areas, where there is easier access to fallen seeds. They nest in a hollow limb or trunk of a *Eucalyptus* tree, especially *E. brevifolia*. Breed in loose colonies with several pairs in the same or neighbouring trees. Individual birds may travel 2 – 17 km in one day. Usually nest within 4 km of water and remain within 10 km of water and *Sorghum* grasses during the non-breeding season.
	Breeding is limited by availability of suitable sized robust hollows (deep but small diameter) in smooth-barked *Eucalyptus* and *Corymbia* trees. Wildfires have removed many older trees with suitable hollows. Birds form mixed species flocks after breeding and move over lowlands granite soil area feeding on a range of grass species (*Alloteropsis semialata, Chrysopogon fallax, Sehima nervosum, Xerochloa laniflora, Themeda triandra* and *Triodia* spp.) as the supply of seeds in the breeding areas become depleted. Numerous records of adults, juveniles and active breeding hollows during surveys in the Ord Stage 2 Buffer Area.
	During the non-breeding season (in the late dry season) most birds were feeding on seeding perennial grasses *Triodia* and *Alloteropsis*, and less frequently on *Chrysopogon*. Numerous birds recorded during the non-breeding season survey, mostly in the Buffer Area, few in the Development Area or in the previously identified breeding habitats.

Fauna species	Characteristics
	Will fly 3-4 km during late dry season to access fresh water, and may fly 10-100 km in search of seeding grasses. Banded juvenile birds have flown 200 km in a few weeks from Wyndham to Newry Station in the NT. Generally not found in very steep ridges and gullies, or in areas that have dense vegetation (e.g. with palms). They also avoid black soil plains and scrubby areas. Generally only nest where there are clumps of suitable nesting trees together (i.e. at least 30 trees) and suitable grass species for feeding.
	Open tropical woodlands with scattered trees and tall native grasses. Spinifex with scattered shrubs. In vegetation along watercourses, never far from water. Uses trees on low stony ridges when breeding.
Red Goshawk	Forest and woodland, riverine forests, including *Melaleuca* swamp forests, which support high bird populations. Prefer a mosaic of vegetation types e.g. ecotones and edges between different vegetation types. They avoid very open or dense habitats. In the Kimberley, they prefer tall open forest and woodland or tall fringing woodlands along rivers in surrounding grasslands, shrublands and low open woodlands. Habitat needs to be open enough for fast attack of prey. Nest in a living tall tree (>20 m), often the tallest and most massive tree in the stand, within 1km of permanent water (river, swamp or pool). Use a large horizontal branch to build their nest, with open space below and on one side for access. Feed on birds (95% of diet) including parrots, cockatoos, ducks, kookaburras, magpie-larks and other birds so they need to be in habitats which support high bird densities especially during breeding. Sometimes follow fires and capture prey fleeing from fires. Adults usually resident. Estimated home range of 200 km^2. Adult males fly up to 7 km from nest during breeding, while juveniles may disperse hundreds of km.
	Three records of Red Goshawk in the vicinity of Kununurra and within 40 km of Livistona reserve.
Crested Shrike-tit (northern)	Open eucalypt woodlands, dominated by *Corymbia opaca, Eucalyptus tectifica and C. confertifolia,* and less often in woodland dominated by *E. miniata, E. tetrodonta*. In areas with grassy understorey and sometimes with shrubby understorey.
	Occasionally recorded in woodlands dominated by *Melaleuca* spp. or *Terminalia arostrata*; or in mixed woodland with *E. tectifica* and *Melaleuca viridiflora.* Presence of 'flaky-barked' bloodwood trees, areas not dominated by a thick shrub layer, and areas prone to seasonal waterlogging may increase suitability, although the species has been recorded from hilly areas. Feeds on insects by prising under loose or peeling bark. Lives in widely spaced groups up to 20 km apart and defend a home range of about 20 ha. Threatened by frequent hot fires in the late dry season which prevent invertebrates becoming established beneath the bark.
	Presumed to feed on invertebrates gleaned from beneath ribbons of bark that peel from gum-barked trees.
	Open forests, woodlands, riverside and watercourse trees, stands of cypress pines, Banksia woodlands.
	There are no records of Crested Shrike-tit (northern) within 200 km of Kununurra, and very few in the central and north Kimberley.
Northern Quoll	Wide range of Eucalyptus forest and woodland habitats associated with steep dissected rocky terrain. Also in rainforest patches, creekline vegetation and mangroves. Important factors include shallow soils, large cover of rocks, close to permanent water and low fire frequency. Dens occur in rock overhangs, tree hollows, hollow logs, termite mounds and burrows. Also use non-rocky foraging and dispersal habitats. Feed mainly on invertebrates, and also small mammals, birds, eggs, frogs, nectar and fruit. Highly susceptible to cane toads.
	More abundant in large well-connected areas of complex broken rock on sides of gorges, large cliffs, boulder fields or where rocky habitat follows a creekline. Not in small isolated rocky gullies more than 2 km from similar habitat or less than 2 km in extent. Need to be close to permanent water, with protection from predators.
	Do not have highly specific habitat requirements. Opportunistic foragers, wide dietary range, non-specific shelter sites and daytime den sites. Habitat critical to survival are those least exposed to threats. Areas that are rugged with complex topography or large boulders are prime habitat. Rocky areas retain water with diverse microhabitats and support greater density and/or diversity of prey items. Also more protected from cats, fire impacts and livestock grazing.

