PHOSPHATE RESOURCES LIMITED

Attachment H

EPBC Act Protected Matters Risk Assessment

Proposed Exploration Drilling UCL Christmas Island

September 2016

Range to Reef ENVIRONMENTAL

Prepared for Phosphates Resources Limited

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F&F ver 0.1	Draft	0.1	27/06/2016
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Prepared for Phosphate Resources Limited (trading as Christmas Island Phosphate)

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1 Introduction

Phosphate Resources Pty Ltd (PRL trading as Christmas Island Phosphates CIP) are proposing to undertake exploratory drilling (the proposed action) on Unallocated Crown Land (UCL). This report has been prepared to assess the risks associated with the undertaking of the proposed action to inform a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC). This has assessed the potential risks of impact to EPBC Matters of National Significance (MNES) and impacts on Commonwealth land.

The risk assessment demonstrates that the proposed action is unlikely to have a significant impact on:

- Matters of National Environmental Significance; and
- Commonwealth land (in accordance with Significant Impact Guidelines 1.2 (SEWPaC 2013)): anticipated impacts are short term, reversible, small scale, localised and of low intensity.

1.1 Background

PRL is seeking to undertake a programme of exploration drilling in UCL on Christmas Island as covered by Exploration Licence ECI 70/2. The proposed exploration works will be located on the eastern side of Christmas Island in close proximity to the North South baseline haul road. The exploration will be undertaken on drill lines that have been previously cleared for exploration activities prior to 1976 and in some cases for mining. Some areas have also been impacted by the completion of ground works associated with historical and current phosphate mining activities.

PRL has developed the proposed action using an iterative risk process to ensure appropriate consideration has been given to avoiding and minimising potential impacts of the proposed action on MNES or Commonwealth land.

Key steps in this planning process include:

1. A desk top review using existing information was undertaken in September/October 2015 on the values in and adjoining to the proposed exploration drilling programme and amendments to avoid impacts on MNES (particularly Abbott's booby nest trees, *Tectaria devexa var. minor* and migratory species nesting areas);
2. Environmental surveys of the proposed exploration lines were undertaken in November 2015;
3. Amendment of the proposed lines based on the November 2015 results to avoid MNES;
4. Submission of clearing permit applications under the Environmental Protection Act 1986 (WA) (CI);
5. Further amendment of the proposal based on discussions with Department of Environment and Regulation (DER) staff assessing the proposed application to avoid MNES and to minimise impacts through management and mitigation conditions;
6. Additional detailed flora and fauna surveys were undertaken on UCL (Feb-June 2016) providing additional information on listed threatened species locations on, or in the general vicinity of, the proposed exploration lines; and
7. Further amendment of the proposal based on the above surveys to develop the final proposed exploration drilling programme.

The proposed action being referred under the EPBC Act is therefore a program that has been modified a number of times to minimise impacts and risks to MNES and the environmental values of Commonwealth land. The potential risks of this modified program have been assessed and this report summarises the results of this assessment. The results of environmental surveys (Range to Reef Environmental (R2R) and Island Wide Survey (IWS)) have been used to inform this risk assessment and to determine the risk of impact of the proposed action on MNES.

1.1.1 Exploration Programme

PRL proposes a programme of low impact aircore drilling in Exploration Licence ECI 70/2 for the purposes of phosphate resource exploration on UCL. To provide access for the proposed exploration works, a total of 6.83 hectares of vegetation (of which 6.73 hectares is native vegetation) is required to be cleared. Clearing will be restricted to historical exploration lines (clearly visible on the laser digital elevation model Figure 1) or previously cleared blocks containing regrowth vegetation.

Historically (i.e. prior to 1976) exploration tracks were cleared with a minimum width of approximately 8m. A grid pattern of tracks was established across the Island at variable spacing (between 25 and 100m apart). The proposed exploration programme will require smaller or narrower access tracks with a proposed clearing width of 5m. A minimum number of lines will be cleared to enable an assessment of the phosphate resource.

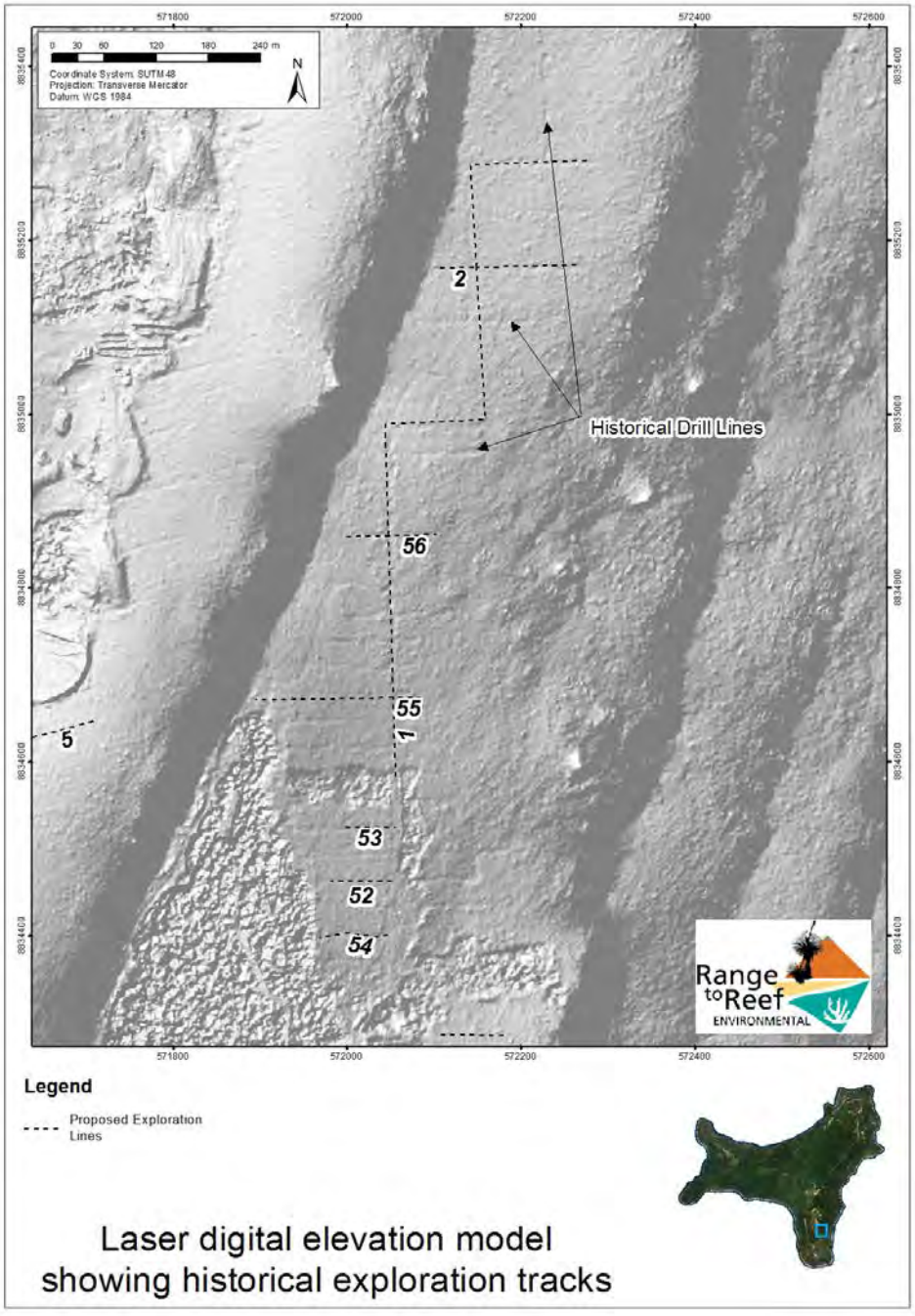

Figure 1. An example of historical clearing and ground disturbance with proposed drill lines

The clearing width will be the minimum amount to facilitate the temporary access of a 4WD drill vehicle (see Figure 2). The activity will be undertaken in such a way as to minimise clearing and avoid large trees (see Section 1.1.2). The drilling will not require the construction of cut and fill pads or tracks, nor would it be likely to encounter groundwater.

Figure 2. 4WD mounted aircore drill rig

1.1.2 Clearing Approach

Clearing to provide access for the proposed exploratory drilling will be low impact and will be undertaken in such a manner to allow rapid post action recovery of the vegetation along the exploration tracks.

Clearing will be accomplished by mechanical removal using a front end loader (or similar). Clearing will be along previously cleared drill lines (which contain understorey and smaller, regrowth vegetation) and will be diverted where necessary to avoid any large trees that have established on the old exploration lines (refer Figure 4).