Fauna species	Characteristics
	Prime habitat in the Kimberley is sandstone escarpment. On the Mitchell Plateau, habitats include low open Eucalyptus woodland and hummock grass on sandstone, deciduous vine thicket and open Eucalyptus woodland over dense grasses. Open forest and woodlands on plains dominated by *E. tetrodonta, E. miniata* and *E. tectifica*. These habitats usually have high structural diversity and large diameter trees, termite mounds or hollow logs for denning. Also open woodland on low rocky hills and riparian areas with flowing water and *Melaleuca viridiflora* and *Pandanus spiralis.* Rocky habitats support a higher density of dens and greater breeding success. Female home range average 35 ha, males extend to 100 ha during breeding season.
	Only one older record of Northern Quoll in the area, about 54 km NW of Kununurra in Parry Lagoons Nature Reserve, about 8 km from the Livistona boundary. Another record about 128 km WSW of Kununurra. This is a productive woodland site with dense grasses and permanent water.

4.2 Habitat mapping and suitability

The extent and suitability of habitat for species of conservation significance was mapped by the Department of Environment and Conservation (DEC) as part of the management of the newly created conservation reserves (Shedley 2012) (Appendix 4). The habitat mapping used GIS and field-based investigations data on the following:

- vegetation type (structure and floristics)
- distance to water points
- landform
- home range and mobility of threatened fauna species
- habitat characteristics.

Table 3 Habitat suitability

Species	Suitable	Possible	Unsuitable
Gouldian Finch	Breeding • Upland foothills, ridges and low rises with open woodland with smooth-barked trees, mainly *Eucalyptus brevifolia* and *C. dichromophloia*, over a grassy understorey of *Sorghum* and *Triodia* spp., particularly *Sorghum stipoideum* and *Triodia bitextura* • Clumps of mature trees (at least 30+) in close proximity with suitable deep hollows with small diameter (only assessed by ground truthing and not reliable for GIS analysis) • Vegetation types with records of breeding habitat and sightings during breeding • Woodland may include E. tectifica, E. miniata, C. confertiflora and Erythrophleum chlorostachys; • Within 2 km of fresh drinking water in small pools, springs or flowing creeks • Area protected from frequent and intense fires, but some fire tolerated. Non-breeding • Lowland open woodland with a low open understorey including *Petalostigma quadriloculare* and ground cover of dense grasses including *Triodia bitextura*, *Alloteropsis semialata* and *Chrysopogon phallax*. Other grass species include *Sehima nervosa, Xerochloa laniflora, Themeda triandra* and other Triodia species • Vegetation types with records of feeding and sightings during non-breeding period • Within 4 km of fresh water source, including floodplains, springs and artificial holes • May be long distances (10-100km) from breeding areas • Some exposure to moderate fire but not heavily grazed.	N/A	• Steep ridges and gullies, black soil plains • Dense vegetation, shrubland, sparse woodland • Areas with tree species that don't form suitable hollows, or immature trees of the preferred species with no hollows • Areas that don't support the preferred grass species • Lack of fresh water sources within 2 km of breeding area or 4km of feeding areas • Heavily grazed or eroded areas • Frequently burnt areas that remove hollow-bearing trees and reduce productivity of grasses.
Red Goshawk (breeding)	• Tall riparian vegetation, open woodland, along major river banks, including Eucalyptus camaldulensis and large *Melaleuca leucadendra* gallery forests • Other large riparian *Eucalyptus* or *Corymbia* species may include *E. microtheca*, *C. polycarpa, C. grandifolia, C. bella, C. confertiflora* • Waterbodies in or within 1km of MG reserves with suitable vegetation or patches of vegetation, including Ord, Dunham, and Keep rivers, smaller rivers such as Packsaddle, Valentine and Parry Creeks, permanent pools and swamps • Broad drainage floors and channels with watercourses and with woodland • Rivers and creeks with permanent water and dense tall vegetation • Likely or known to support high density of birds for prey.	• Tall riparian vegetation with species other than Eucalyptus, Corymbia or Melaleuca listed for Suitable • Waterbodies and pools with patches of suitable vegetation in more remote areas, such as within sandstone ranges • Moderately degraded riparian vegetation affected by flooding, erosion, overgrazing or woody weed infestation, from ground truthing observations • Likely to support only moderate density of birds for prey.	• Vegetation other than riparian vegetation or woodland along rivers, creeks and pools • Very open vegetation on sandstone or limestone ranges • Severely degraded riparian vegetation affected by flooding, erosion, overgrazing or woody weed infestation, from ground truthing observations • Likely to have a low density of birds for prey.

Species	Suitable	Possible	Unsuitable
Crested Shrike-tit (northern)	• Woodland or open woodland with grassy understorey with *Corymbia opaca*, *Eucalyptus tectifica* and *C. confertifolia*, and less often in woodland dominated by *E. miniata* or *E. tetrodonta* • Other local dominant tree species that are possibly suitable habitat, based on the preferred bark characteristics, include *C. ferruginea*, *C. polycarpa*, *C. dichromophloia, C. grandifolia, C. phytocarpa, E. microtheca, E. brevifolia, E. pruinosa* and *E. camaldulensis* • Absence of thick understorey • Undulating landform, lower slopes, plains, watercourses • Moderate canopy cover of trees (not sparse woodland) • Not prone to frequent intense fires.	• Vegetation contains some of the preferred tree species, or in very open or sparse woodland; • Woodlands dominated by *Melaleuca* spp. or *Terminalia arostrata*; or in mixed woodland with *E. tectifica* and *Melaleuca viridiflora* • Hilly landscape • Some areas of moderate canopy cover of trees within the map unit.	• Vegetation with no trees, or no tree species listed in Table 2 • Steep hills, stony, rock outcrops, cracking clays, tidal flats, swamps • Prone to frequent fires, e.g. the eastern faces of ranges, close to public roads.
Northern Quoll	• Areas that are rugged with complex topography or large boulders, steep dissected terrain, large cliffs or boulder fields to provide protection from predators and fire • Well connected rocky terrain greater than 2 km in extent and no more than 2 km from similar habitat • Close proximity (<1 km) to permanent water, flowing creekline, pools • Dens occur in rock overhangs, caves, tree hollows, hollow logs, termite mounds and burrows • Foraging areas in adjoining less rugged areas, open forest and woodlands on plains dominated by *E. tetrodonta, E. miniata* and *E. tectifica* with high structural diversity and large diameter trees, termite mounds or hollow logs for dens • Areas with high diversity of prey items • Protected from fire and impacts of cattle grazing.	• Open woodland on low rocky hills and riparian areas with flowing water and *Melaleuca viridiflora* and *Pandanus spiralis* • Non-rocky lowland habitats, *Eucalyptus* forest and woodland, rainforest, shrubland and grassland • Human dwellings and campgrounds.	• Small isolated rocky outcrops less than 2 km in extent • Plains and lowlands with little topographic complexity or few den sites • Areas greater than 1km from fresh water, or water sources with little protection from predators • Areas exposed to frequent fire and cattle impacts.

4.3 Extent of habitat

The extent of suitable, possible and unsuitable habitat in the six conservation reserves and directly affected in the Development Area was calculated based on the habitat mapping by DEC (Appendix 4).

4.3.1 Habitat affected within the Development Area

Extent of suitable habitat that will be disturbed for each threatened species of interest is described in Table 4.

Table 4 Extent of suitable habitat for terrestrial fauna within the Development Area

Species	Suitable (ha)	Possible (ha)	Unsuitable (ha)
Gouldian Finch	55 (0.6%) (non-breeding)	N/A	8732 (99.4%)
Red Goshawk	47 (0.5%)	0	8740 (99.5%)
Crested Shrike-tit (northern)	1 (0.01%)	118 (1.3%)	8668 (98.6%)
Northern Quoll	0	10 (0.1%)	8777 (99.9%)

4.3.2 Habitat protected within conservation reserves

The extent of habitats in each of the conservation reserves for the Gouldian Finch (presented as breeding, non-breeding and unsuitable), Red Goshawk, Crested Shrike-tit (northern) and Northern Quoll (presented as suitable, possible and unsuitable) are presented in Table 5 to Table 8 and shown in Figure 4 to Figure 7.

Table 5 Extent of Gouldian Finch breeding and non-breeding habitat within reserves

Conservation reserve	Breeding (ha)	Non-breeding (ha)	Total suitable (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	10 212	8044	18 256	51 956
Pincombe range (14 154 ha)	10 585	2300	12 885	1269
Ningbing range (25 505 ha	1541	17 315	18 856	6650
Weaber range (29 084 ha)	16 055	13 012	29 067	17
Mt Zimmerman (14 315 ha)	1898	2842	4740	9575
Packsaddle (804 ha)	0	0	0	804
Total (ha)	**40 291**	**43 513**	**83 804**	**70 271**
% of total area	**26.2**	**28.2**	**54.4**	**45.6**