A number of management commitments are made to reduce the impact of the proposed clearing:

- Clearing will be along previous drill lines;
- The width of the access tracks will be limited to 5m (i.e. the minimum amount to facilitate access of a 4WD drill vehicle – see Figure 2);
- Access tracks will be surveyed and set out using flagging tape prior to any clearing commencing in accordance with PRL procedures;
- The Giant Gecko Management plan (referral Attachment D) will be implemented in accordance with the conditions of the native vegetation clearing permits CPS6920/1 and CPS7040/1 to remove giant geckos prior to clearing;
- Clearing will be undertaken during the dry season to minimise impacts on red crabs (i.e. avoiding months when crabs are active or migrating), as well as minimising potential for erosion due to stormwater runoff;
- An observer will remove robber crabs from the line immediately prior to clearing;
- Machinery will be supervised by Technical Services staff, with 2-way radio communication, flagging and GPS operators;

- Where possible the drill rig will reverse down the track to minimise the need for a turning circle at the end of the drill line. If required turning areas will be provided and have been included in the clearing footprint for the exploration works;
- Existing tracks will be used where available to facilitate access;
- Significant vegetation (e.g. large habitat and other trees) will be avoided by diverting equipment around them;
- Where any large fallen tree crosses the drill line, the portion of the trunk blocking the line will be removed by chainsaw to minimise disturbance outside the drill line;
- Where possible, cut vegetation will be replaced on the drill line following exploration. If this is not possible, the vegetation will be brushed to the side of the 5 m exploration track. Vegetation quickly breaks down in a tropical environment and is consumed by red crabs and rots quickly;
- Exposed rocks i.e. limestone will be pushed to the side of tracks;
- Drill holes will be secured immediately after survey by capping with rocks/debris;
- Surface water runoff channels will be incorporated into clearing at 150 m intervals in sloping areas to encourage water flow into nearby undisturbed area and minimise track erosion;
- Traffic will be minimised to limit soil compaction (1 x 960 FEL, 1 x drill rig). All support vehicles (2 x light vehicles, air compressor) will remain where possible external to the exploration drill lines;
- Vehicle hygiene will be maintained to prevent the spread of invasive species (machinery washed down before first pass clearing);
- Refuelling will be completed in areas external to the exploration drill lines with access by service/fuel truck during operating hours which includes own spill kit;
- A procedure is in place for any hydrocarbon spills (ENV-SOP-004 Fuel and Oil Spill Management);
- Daily removal of rubbish and sample bags;
- Access to tracks will be blocked to vehicles following clearing and exploration activities; and
- Parks Australia North will have access to use cleared tracks during the annual IWS while open.

Figure 3. An example of vegetation in a proposed exploration drill line.

Note in Figure 3 the clearing pre-1976 has removed large tress from the line. Therefore, the proposed clearing footprint generally contains no large trees and will be smaller than the historical clearing footprint to avoid impacts on uncleared vegetation (refer Figure 4).

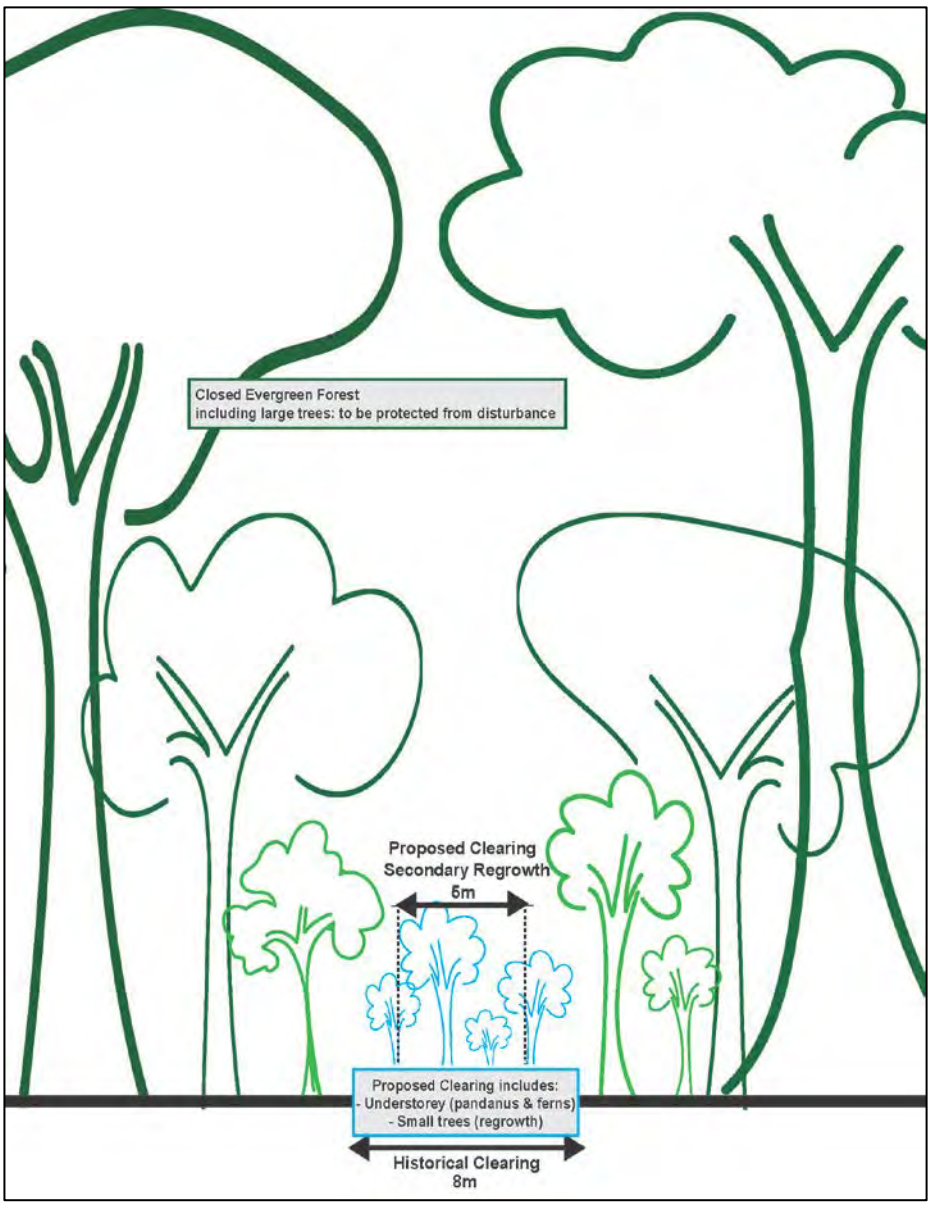

Figure 4. Schematic representation of proposed native vegetation clearing

1.2 Scope

A search of the Federal Department of Environment (DotE) *Environment Protection and Biodiversity Act 1999* (EPBC Act 1999) Protected Matters Search Tool (PMST) was undertaken for the exploration drilling lines, including a minimum 1 km buffer. This search was completed in February 2016. This highlights the potential MNES that should be considered (refer Section 3).

The report provides a broad overview of the likely risks for those threatened species identified as potentially present in proposed exploration areas. In addition to this, potential risks to migratory species and other species identified as having special conservation status have also been considered to inform the development of the approvals strategy for this work.

1.3 Information Sources and Limitations

The assessment of the risks associated with the proposed action have been assessed using the following sources of information.

1.3.1 Desktop Survey

The following desktop survey information has been accessed and used:

- Aerial photography;
- Flora and fauna surveys (R2R November 2015, February to June 2016 – in preparation);
- Spatial data provided by DotE (in July 2016) on species presence/absence from the IWS (Director of National Parks DNP 2013 and 2015); and
- Information on habitat requirements of species of conservation significance (DNP 2012).

1.3.2 Environmental Surveys

Targeted field flora and fauna surveys and inspections were undertaken by R2R between November 2015 and June 2016. These surveys were undertaken to assess potential impacts, amend the proposed action to avoid MNES, and to enable an assessment of the risks to MNES and Commonwealth Land.

Additional surveys were undertaken for several key species to provide more detailed information on presence/absence and population estimates.

November 2015

- Every proposed exploration drill line (original total of 76) was walked by an experience botanist and a fauna expert;
- Detailed vegetation and habitat assessments;
- All proposed exploration drill lines searched for threatened flora;
- Diurnal searches and fauna observations; and
- The primary objective was to inform Clearing Permit applications under the *Environmental Protection Act 1986 (WA) (CI).*

February to June 2016

- Detailed flora surveys (equivalent to a Western Australian 'Level 2' survey) to assess flora values of Unallocated Crown Lands;
- Detailed grid searches for listed threatened flora where species likely/possible to occur;
- Detailed fauna assessments (pit traps; diurnal surveys; spotlight transects; bat surveys (using bat detectors); avifauna surveys; and remote cameras; and
- Sites located on or in the general vicinity of the proposed exploration tracks.

1.3.3 Limitations

It should be noted that the conclusions made as a result of this risk assessment are based on the best available information at the time of completion and are intended to provide a guide to the level of risk posed by the proposed action to inform the assessment under the EPBC Act.

2 Risk Analysis Method for Threatened and Migratory Species

The final proposed action (i.e. exploration drilling and clearing of 6.83 hectares of vegetation) has been assessed to determine the risk of the impact on listed threatened species and migratory species. observed on or in the vicinity of the proposed exploration drill lines.

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that event or impact. Likelihood and consequences are categorised and described below in

Table 1 and Table 2). These criteria do not fit all circumstances (e.g. adequacy of fauna survey data), however, they are useful in providing an appreciation of the level of likelihood and consequences of an event. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the proposed action (Table 3).

Actions have the potential to impact fauna at multiple scales – site, local, landscape and regional. Each of these was considered in the risk assessment and where the inherent risk was assessed as being low or greater, management actions have been developed to reduce the residual risk to an acceptable level.

Table 1. Definitions of Likelihood (as used in the risk assessment)

Likelihood	Definition
Almost Certain	The species will be present in most circumstances.
Likely	The species is expected to be present in most circumstances.
Possible	The species should be present in most circumstances.
Unlikely	The species could be present in most circumstances.
Rare	The species may be present in most circumstances.