Table 6 Extent of suitable habitat for Red Goshawk within reserves

Conservation reserve	Suitable habitat (ha)	Possible (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	482	2758	335
Pincombe range (14 154 ha)	14	0	14 140
Ningbing range (25 505 ha	1636	0	23 869
Weaber range (29 084 ha)	4155	0	24 929
Mt Zimmerman (14 315 ha)	18	0	14 298
Packsaddle (804 ha)	43	426	335
Total (ha)	**6348**	**3184**	**144 543**
% of total area	**4.1**	**2.1**	**93.8**

Table 7 Extent of suitable habitat for Crested Shrike-tit (northern) within reserves

Conservation reserve	Suitable habitat (ha)	Possible (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	8600	4087	57526
Pincombe range (14 154 ha)	1864	2993	9297
Ningbing range (25 505 ha	7534	8840	9130
Weaber range (29 084 ha)	4711	22970	1403
Mt Zimmerman (14 315 ha)	2910	4633	6722
Packsaddle (804 ha)	6	134	664
Total (ha)	**25 625**	**43 657**	**84792**
% of total area	**16.6**	**28.3**	**55**

Table 8 Extent of suitable Northern Quoll habitat within reserves

Conservation reserve	Suitable (ha)	Possible (ha)	Unsuitable (ha)
Livistona Range (70 213 ha)	1776	2327	66 109
Pincombe range (14 154 ha)	0	357	13 798
Ningbing range (25 505 ha	4706	0	20 799
Weaber range (29 084 ha)	15983	0	13 101
Mt Zimmerman (14 315 ha)	107	6772	7436
Packsaddle (804 ha)	0	0	804
Total (ha)	**22572**	**9456**	**122 047**
% of total area	**14.6**	**6.1**	**79.2**

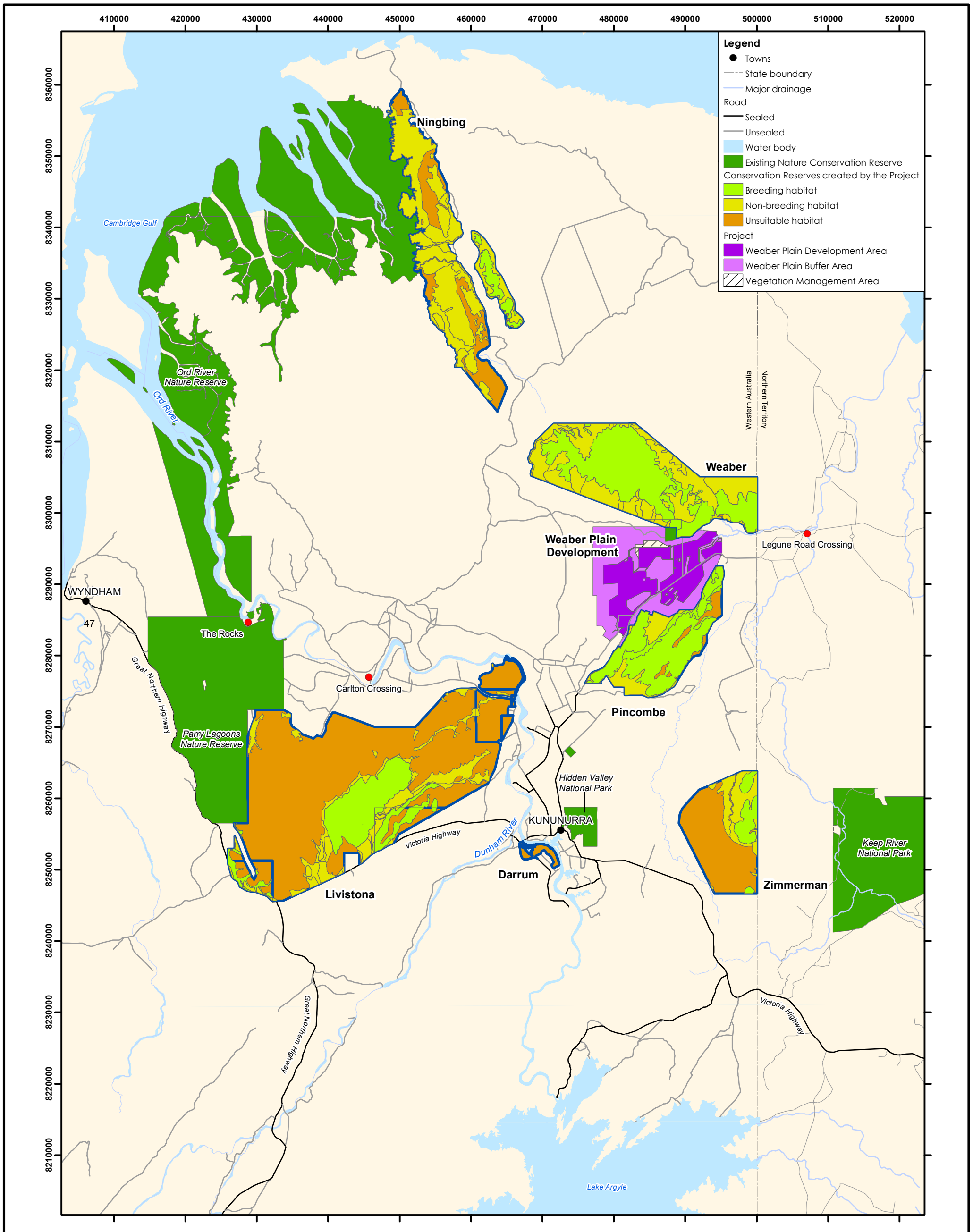

Figure 4 Suitable habitat for Gouldian Finch within conservation reserves

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Scale
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Kilometres

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1:500,000
at A3

Coordinate System: GDA 1994 MGA Zone 52
Date: 22/08/2012
Author: jcrute, rmaeder

Source: Geoscience Australia 2006. DEC 2012.
Note that positional errors may occur in some areas

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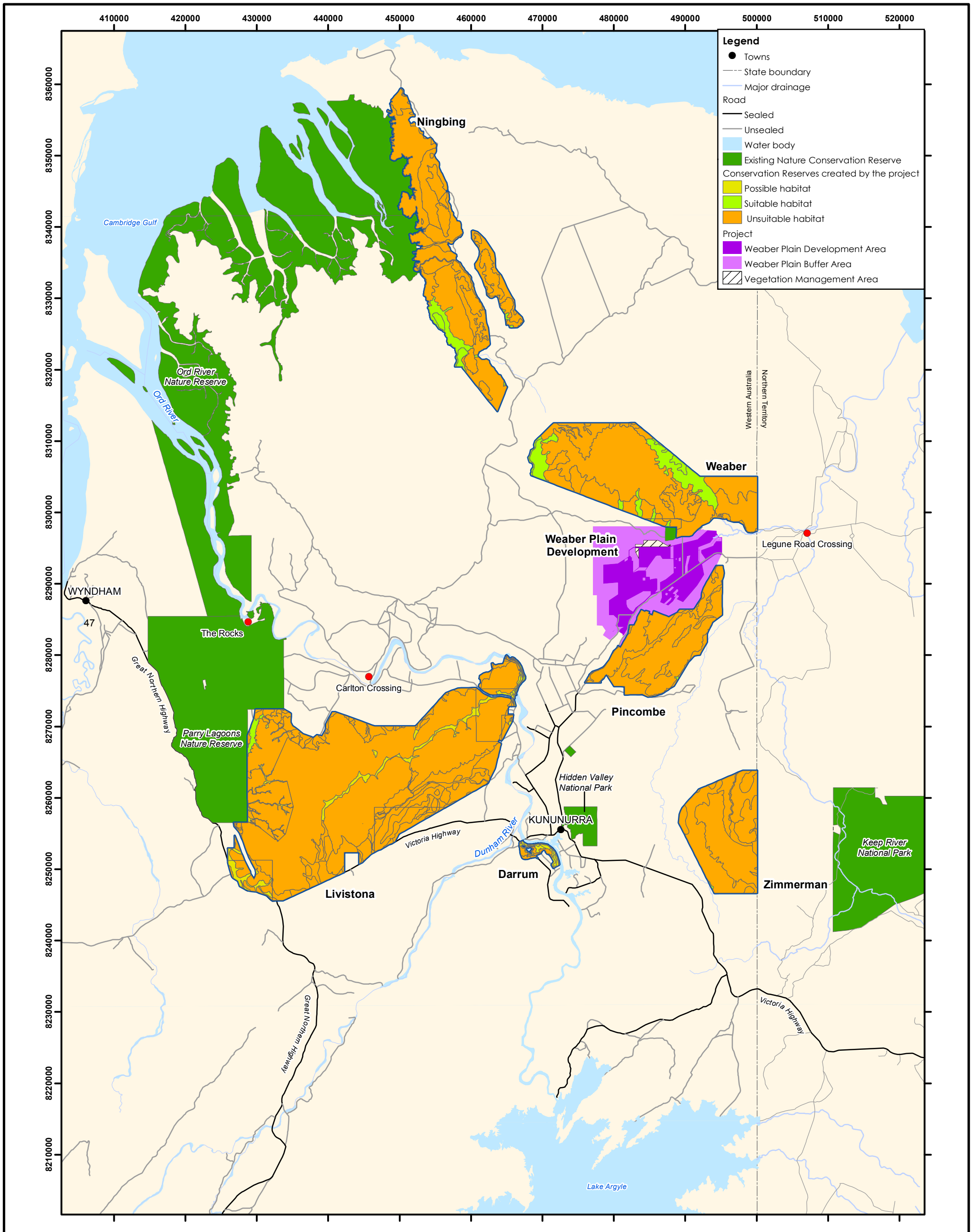