Table 2. Definitions of Consequence (as used in the risk assessment)

Consequence	Definition
Catastrophic	Loss of the species at the regional scale, adverse effect on species (abundance, age, fecundity). Decades to recover if any recovery possible.
Major	Adverse effect on the species. Years to decades to recover.
Moderate	Impact cause detectable changes to the species. Months to years to recover.
Minor	Incidental changes to the species. Weeks to months to recover.
Insignificant	Short term, localised and insignificant impact on the species. Recovery in days to months.

Table 3. Risk Assessment Matrix Risk Ranking

Risk Assessment Matrix		Consequence				
		Catastrophic	Major	Moderate	Minor	Insignificant
Likelihood	Almost Certain	H	H	H	L	N
	Likely	H	H	M	L	N
	Possible	H	M	L	L	N
	Unlikely	M	M	L	N	N
	Rare	M	L	N	N	N

Where:

High (H) = Immediate changes to design or procedures required.

Medium (M) = Risk reduction measures and monitoring required.

Low (L) = Acceptable risk, monitoring activity and manage as required.

Negligible (N) = Risks are acceptable, no further management.

3 Potential Impacts on MNES and Commonwealth land

3.1 Commonwealth Marine Areas

The proposed action is not located in or adjacent to Commonwealth Marine areas and there will be no direct or indirect impacts.

3.2 National Heritage Places

There are no sites listed as National Heritage List on Christmas Island.

There are places listed on the Commonwealth Heritage List on Christmas Island however only one ("Christmas Island Natural Areas") is relevant to this proposed action. This site was originally listed under the Register of National Estate (RNE) which was established as a register of places based on their natural values. The RNE was repealed in 2012 (Environment Australia 2016) and places can no longer be added or removed from the RNE. The RNE is maintained on a non-statutory basis as a publicly available archive and educational resource.

The majority of the exploration drill lines partially or wholly overlap the 'Christmas Island Natural Areas' (see Figure 5).

Due to the nature and small scale of the works, the impact of exploration activities associated with the proposed action will be Negligible and hence will be insignificant.

3.3 Wetlands of International Importance (declared RAMSAR wetlands)

No exploration is proposed on *Wetlands of International Importance* (declared Ramsar). The closest Ramsar wetland, Hosnie's Springs, is located approximately 875m to the south east of exploration line 33 (Figure 5).

The clearing of temporary access tracks is not expected to have any impact on drainage in the areas adjacent to the exploration drill lines. The impacts of the exploration work will be insignificant and can be managed through the implementation of current environmental management procedures and management actions developed for the proposed exploration work. The works will be temporary and all cleared vegetation will be re-spread across the cleared access tracks on completion of the works to promote regrowth of vegetation. It is anticipated, based on evidence from past clearing activities, that the vegetation will rapidly recover in these areas (refer Figure 7). As a result, there will be no direct or indirect effects from the proposed action *Wetlands of International Importance*.

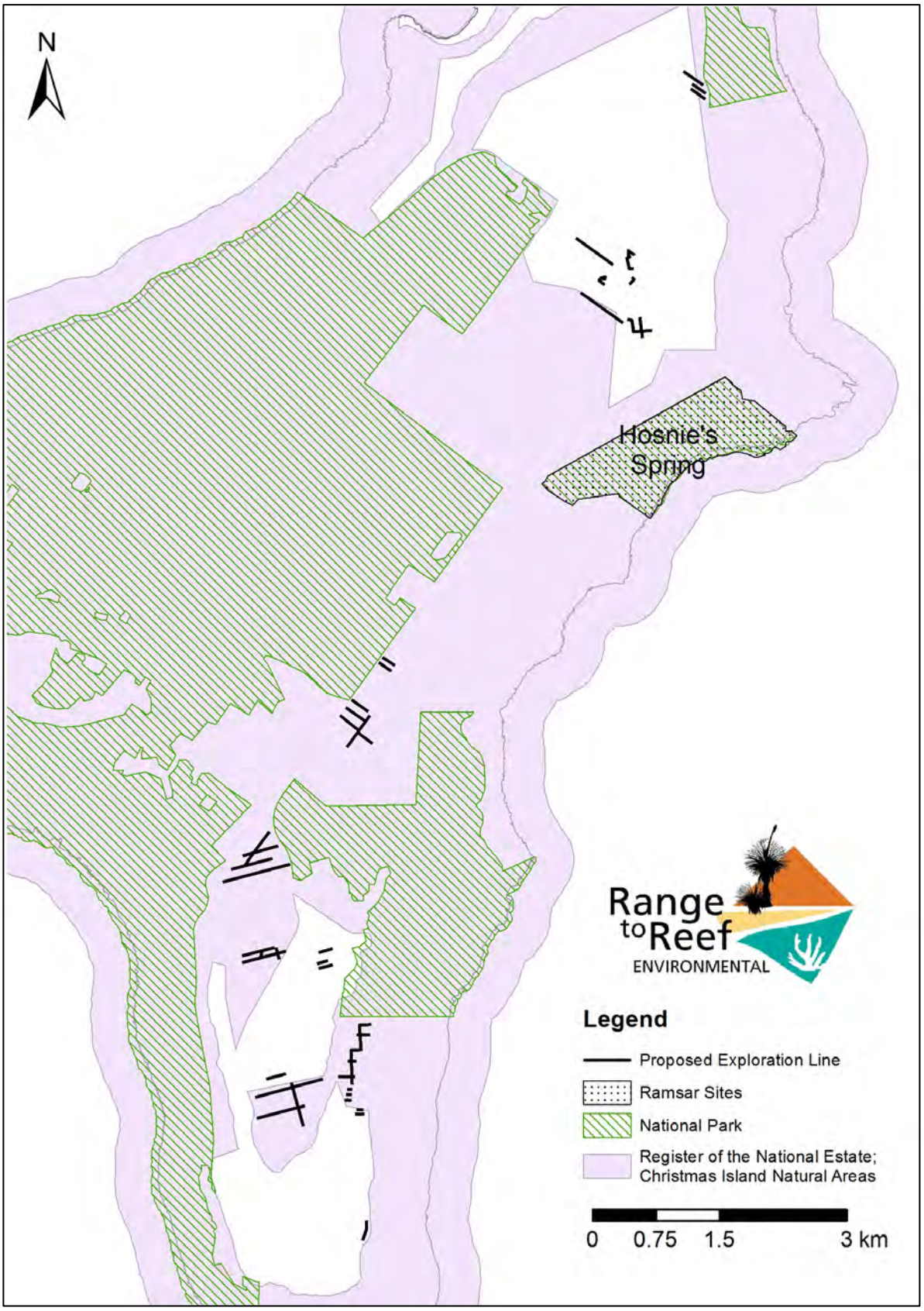

Figure 5. Register of Commonwealth Heritage Places as “Christmas Island Natural Areas”

3.4 Listed Threatened Species and Ecological Communities

The Protected Matter Search Tool report highlights 28 potential threatened species that may be present in or in the vicinity of the exploration drill lines. 11 are marine species which will be unaffected by the exploration works as the proposed action will have no interaction, directly or indirectly, with the marine environment. No further consideration has been given to these species in this risk assessment (and the associated referral).

17 listed threatened species are potentially relevant to this proposed action:

Birds

- Christmas Island Goshawk, Endangered:
- Emerald Dove, Endangered;
- Christmas Island Frigatebird, Vulnerable;
- Christmas Island Hawk-Owl, Vulnerable;
- Abbott's booby, Critically Endangered;
- White-tailed Tropicbird, Endangered; and
- Christmas Island Thrush, Endangered.

Mammals

- Christmas Island Shrew, Endangered;
- Christmas Island Pipistrelle, Critically Endangered; and
- Christmas Island flying fox, Critically Endangered.

It is believed that the first two mammal species are extinct.

Plants

- *Asplenium listeri (*Christmas Island Spleenwort), Critically Endangered; and
- *Tectaria devexa var. minor,* Endangered.
- *Pneumatopteris truncate,* Critically Endangered.

Reptiles

- Lister's gecko, Critically Endangered;
- Christmas Island blind snake, Vulnerable;
- Christmas Island blue-tailed skink, Critically Endangered;
- Christmas Island giant gecko, Endangered; and
- Christmas Island forest skink, Critically Endangered.

The following sections present an assessment of the listed threatened species based on information in relevant National Recovery Plans (NRP) and Conservation Advice Notes (C'wealth 2014 a-g, Hill 2004, Butz 2004, Schulz 2004).

3.4.1 Birds

3.4.1.1 Accipter hiogaster natalis (Christmas Island Goshawk)

Listing advice and primary threats

The Christmas Island Goshawk is listed as Endangered. The NRP details primary threats to include degradation of habitat by super-colonies of YCA, predation by feral cats and loss of vegetation associated with clearing around the settlement area (Hill 2004).

Presence/absence of species

The Christmas Island Goshawk *(Accipiter hiogaster natalis)* is described as widespread but uncommon on Christmas Island (Hill, 2004a). Whilst the Goshawk presence is scattered across the island and the population is small (Hill 2004), it is believed the population is stable (Garnett et al., 2011). Ongoing banding studies initiated in 2004 suggest an approximate population size of 250 individuals (DNP 2014).

The Christmas Island Goshawk was observed in the general vicinity of proposed exploration drill lines 1 to 6, 11 to 13, 20 to 24, 55 to 60 during surveys completed between November 2015 and June 2016.