Figure 5 Suitable habitat for Red Goshawk within conservation reserves

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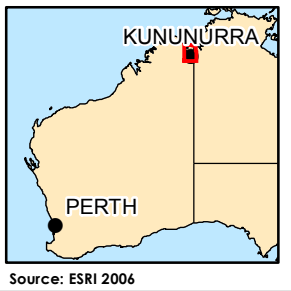
Date: 22/08/2012
Author: jcrute, rmaeder

Source: Geoscience Australia 2006. DEC 2012.
Note that positional errors may occur in some areas

Regional



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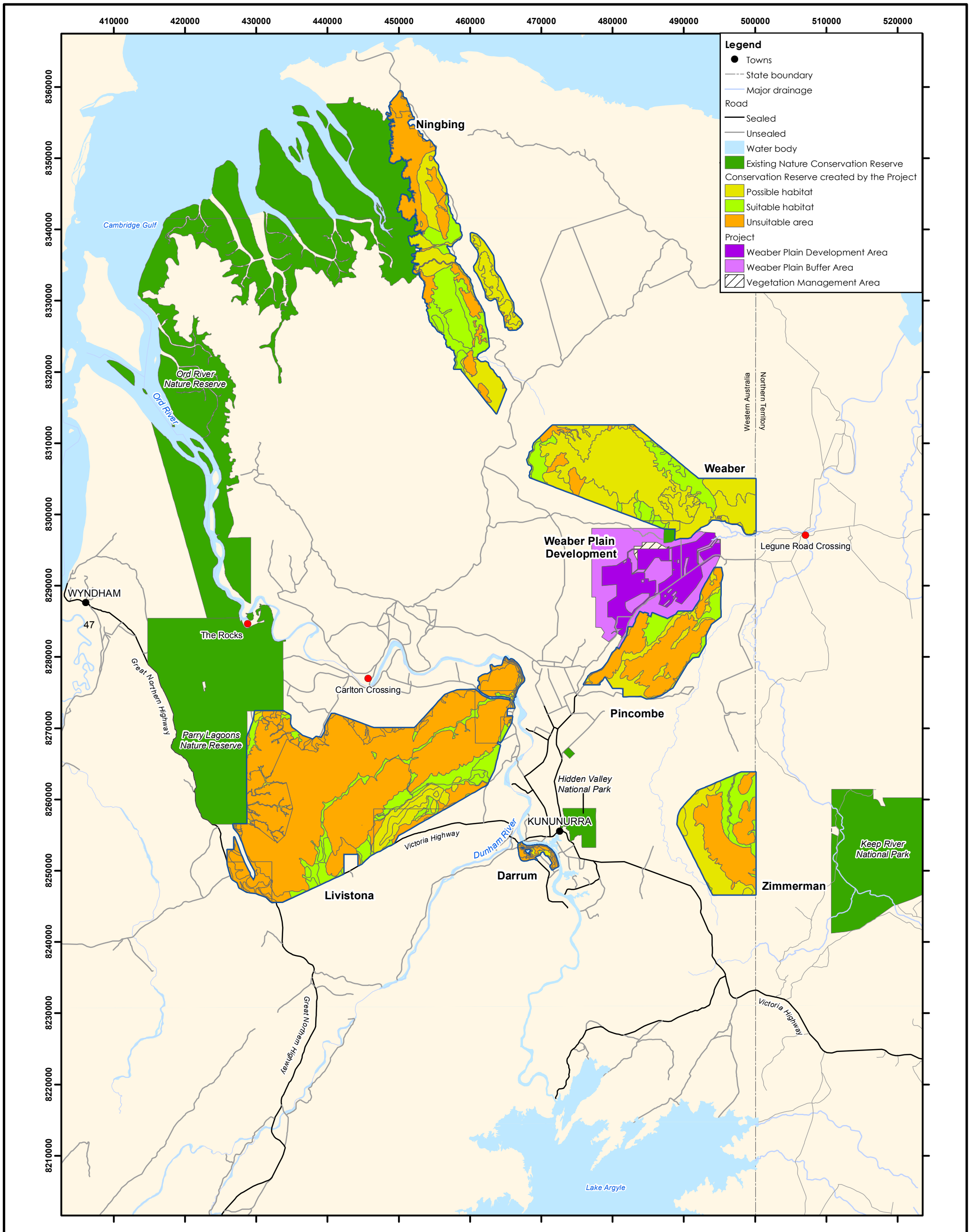

Figure 6 Suitable habitat for Crested Shrike-tit (northern) within conservation reserves

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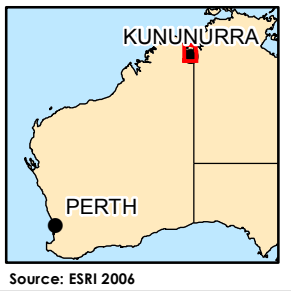
Author: jcrute, rmaeder

Source: Geoscience Australia 2006. DEC 2012.
Note that positional errors may occur in some areas