Importance of the exploration areas for the species

The Christmas Island Goshawk is considered a habitat generalist with respect to foraging and individuals are often observed in clearings, disturbed areas and areas of regrowth. They are believed to be more specific in their habitat requirements for breeding. Key habitat for the survival of the species is defined as all Primary Rainforest, Marginal Rainforest (Du Puy 1993) and possibly secondary growth forest as the Christmas Island Goshawk breeds/nests in habitat trees typically located in these vegetation types.

The proposed exploration drill lines are located within tall evergreen and semi-deciduous forest and well developed areas of secondary forest, all of which may be considered as habitat for the Christmas Island Goshawk.

Potential Impacts due to the proposed action

The proposed action poses no mortality threat to the species.

Direct impacts will be avoided or minimised as a result of the temporary nature of the proposed exploration works, the limited extent of the clearing required to provide access for the works, the avoidance of large potential nesting habitat trees during clearing and the mobility of the species.

There will be no indirect impacts due to the limited and localised disturbance of foraging habitats and the ability of the species to utilise disturbed areas.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.1.2 Chalcophaps indica natalis (Christmas Island Emerald Dove)

Listing advice and primary threats

The conservation advice for the endemic Christmas Island Emerald Dove details primary threats as degradation of habitat by super-colonies of YCA and predation by feral cats and rats. Habitat loss through clearing of vegetation associated with mining and construction may have been experienced (C’wealth 2014a).

Presence/absence of species

The Christmas Island Emerald Dove *(Chalcophaps indica natalis),* which is listed as Endangered, is described as widespread and common in areas of rainforest on the island. It is restricted in its geographic location to an area of 100km^2 of Christmas Island and the population is currently estimated at between 900 and 3500 individuals (DotE 2014).

The Christmas Island Emerald Dove was observed along and in the general vicinity of proposed exploration drill lines 1 to 6, 11 to 17, 20 to 26, 33 to 36, 50 to 60, 65 to 67 during surveys completed between November 2015 and June 2016.

Importance of the exploration areas for the species

The Christmas Island Emerald Dove occurs in most forested habitats and is most common in tall closed evergreen rainforest and open semi-deciduous rain forest typical of the terraces that surround the central plateau of Christmas Island. It has also been observed in deciduous scrub, areas of disturbed vegetation, secondary regrowth and on lawns, gardens and around houses in the settlement (DotE 2014).

The exploration drill lines comprise areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest that may be considered as habitat for the Christmas Island Emerald Dove. As the species is considered a "generalist" no specific habitats have been identified along the exploration drill lines as critical for its survival.

Potential Impacts due to the proposed action

The proposed action poses no mortality threat to the species.

Direct impacts will be avoided or minimised as a result of the temporary nature of the proposed exploration works, the limited extent of the clearing required to provide access for the works and the mobility of the species.

No indirect impacts will be experienced due to limited and localised disturbance of foraging habitats.

Proposed mitigation measures

The (inherent) risk to this species is considered "Negligible" and no specific management or mitigation measures are required.

3.4.1.3 Fregata andrewsi (Christmas Island frigatebird)

Listing advice and primary threats

The Christmas Island frigatebird is listed as Vulnerable. The NRP details primary threats as loss of habitat due to clearing for settlement and, to a lesser extent mining, dust from ship loading activity (which is now managed) and predation by feral cats and rats (Hill and Dunn 2004).

Presence/absence of species

The Christmas Island frigatebird only breeds on Christmas Island. Outside the breeding season the birds range widely around South-east Asia and Indian Ocean. Breeding is confined to four colonies located at the golf course (two), cemetery and Margaret Beach. Other small clusters of nests have been observed in the settlement and Flying Fish Cove.

The population is estimated at between 4800 and 5000 individuals with 1100 breeding pairs (DNP 2014).

The Christmas Island frigatebird was not observed at or in the vicinity of any of the exploration drill lines during the surveys completed between November 2015 and June 2016.

Importance of the exploration areas for the species

The Christmas Island frigatebird nests in tall trees along the shore terraces that are protected from the south east trade winds and elevated to assist with take-off. Preferred nesting trees include Indian Almond *Terminata catappa* and *Ficus sp*.

The exploration drill lines comprise areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest none of which is habitat suitable for the Christmas Island frigatebird.

Potential Impacts due to the proposed action

The proposed action poses no mortality threat to the species given that they do not occur in the proposed exploration areas or utilise the habitats that will be disturbed and are highly mobile. There will be no direct or indirect impacts on the species.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.1.4 Ninox natalis (Christmas Island Hawk-Owl)

Listing advice and primary threats

The endemic Christmas Island Hawk-Owl is listed as Vulnerable. Information from the DNP (2014) details primary threats as degradation of habitat due to climate change, loss of habitat due to vegetation clearing, the impacts of super-colonies of YCA and predation by feral cats (Hill 2004).

Presence/absence of species

The Christmas Island Hawk-Owl *(Ninox natalis)* inhabits dense rainforest on both the plateau and coastal plains of Christmas Island. The most recent survey estimates the population to comprise less than 400 mature individuals and noted the wide distribution across the island (Morcombe 2016).

The Christmas Island Hawk-Owl was observed in the general vicinity of proposed exploration drill lines 1 to 6, 11 to 17, 20 to 26, 33 to 36, 50 to 60, 65 to 67 during surveys completed between March and June 2016.

Importance of the exploration areas for the species

The Christmas Island Hawk-Owl is known to occur in tall evergreen rainforest with irregular canopy and numerous emergent trees on the central plateau up to 40m tall. On the coastal terraces it is known to occur in deciduous forests with a canopy up to 30m. It is also known to occur in highly disturbed areas with secondary growth of native and introduced species (DNP 2014). The Christmas Island Hawk-Owl requires large trees (typically *Syzygium nervosum)* with hollows typically in the lower third of the canopy, found on the central plateau.

The proposed exploration occurs within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest that may be considered as habitat for the Christmas Island Hawk-Owl.

Potential Impacts due to the proposed action

The proposed action poses no mortality threat to the species.

Direct impacts will be avoided or minimised as a result of the temporary nature of the proposed exploration works, the limited extent of the clearing required to provide access for the works, the avoidance of large potential nesting trees during clearing and the mobility of the species.

No indirect impacts will be experienced due to the limited and localised disturbance of foraging habitats. The proposed exploration drilling access tracks are likely to provide suitable (short term) foraging habitat.

Proposed mitigation measures

The (inherent) risk to this species is considered "Negligible" and no specific management or mitigation measures are required.

3.4.1.5 Papasula abbotti (Abbott's booby)

Listing advice and primary threats

The listing advice for the Abbott's booby details primary threats as modification/destruction of habitat by vegetation clearing (mining, cyclone, settlement), climate change and the impacts of super-colonies of YCA.

Presence/absence of species

The Abbott's booby *(Papasula abbotti)* is listed as Critically Endangered. It is a large migratory seabird that is only known (since the early 1900s) to nest on Christmas Island. The most recent survey data (1991) estimates the population at 7000 mature individuals (DNP 2014). The Abbott's booby is typically found in tall rainforest trees above 150m in elevation in the western, central and northern portions of the island.

The Abbott's booby was observed in the general vicinity of exploration drill lines 14 to 17, 20 to 26, 61, 65 to 67 during surveys completed between November 2015 and June 2016.

Surveys of the proposed exploration drill lines completed between February 2016 and June 2016 confirmed that no Abbott's booby nest trees occur on or immediately adjacent to the proposed drill lines.

Importance of the exploration areas for the species

The Abbott's booby nests in tall emergent rainforest trees in the deeper plateau and terrace soils of the western, central and northern portions of Christmas Island (DotE 2004). Within suitable habitats the location of nests is determined by the local topography, canopy and the direction of prevailing winds (to assist with take-off and landing).

Whilst Abbott's booby does occur in the general vicinity of the proposed exploration drill lines, surveys have confirmed that no nest trees are located on or immediately adjacent to the proposed drill lines. Therefore, the habitat along the exploration lines is not critical for this species.

Potential Impacts due to the proposed action

The proposed action poses no mortality threat to the species as they were not observed on the exploration drill lines.

Direct and indirect impacts will be avoided through the implementation of a 30m buffer around all known Abbott's booby habitat trees based on information gathered during the 2016 surveys and most recent IWS (DNP 2015).

Given the minor nature of the clearing, no wind turbulence is likely to occur as a result of creating the temporary access tracks. No impacts are therefore anticipated.

Proposed mitigation measures

The (inherent) risk to the species is considered "Negligible" and no specific management or mitigation measures are required.

3.4.1.6 Phaethon lepturus fulvus (White-tailed Tropicbird)

Listing advice and primary threats

The conservation advice for the White-tailed Tropicbird (DotE 2014) details primary threats as predation by rats and cats, the impact of YCA and the limited area for habitation by the species (C'wealth 2014d).

Presence/absence of species

The White-tailed Tropicbird is listed as Endangered. It is typically oceanic and roosts at sea. Adults only spend time on the nest during breeding cycles for incubation and raising of young. Adults do not move easily on land and hence favour life at sea.

The White-tailed Tropicbird was observed in the general vicinity of proposed exploration drill lines 20 to 23, 33 and 34 during surveys completed between November 2015 and June 2016.

Importance of the exploration areas for the species

The White-tailed Tropicbird nests in deep shaded hollows or crevices typically in rock faces, cliffs and rainforest trees.

The exploration areas comprise areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest and do not comprise habitat for the White-tailed Tropicbird.