Regional



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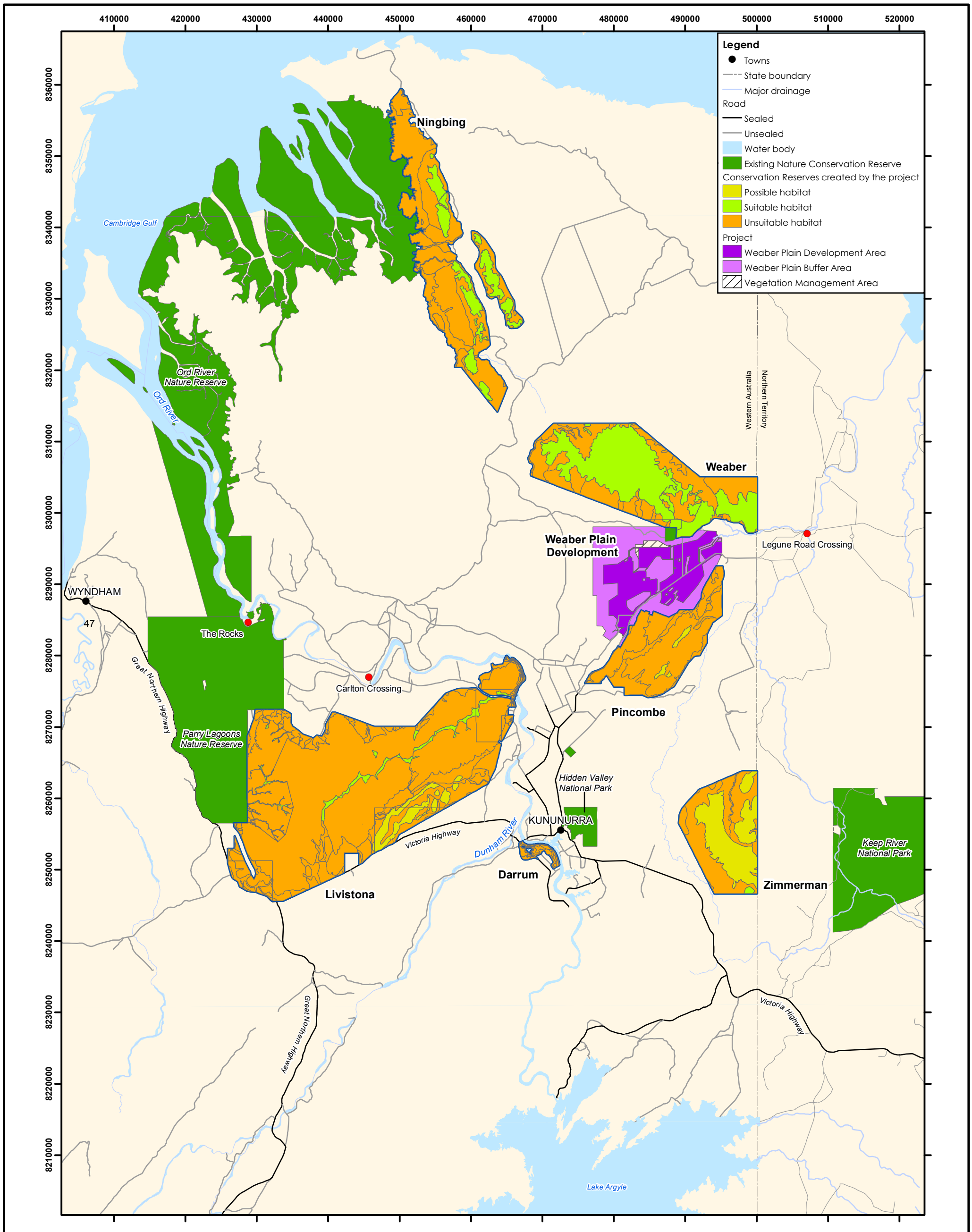

Figure 7 Suitable habitat for Northern Quoll within conservation reserves

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Note that positional errors may occur in some areas

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4.3.3 Comparison of directly affected and reserved terrestrial fauna habitat

The DEC *Ord Irrigation Area Fauna Habitat Mapping Project* report (Shedley 2012) (Appendix 4) describes the methodology used to determine suitability of habitat within the Development Area and conservation reserves, and in particular whether the conservation reserves provide the same landscape function and habitat type for the EPBC Act species as the Development Area. The habitat assessment of the conservation reserves demonstrates that extensive suitable habitat for listed threatened species is contained within these areas. A comparison of the amount of suitable and possible habitat to be cleared for each species and the amount of this habitat that will be protected in conservation reserves is shown in Table 9. For all species the extent of habitat in the conservation reserves is significantly greater than that affected as a result of the Project. The reserves will deliver a real conservation outcome with a ratio for all species of at least 1:202 for the Red Goshawk and up to 1:3202 for the Northern Quoll.