Potential Impacts due to the proposed action

The proposed action poses no mortality threat to the species, given that they are limited inhabitants of the rainforest and were only observed in the general vicinity of the above exploration drill lines.

Direct impacts will be avoided or minimised as a result of the temporary nature of the proposed exploration works, the limited extent of the clearing required to provide access for the works and the avoidance of large potential habitat trees during clearing.

There will be no indirect impacts.

Proposed mitigation measures

The (inherent) risk to this species is considered "Negligible" and no specific management or mitigation measures are required.

3.4.1.7 Turdus poliocephalus erythropleurus (Christmas Island Thrush)

Listing advice and Primary threats

The conservation advice for the Christmas Island Thrush details the primary threat as competition from and degradation of habitat by YCA. The ants compete for food sources and also impact on the Red Crabs, the absence of which impacts on the open nature of the forest which is favoured by the Thrush for foraging and feeding (C'wealth 2014g).

Presence/absence of species

The Christmas Island Thrush *(Turdus poliocephalus erythropleurus)* is listed as Endangered and is wide spread throughout south east Asia and the south west Pacific. The Christmas Island Thrush is a subspecies unique to Christmas Island with an estimated population of between 20,000 and 50,000 individuals (DNP 2012).

As anticipated the Christmas Island Thrush was observed along and in the general vicinity of all proposed exploration drill lines during surveys completed between November 2015 and June 2016.

Importance of the exploration areas for the species

The Christmas Island Thrush is common in most habitats on Christmas Island, including tall closed evergreen rainforest, open semi-deciduous rainforest, secondary regrowth, thickets of weeds and semi-deciduous vines, settled areas (where it forages on lawns and nests on buildings) and on the Christmas Island golf course. Whilst this species is ubiquitous across the Island and found in all habitats it is most common in tall closed evergreen rainforest, open semi-deciduous rainforest on the coastal and higher terraces and plateau of Christmas Island (DNP, 2012c).

The proposed exploration drill lines are located within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest habitats. Whilst the Thrush occurs in these areas, the small areas of habitat to be cleared for exploratory drilling are not critical for survival of the species. This species is resilient and a habitat generalist and is common in disturbed habitats.

Potential Impacts due to the proposed action

The proposed action poses no mortality threat to the species.

Direct impacts will be avoided or minimised as a result of the temporary nature of the proposed exploration works, the limited extent of the clearing required to provide access for the works, the avoidance of large trees during clearing and the mobility of the species.

No indirect impacts will be experienced due to the limited and localised disturbance of foraging habitats and the ability of the species to survive in a range of disturbed habitats.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.2 Mammals

3.4.2.1 Crocidura attenuate trichura (Christmas Island Shrew)

Listing advice and primary threats

The Christmas Island Shrew is listed as Critically Endangered. Information from the DotE (2004) lists primary threats as modification/destruction of habitat by vegetation clearing (mining, cyclone, settlement), climate change and the impacts of super-colonies of YCA (Schulz 2004).

Presence/absence of species

The Christmas Island Shrew has not been observed in the wild since 1985, is considered rare and is believed to be extinct (Lumsden 1999).

It is believed that the species has been significantly impacted by the super-colonies of YCA, disease, habitat loss and predation (by cats and rats).

The R2R 2015 and 2016 surveys included the use of pit traps and remote cameras set up at locations in the vicinity of the proposed exploration drill lines to record any fauna activity including the Christmas Island Shrew. Daily inspections of the pit traps over a seven day period at each survey site and analysis of the camera data provided no evidence that the Christmas Island Shrew was present in or in the vicinity of the proposed exploration drill lines.

Importance of the exploration areas for the species

The proposed exploration drill lines are located within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest habitats which are considered habitat for the Christmas Island Shrew. The R2R 2015 and 2016 surveys did not find this species along or in the vicinity of the proposed exploration drill lines.

Potential Impacts due to the proposed action

There will be no direct and indirect impacts due to the proposed action as the species is believed to be extinct and was not observed during surveys completed along and in the vicinity of the exploration drill lines.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.2.2 Pipistrellus murrayi (Christmas Island Pipistrelle)

Listing advice and primary threats

The Christmas Island Pipistrelle is listed as Critically Endangered. Information from the DotE (2004) lists primary threats as modification/destruction of habitat by vegetation clearing (mining, cyclone, settlement), climate change and the impacts of super-colonies of YCA (Schulz and Lumsden 2004).

Presence/absence of species

The Christmas Island Pipistrelle has not been observed in the wild since 1998 and is believed to be extinct (Lumsden 1999).

The species has been significantly impacted by super-colonies of YCA and the potential impacts of associated management measures, disease, habitat loss and predation (by cats and rats).

The R2R 2015 and 2016 surveys included the use of bat detectors set up at locations in the vicinity of the proposed exploration drill lines to record any bat activity including the Christmas Island Pipistrelle. The recordings were analysed by an experienced zoologist and no evidence was found from the data to indicate the presence of any bats including the Christmas Island Pipistrelle.

Importance of the exploration areas for the species

The proposed exploration lines are located within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest habitats which are considered habitat for the Christmas Island Shrew (Lumsden 1999). The results of the R2R 2015 and 2016 surveys (bat detectors) indicate that the species is not found along or in the vicinity of the proposed exploration drill lines.

Potential Impacts due to the proposed action

The species is believed to be extinct and was not recorded or observed during surveys completed along and in the vicinity of the exploration drill lines.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.2.3 Pteropus melanotus natalis (Christmas Island flying fox)

Listing advice and primary threats

The conservation advice for the Christmas Island flying fox lists the primary threats as loss of habitat due to the clearing of native vegetation for mining, predation by feral cats and other invasive species, super-colony infestation of YCA (an indirect impact), reduction of preferred food sources and disturbance from cyclonic events.

Presence/absence of species

The endemic Christmas Island flying fox is listed as Critically Endangered. It roosts close to the coast and forages in rainforests, gardens and areas of post mining vegetation. The species eats a wide range of fruit and nectar, playing an important role in the pollination and dispersal of plants on the island. As a result, it is regarded as a keystone species. Recent estimates put the population at approximately1500 individuals (DNP 2014).

The Christmas Island flying fox was observed foraging and/or heard in the general vicinity of proposed exploration drill lines 1 to 6, 11 to 13, 52 to 60, 69 to 71 during surveys completed between November 2015 and June 2016.

No roost sites were found in the areas where exploration is proposed.

Importance of the exploration areas for the species

The Christmas Island flying fox is found in coastal roosts and can be observed in the vicinity of Flying Fish Cove and Margaret Knoll. It is known to forage across the whole of the island.

No roost sites have been identified on the proposed exploration lines. The Christmas Island flying fox forages across the island and was observed at some of the proposed exploration locations (as above) feeding in large trees (which will be unaffected by the proposed action). As a result, whilst the Christmas Island flying fox may forage in the proposed exploration areas from time to time (depending on the availability of fruiting trees), the proposed exploration works are unlikely to affect these foraging activities.

Potential Impacts due to the proposed action

There will be no direct or indirect impacts on the species as a result of the proposed action.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.3 Plants

3.4.3.1 Tectaria devexa var. minor

Listing advice and primary threats

The listing advice for *Tectaria devexa* var. *minor* details the primary threats as loss of habitat through clearing of native vegetation is relation to mining and construction, associated weed infestation, unauthorised collecting of specimens and disturbance from cyclonic events (Butz 2004).

Presence/absence of species

Tectaria devexa var*. minor* is listed as Endangered and grows mainly on the plateau in the primary rainforest above elevations of 80m. It prefers deeper, wet soils typically located at the base of slopes. The population is currently estimated to comprise less than 400 individuals (DNP 2014).

The fern was observed in the general vicinity of proposed exploration drill lines 3 to 6 during surveys completed between November 2015 and June 2016.

Recent survey work suggest that the species is not widespread or abundant and occurs in very small clumped populations. All proposed exploration drill lines were walked by experienced botanists and no plants were found in the proposed clearing footprint. The survey identified one specimen located approximately 50m to the south of exploration drill line 5. This is the closet known plant or population to the proposed action.

Importance of the exploration areas for the species

The species recovery plan identifies all plateau rainforest as potential habitat with emphasis being placed on areas with canopy gaps due to storm damage especially around limestone outcrops. Mapping data indicates the fern *Tectaria devexa var. minor* is potentially found in rainforest habitats similar to those found in the southern area of the island (in close proximity to exploration lines 3 to 6). The area has deeper soils adjacent to slopes and rocky outcrops in tall evergreen forest. The area around exploration drill lines 3 to 6 was gridded out and surveyed intensely to map all populations of the species (see above).

Potential Impacts due to the proposed action

Thorough searches were undertaken of the clearing footprint and potential areas near known populations of *Tectaria*. Only one of the 44 proposed exploration drill lines is located close to locations of *Tectaria devexa var. minor* locations.

No direct or indirect impacts will occur to this plant as a buffer of 50m will be implemented around this location.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.3.2 Asplenium listeri (Christmas Island Spleenwort)

Listing advice and primary threats

The listing advice for the Christmas Island Spleenwort details the primary threats as loss of habitat through clearing of native vegetation in relation to mining and construction, associated weed infestation, unauthorised collecting of specimens and disturbance by fire (Butz 2004).

Presence/absence of species

The Christmas Island Spleenwort is listed as Critically Endangered. It is only known from Christmas Island and as of 2004 (DotE) is only found in five locations on the island. It grows on limestone rock crevices located at cliff tops and terraces that are typically up to 15 metres in width and in closed and semi deciduous forest beneath or near *Ficus microcarpa.*

The combined population is estimated at less than 300 individuals (DNP 2014).

The Christmas Island Spleenwort was not observed along or in the vicinity of any of the exploration drill lines during the surveys completed between November 2015 and June 2016.

Importance of the exploration areas for the species

The Christmas Island Spleenwort is potentially found in limestone rock crevices at between 110 and 225 metres elevation. Areas of rainforest that may include such habitats are located in the south and east of the island.

The proposed exploration drill lines are located within areas of tall evergreen and semi deciduous forest and well developed areas of secondary forest habitats located on the upper terraces of the island. These areas, as demonstrated by the results of the recent surveys, do not provide suitable habitat for the species.

Potential Impacts due to the proposed action

The proposed exploration drill lines do not occur near to any known locations of the species based on the results of the most recent R2R 2015 and 2016 surveys and IWS (DNP 2013, 2015), neither is the proposed exploration to be completed in habitat likely to support the species.

No direct or indirect impacts will occur to the Christmas Island Spleenwort as a result of the proposed exploration works.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.3.3 Pneumatopteris truncata

Listing advice and primary threats

The conservation advice for *Pneumatopteris truncata* details the primary threats as loss of habitat through clearing of native vegetation in relation to mining and construction, associated weed infestation, unauthorised collecting of specimens and disturbance by fire (C’wealth 2014e).

Presence/absence of species

The *Pneumatopteris truncata* is listed as Critically Endangered, it has been observed at two sites on Christmas Island and has fragmented distribution over Asia and Malaysia. It grows in permanently moist sites in semi-deciduous forest between 50m and 140m elevation.

The combined population is estimated at less than 45 mature individuals (DNP 2014).

Pneumatopteris truncata was not observed along any of the exploration drill lines during the surveys completed between November 2015 and June 2016.

Importance of the exploration areas for the species

Pneumatopteris truncata is potentially found in permanently moist sites in semi deciduous forest between 50m and 140m elevation. None of the exploration drill lines, which are located in areas of tall evergreen forest and semi-deciduous forest, comprise habitats that may be suitable for the *Pneumatopteris truncata.*

Potential Impacts due to the proposed action

There will be no direct and indirect impacts due to the proposed action.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.4 Reptiles

3.4.4.1 Lepidodactylus listeri (Christmas Island (Lister's) gecko)

Listing and primary threats

The listing advice for the Christmas Island (Lister's) gecko details the primary threats as loss of habitat due to the clearing of native vegetation for mining, predation by feral cats and other invasive species, super-colony infestation of YCA and reduction of preferred food sources (by competition from YCA) (Cogger 2006).

Presence/absence of species

The Christmas Island (Lister's) gecko is listed as Critically Endangered, has not been observed in the wild since 2012 and is only known to exist in captive breeding programmes. It has been significantly impacted by the super-colonies of YCA.

The species was last sighted in Egeria Point and North West point in 2012.

The 2015 and 2016 surveys included the use of pit traps, spotlight and diurnal searches at locations in the vicinity of the proposed exploration drill lines to record any fauna activity including the Christmas Island (Lister's) gecko. Daily inspections of the pit traps over a seven day period and the results of the spotlight and diurnal searches completed by an experienced zoologist provided no evidence that the Christmas Island gecko was present in or in the vicinity of the proposed exploration drill lines.

Importance of the exploration areas for the species

The Christmas Island gecko was last observed in the wild four years ago at the western end of the island at Egeria Point and NW point. These locations are approximately between 15km to 20km west of the locations where the proposed exploration programme is to be completed. Whilst the proposed exploration drill lines are located within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest, the location of the last sightings indicate that the species is highly unlikely to be found in the proposed exploration area.

Potential Impacts due to the proposed action

No direct or indirect impacts are anticipated as the species is considered extinct in the wild and the last known sighting occurred at distance of 15km or more away from the areas of the proposed exploration drilling.

Proposed mitigation measures

The (inherent) risk to this species is considered "Negligible" and no specific management or mitigation measures are required.

3.4.4.2 Cryptobelpharus egeriae (Christmas Island blue-tailed skink)

Listing and primary threats

The conservation advice for the Christmas Island blue-tailed skink details the primary threats as loss of habitat due to the clearing of native vegetation for mining, predation by feral cats and other invasive species, super-colony infestation of YCA and reduction of preferred food sources (by competition from YCA) (C'wealth 2004).

Presence/absence of species

The Christmas Island blue-tailed skink which is listed as Critically Endangered, has not been observed in the wild since 2012 and is only known to exist in captive breeding programmes. The species has been significantly impacted by the super-colonies of YCA.

The species was last sighted in Egeria Point in 2012.

The 2015 and 2016 surveys included the use of pit traps, spotlight and diurnal searches at locations in the vicinity of the proposed exploration drill lines to record any fauna activity including the Christmas Island blue-tailed skink. Daily inspections of the pit traps over a seven day period and the results of the spotlight and diurnal searches by an experienced zoologist provided no evidence that the Christmas Island blue-tailed skink was present in or in the vicinity of the proposed exploration drill lines.

Importance of the exploration areas for the species

The Christmas Island blue-tailed skink was last observed in the wild four years ago at the western end of the island at Egeria Point. This location is approximately between 15km to 20km west of the locations where the proposed exploration programme is to be completed. Whilst the proposed exploration drill lines are located within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest, the location of the last sightings indicate that the species will not be found in the proposed exploration area.

Potential Impacts due to the proposed action

No direct or indirect impacts are anticipated as the species is considered extinct in the wild and the last known sighting occurred at distance of 15km or more away from the areas of the proposed exploration drilling.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.4.3 Emoia nativitatis (Christmas Island forest skink)

Listing and primary threats

The conservation advice for the Christmas Island forest skink details the primary threats as loss of habitat due to the clearing of native vegetation for mining, predation by feral cats and other invasive species, super-colony infestation of YCA and reduction of preferred food sources (by competition from YCA) (C’wealth 2014c)

Presence/absence of species

The Christmas Island forest skink is listed as Critically Endangered and has not been observed in the wild since 2010. The species has been significantly impacted by the super-colonies of YCA.

The species was last sighted in Egeria Point in 2010.

The 2015 and 2016 surveys included the use of pit traps, spotlight and diurnal searches at locations in the vicinity of the proposed exploration drill lines to record any fauna activity including the Christmas Island forest skink. Daily inspections of the pit traps over a seven day period and the results of the spotlight and diurnal searches by an experienced zoologist provided no evidence that the Christmas Island forest skink was present in or in the vicinity of the proposed exploration drill lines.

Importance of the exploration areas for the species

The Christmas Island forest skink was last observed in the wild four years ago at the western end of the island at Egeria Point. This location is approximately between 15km to 20km west of the locations where the proposed exploration programme is to be completed. Whilst the proposed exploration drill lines are located within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest, the location of the last sightings indicate that the species will not be found in the proposed exploration area.

Potential Impacts due to the proposed action

No direct or indirect impacts are anticipated as the species is considered extinct in the wild and the last known sighting occurred at distance of 15km or more away from the areas of the proposed exploration drilling.

Proposed mitigation measures

The (inherent) risk to this species is considered “Negligible” and no specific management or mitigation measures are required.

3.4.4.4 Cyrtodactylus sadleiri (Christmas Island giant gecko)

Listing advice and primary threats

The giant gecko was unlisted, until 2014, and considered common across the Island. However, surveys indicating a possible decline of the species led to the listing of this species as ‘endangered’ in 2014. The conservation advice for the Christmas Island giant gecko details the primary threats as loss of habitat due to the clearing of native vegetation for mining, predation by feral cats and other invasive species, super-colony infestation of YCA and reduction of preferred food sources (by competition from YCA) (C’wealth 2014b).

Presence/absence of species

The endemic Christmas Island giant gecko (*Cyrtodactylus sadleiri*) is listed as Endangered, is widespread across Christmas Island, with densities found to be highest in the central plateau rainforest and along terrace scree slopes. An island-wide population study has not yet been completed (Wynn, pers comm). Whilst the Island Wide Survey does have records from the use of Ink Cards, the survey is not designed to be a valid indicator of presence/absence nor sufficient to calculate abundance. Giant geckos have previously been recorded returning to cleared land and revegetated sites (Department of the Environment, 2014).

The Christmas Island giant gecko was observed in the general vicinity of proposed exploration drill lines 3 to 5, 11 to 15, 25, 26, 33, 36, 58, 64 to 66 and 71 during surveys completed between March and June 2016 by R2R.

The R2R 2016 surveys included the use of pit traps, spotlight transects and diurnal searches completed by experienced fauna specialists at locations in the vicinity of the proposed exploration drill lines to record any fauna activity including the Christmas Island giant gecko. The methodology for the nocturnal spotlight transects was designed to enable quantitate estimates of abundance and provide a valuable new source of information on giant gecko distribution, abundance and provide data for the first time to estimate the possible island wide population.

Importance of the exploration areas for the species

The Christmas Island giant gecko is most commonly found perched on buttress trunks, branches of small trees, vines, leaves, and limestone pinnacles. Trees with large buttress roots, low branches, vines, epiphytes or flaky bark are the preferred choice of habitat for giant geckos, over those trees with thin, isolated trunks with little shelter.

The exploration drill lines are located in areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest with crevices and hollows that may be considered suitable habitat for the giant gecko.