Table 9 Summary of terrestrial fauna habitat affected and conserved

Species	Habitat affected (suitable and possible) (ha)	Habitat in conservation reserves			Ratio
		Suitable (ha) (including breeding and non-breeding habitat for Gouldian Finch)	Possible (ha)	Total (ha)	
Gouldian Finch	55	83 804	N/A	83 804	1:1524
Red Goshawk	47	6348	3184	9532	1:202
Crested Shrike-tit (northern)	119	25 625	43 657	69 282	1:582
Northern Quoll	10	22 572	9456	32 028	1:3202

4.3.4 Extent of habitat within the Buffer Area

Suitability of Gouldian finch habitat within the Buffer Area was surveyed by Sarah Pryke (2010). Results showed suitable breeding areas for Gouldian Finch and sightings in the Buffer Area. As these areas occur within the buffer, destocking and weed and pest control will take place to enhance the habitat. Mapping of suitable habitat within the Buffer Area for the other threatened species will be undertaken during seasonal conditions and species-related behaviours, prior to December 2012, as required under Condition 7 of EPBC 2010/5491.

In addition to providing net positive offset ratios, an environmental buffer of approximately 11 470 ha of native vegetation will be established to protect watercourses and surrounding conservation reserves. The primary role of the Buffer Area is to absorb any edge effects from the development to protect surrounding land outside the Buffer Area from environmental impacts.

Landscape restoration of the Buffer Area will provide ecological benefits for listed fauna offsetting further the direct impacts on the development. Offset measures include:

- destocking the buffer
- rehabilitating disturbed portions of the buffer to benefit threatened fauna species
- revegetate areas within the buffer where vegetation condition is assessed as being below a rating of 'Very Good'
- liaising with DEC regarding the need to work at removing cane toads from the Buffer Area.

Further information regarding the restoration of habitat values of the buffer is in the Buffer Management Plan (Strategen 2012). The buffer will help protect the environmental values of the Point Springs Nature Reserve, Weaber range conservation area and Pincombe Range conservation area. The buffer will be managed by the Proponent, with management responsibilities transferring to a suitable body corporate in the future. Appropriate arrangements will be established to ensure legal responsibilities for implementing EPBC approval 2010/5491 are maintained.

5. Threatened aquatic fauna species

The Recommendation Report (DSEWPaC 2011b) identified that the likely impacts on listed threatened Glyphis and Pristis species in the Keep River as a result of the Action are uncertain. As a result of this uncertainty there is potential for adverse impacts on the species and the potential viability of populations in the region. To address this uncertainty the conditions of approval require the application of mitigation measures, such as the use of on-farm Tailwater Management Systems.

Condition 14C of the approval requires an indirect offset to fund research to the value of $150 000 per year for ten years for the management, monitoring and/or improved protection of the critically endangered Speartooth (Glyphis glyphis), the endangered Northern River Shark (Glyphis garricki), the vulnerable Freshwater Sawfish (Pristis Microdon) and the vulnerable Dwarf Sawfish (Pristis clavata).

The condition requires proposed research activities to be developed in consultation with the Sawfish and Glyphis Recovery Team. Payments for the research must be made into a trust fund agreed to by SEWPaC.

The research activities and associated trust fund are being established by the Recovery Team in partnership with the CSIRO. The research proposal has been approved by SEWPaC and is contained in Appendix 5.

In summary, over the next three years, the proposed research will include research surveys, capture, tagging and monitoring of sawfish, which will focus on rivers in the Northern Territory to expand the current National Environmental Research Program (NERP). The 10 year offset funding will enable ongoing collection of tissue from current and future projects (e.g. Murdoch University – Fitzroy River, NERP, and consultancy programs (McArthur, Keep River etc)) for retrospective analysis of trends in populations of sawfish and Glyphis (CSIRO 2012)

The proponent will contribute on an annual basis to this fund for ten years, to assist in national efforts for Glyphis and Sawfish species recovery.

Currently the Proponent is monitoring population sizes and collecting DNA samples, a component of the requirements of Condition 10 to undertake a targeted non-lethal baseline surveying program. Liaison will occur with the Glyphis and Sawfish Recovery Team to ensure research undertaken by the Proponent is communicated to and integrated with the national recovery efforts.

6. Conclusion

The conservation reserves created to offset the impacts of the development of the Project will provide very substantial net positive environmental benefits and more than compensate for any direct impacts of the development on threatened terrestrial fauna species. The habitat value of the conservation reserves has been determined by DEC survey. The habitat mapping determined that for each species the reserves will deliver a real conservation outcome with a ratio for all species of at least 1:202 for the Red Goshawk and up to 1:3202 for the Northern Quoll.

Landscape restoration within the Buffer Area will also provided ecological benefits for threatened fauna which will further offset direct impacts to threatened species.

While no direct impacts to aquatic fauna are expected, an indirect offset for the management and monitoring and/or improved protection of threatened aquatic fauna will be undertaken as per condition 14C of the EPBC approval.

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