Potential Impacts due to the proposed action

Exploration lines with high giant gecko abundance have been removed from the program in the planning of this proposed action.

No giant geckos were observed along or in the vicinity of proposed exploration drill lines 1, 2, 6, 16, 17, 20 to 24, 35, 50 to 57, 59, 60, 61, 63, 67, 69 and 70 and so no impact is anticipated along these lines.

R2R surveys (2016) indicate low abundance in proposed exploration drill lines 3 to 5, 11 to 15, 25, 26, 33, 36, 58, 64 to 66 and 71.

The analysis of the giant gecko survey data showed that the abundance could be split into four zones across the eastern seaboard of Christmas Island (refer Figure 6). Surveys showed that there were very high densities in the north-east part of the Island (i.e. Phosphate Hill zone), with a reduction in density moving south. The South Point zone had very low abundance with many areas having no geckos recorded. The results of this assessment are presented in Table 4.

Table 4. Giant gecko population density estimates

Zone	Drill Lines	Density estimate / geckos per ha	S.E.	95% Confidence Interval
Phosphate Hill	33, 36, 64 to 66, 71	31.7	7.9	21.2 – 53.7
Western sites	11 to 15, 58	19.2	10.5	5.8 – 63.6
Eastern sites	25, 26	3.5	2.1	0.99 – 12.7
South Point*	3 to 5	4.5	3.8	3.8 - 32

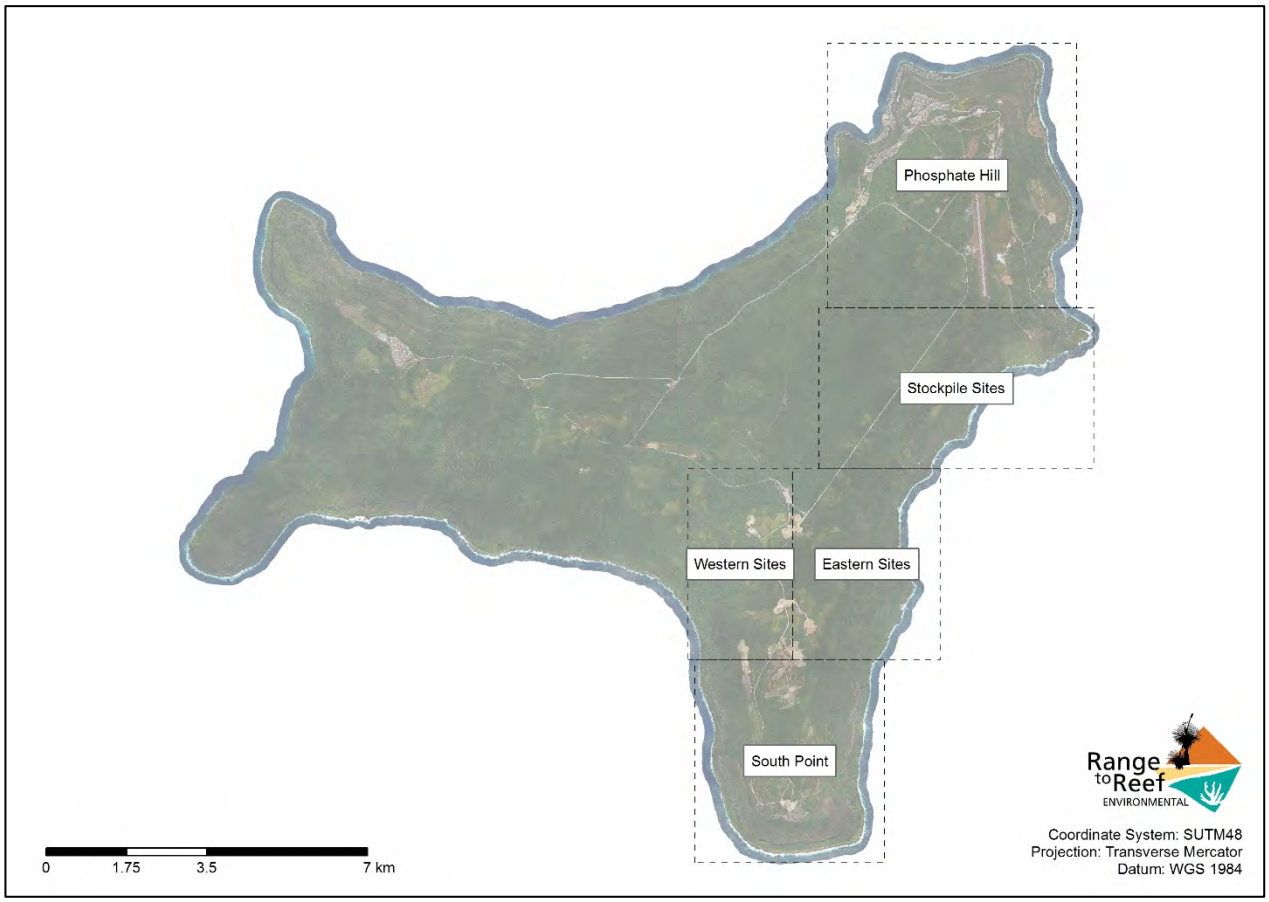

Figure 6. Stratified zones for giant gecko abundance estimates for the giant gecko surveys

The population density estimates for these zones have been used to calculate a mean and a range (i.e. upper and lower at the 95% Confidence Interval) of giant geckos that would be expected to be present along these 17 proposed exploration drill lines (lines 3 to 5, 11 to 15, 25, 26, 33, 36, 58, 64 to 66 and 71). Using these density estimates, it is predicted that the number of giant geckos that may be present along the footprint of the proposed exploration drill lines will vary between 0 and 4 geckos /line (based on the mean). Full details with respect to each exploration drill line are presented in Table 5.

Whilst there are some limitations to undertaking an Island wide giant gecko population estimate, the R2R surveys provide valuable quantitative data on giant gecko abundance that can inform an initial estimate. Based on the abundance data and on the area of the Island that is vegetated (i.e. excluding 'coastal fringe' and 'not vegetated'), an estimate of the Island wide population is put between 202,000 and 455,000 with a mean of 303,000 individuals (Solais Geoinformatics, unpublished 2016). The main limitations to the above estimate are:

- Surveys have been along the eastern side of the Island and no sampling was undertaken in the western side of the Island; and
- Some areas had a high variability in abundance between replicates which reduces confidence levels.

Table 5

Notes on surveys;

The R2R giant gecko surveys involved:

- 39 survey sites in both primary closed evergreen/secondary and semi-deciduous forests;
- 3 replicates were undertaken (i.e. 3 nights sampled for each transect with a total of 95 transects) for the majority of sites;
- Transects were timed;
- For each gecko record a distance (from transect line) and height above ground level was recorded to enable the volume of space surveyed to be calculated; and
- An analysis of the results for observer bias (control charts) with the most proficient observer surveying every site.

Table 5. Giant gecko Population Estimates for the Proposed Exploration Drill Line

Drill Line no.	Gecko abundance/ha from Island zone*			Length of line	Proposed clearing Width	Disturbance Area	No of geckos predicted on clearing footprint for each exploration line		
	Mean	Lower	Upper	(m)	(m)	(ha)	Based on mean	Lower	Upper
3	4.5	3.8	32.0	84	5	0.042	0.19	0.16	1.34
4	4.5	3.8	32.0	199	5	0.100	0.45	0.38	3.19
5	4.5	3.8	32.0	178	5	0.089	0.40	0.34	2.85
11	19.2	5.8	63.6	192	5	0.096	1.84	0.56	6.09
12	19.2	5.8	63.6	146	5	0.073	1.40	0.42	4.65
13	19.2	5.8	63.6	41	5	0.021	0.40	0.12	1.31
14	19.2	5.8	63.6	33	5	0.017	0.32	0.10	1.06
15	19.2	5.8	63.6	170	5	0.085	1.63	0.49	5.40
25	3.5	1.0	12.7	150	5	0.075	0.26	0.07	0.95
26	3.5	1.0	12.7	182	5	0.091	0.32	0.09	1.15
33	31.7	21.2	53.7	199	5	0.100	3.16	2.11	5.35
36	31.7	21.2	53.7	102	5	0.051	1.61	1.08	2.73
58	19.2	5.8	63.6	175	5	0.087	1.68	0.51	5.56
64	31.7	21.2	53.7	109	5	0.054	1.72	1.15	2.92
65	31.7	21.2	53.7	253	5	0.126	4.00	2.68	6.78
66	31.7	21.2	53.7	127	5	0.063	2.01	1.35	3.41
71	31.7	21.2	53.7	202	5	0.101	3.20	2.14	5.42
TOTALS						**1.270**	**24.6**	**13.7**	**60.2**

* estimates from R2R surveys

Proposed mitigation measures

Where no giant geckos were observed along or in the vicinity of exploration lines during the R2R 2016 surveys the (inherent) risk to the species as a result of the proposed action has been assessed as "Negligible" and no further management or mitigation measures are recommended. (i.e. drill lines 1, 2, 6, 16, 17, 20 to 24, 35, 50 to 57, 59, 60, 61, 63, 67, 69 and 70).

Where giant geckos have been recorded along or in the vicinity of exploration lines 3 to 5, 11 to 15, 25, 26, 33, 36, 58, 64 to 66 and 71 mitigation measures are recommended. All of these lines have low abundance of geckos and, based on abundance estimates and area of clearing footprint, it is

anticipated that between 0 and 4 giant geckos are likely to be present along the exploration lines. The inherent risk of impact on the giant geckos as a result of the proposed action is Low, however in the context of the Island population (303,000) this is a very low proportion and insignificant.

Despite the low risk, in order to further mitigate the impacts of the proposed action on this species, a management plan has been developed by staff experienced with giant geckos. This management plan outlines a process to capture and relocate individual geckos immediately prior to clearing to minimise the potential for death or injury during clearing operations.

The (residual) risk to this species following implementation of the Giant Gecko Management Plan along these exploration lines is considered “Negligible” and no further management or mitigation measures are required.

In addition, the risk of impacts on the species will be mitigated by the temporary nature of the proposed exploration works, the limited extent of the clearing required to provide access for the works and the avoidance of large trees where geckos were often observed.

Indirect impacts will not be experienced due to the limited and localised disturbance of foraging habitats and the rapid return of vegetation cover on the cleared access tracks (refer Figure 7).

Table 6 presents a summary of the findings of the risk assessment completed for the proposed exploration programme.

Table 6. Summary of Risk Assessment and Management Actions for Listed Threatened Species

Birds

Species	Listing or Status	Activity	Aspect	Impact	Inherent Risk			Management Actions or Mitigation	Residual Risk			Overall Risk
					Likelihood	Consequence	Risk		Likelihood	Consequence	Risk	
Accipiter hiogaster natalis Christmas Island Goshawk	EN	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Chalcophaps indica natalis Emerald Dove (Christmas Island)	EN	Clearing for exploration	Loss of habitat	Loss of vegetation	Unlikely	Insignificant	**Negligible**	No management action required.				
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird	V	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Ninox natalis Christmas Island Hawk-Owl	V	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Papasula abbotti Abbott's booby	EN	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Minor	**Negligible**	No management action required.				
Phaethon lepturus fulvus White-tailed Tropicbird (Christmas Island)	EN	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Minor	**Negligible**	No management action required.				
Turdus poliocephalus erythropleurus Island Thrush (Christmas Island)	EN	Clearing for exploration	Loss of habitat	Loss of vegetation	Possible	Insignificant	**Negligible**	No management action required.				

Mammals

Species	Listing or Status	Activity	Aspect	Impact	Inherent Risk			Management Actions or Mitigation	Residual Risk			Overall Risk
					Likelihood	Consequence	Risk		Likelihood	Consequence	Risk	
Crocidura attenuata trichura Christmas Island Shrew	EN	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Pipistrellus murrayi Christmas Island Pipistrelle	CE	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Pteropus natalis Christmas Island flying-fox	CE	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				

Plants

Species	Listing or Status	Activity	Aspect	Impact	Inherent Risk			Management Actions or Mitigation	Residual Risk			Overall Risk
					Likelihood	Consequence	Risk		Likelihood	Consequence	Risk	
Tectaria devexa var. minor	E	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Asplenium listeri Christmas Island Spleenwort	CE	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Pneumatopteris truncata	CE	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				

Reptiles

Species	Listing or Status	Activity	Aspect	Impact	Inherent Risk			Management Actions or Mitigation	Residual Risk			Overall Risk
					Likelihood	Consequence	Risk		Likelihood	Consequence	Risk	
Lepidodactylus listeri Christmas Island Gecko, Lister's gecko	CE	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Typhlops exocoeti Christmas Island blind snake, Pink Blind snake	V	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Cryptoblepharus egeriae Christmas Island blue-tailed skink	CE	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				
Cyrtodactylus sadleiri Christmas Island giant gecko	E	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	Majority of proposed exploration drill lines. No management action required.				
					Possible	Moderate	**Low**	**Where exploration drilling is to be completed within 100 m of known records of gecko locations based on the latest 2016 survey data and IWS (Director National Parks 2013 and 2015) the Giant Gecko Management Plan (referral Attachment D) is to be implemented.**	Rare	Insignificant	**Neg**	**Negligible**
Emoia nativitatis Christmas Island forest skink	CE	Clearing for exploration	Loss of habitat	Loss of vegetation	Rare	Insignificant	**Negligible**	No management action required.				

3.5 Listed Migratory Species

Six migratory bird species were identified using the DotE search tool within a 1 km radius of the proposed exploration drill lines. Two species (i.e. Abbott's booby and Christmas Island Frigatebird) are listed threatened species and have already been considered in Section 3.4.

The four remaining migratory species are considered in Table 7. Surveys have not recorded these species specifically using the areas around or adjacent to the proposed exploration drill lines (i.e. for nesting). The risk of these species being impacted by the project is considered negligible based on the following factors:

- There is no habitat within the proposed exploration drill lines that is suitable or meets the habitat requirements for these species; and
- The proposed exploration drill lines and adjacent areas are not important for feeding, foraging nesting or resting.

Table 7. Summary of Risk Assessment for Migratory species

Species	Activity	Aspect	Impact	Inherent Risk			Management Actions or Mitigation
				Likelihood	Consequence	Risk	
Fregata minor Great Frigatebird, Greater Frigatebird	Clearing for exploration	NA	NA	Rare	Insignificant	**Negligible**	No management action required.
Phaethon rubricauda Red Tailed Tropicbird	Clearing for exploration	NA	NA	NA	Insignificant	**Negligible**	No management action required.
Sula leucogaster Brown Booby	Clearing for exploration	NA	NA	Rare	Insignificant	**Negligible**	No management action required.
Sula sula Red-Footed Booby	Clearing for exploration	NA	NA	Rare	Insignificant	**Negligible**	No management action required.

As the migratory species listed above were not observed along or in the vicinity of the exploration drill lines and the proposed action will not have an impact on habitat used by the species, there will be no direct or indirect impacts as a result of the proposed action.

3.6 Potential Impacts to Commonwealth Land

The proposed action will be undertaken on Commonwealth land and has the potential to impact ecosystems and the natural values of Commonwealth land. The impacts are assessed in the following sections with respect to severity (scale, intensity, duration, timing/frequency) and significance.

3.6.1 Impact Severity

Scale

Historically, exploration has been undertaken along a series of gridded lines, separated by distances of between 25m to 100m, across the majority of Christmas Island over the course of its mining history. This is evident from the laser digital elevation mapping data that reveals old exploration and other landforms through the forest (refer Figure 1).

The PRL proposed exploration works have been planned to use old exploration tracks to minimise disturbance and will require re-clearing of a series of 5 m wide temporary access tracks to provide access for and permit completion of the proposed exploration drilling programme. The width of the access tracks has been reduced to provide the minimum required width to allow for safe access and completion of the drilling work and hence minimise the clearing required (refer Figure 4). It should be noted that the width of the access tracks is considerably less than for previous exploration programmes.

The length and number of exploration drill lines and hence the extent of the clearing has been reduced through the adoption of the following measures to avoid or minimise environmental impacts:

- Desktop assessment of key environmental values, listed threatened species and keystone species;
- Environmental surveys completed in 2015 and 2016 of vegetation, habitats and fauna along the proposed exploration drill lines;
- PRL has cross referenced past exploration data with recent drilling activity to verify the accuracy of the data. Where possible exploration lines have been deleted if existing data has been found to be adequate and suitable for the current mine plan development;
- Following further flora and fauna surveys PRL has modified the exploration programme to remove exploration lines that are within 30 m of known Abbot's Booby and 50m of *Tectaria devexa var. minor* (as recommended by the DER and based on the results of the 2015 IWS and 2016 survey data); and
- In accordance with the conditions of native vegetation clearing permits CPS6920/1 and CPS7040/1 a management plan has been developed to minimise the impacts of clearing on giant geckos. The locations have been determined based on the results of the 2013 and 2015 IWS and 2015/2016 fauna surveys.

Based on the above steps the total area of native vegetation to be cleared for the exploration programme is 6.83 ha of previously cleared vegetation.

The impacts are very small in the context of Christmas Island and these habitats. In accordance with Significant Impact Guidelines 1.2 the impact in terms of scale is considered to be small scale and localised.

Intensity

The proposed clearing to provide temporary access for exploration will involve re-clearing the vegetation on access tracks that were previously cleared by former exploration operations. As above the access tracks have been reduced to a width of 5m, the minimum required to provide safe access for the drilling equipment and completion of the work. The clearing prescription has been developed to avoid impacts especially to large established trees and involves only the clearing of understorey and small trees (refer Figure 4).

With respect to the Western Australian native vegetation clearing process, as access is only required for a short period of time to complete the limited exploration works, the tracks are considered temporary. In accordance with the requirements of the native vegetation clearing process, the areas will be allowed to rehabilitate on completion of the works following respreading of cleared vegetation. It should be noted that there will be no formal rehabilitation of the temporary access tracks.

Christmas Island has high rainfall that leads to rapid growth and recovery of vegetation. Experience shows that following this type of track clearing, the forest rapidly regenerates naturally and within a year there would be expected to be significant vegetation cover over the tracks (refer Figure 7).

Exploration Track 6 months' post clearing: note cover of vegetation establishing on track

Exploration Track 1-year post clearing (on Mining Lease 70/1A in secondary forest).

Figure 7. Examples of revegetation post exploration 6 months to 2 years

An operational procedure for clearing (refer Section 1.1.2) has been developed to minimise the potential impact of the proposed exploration drilling by:

- Clearly marking the clearing boundaries using flagging tape prior to the works commencing;
- Providing pre work briefings to all staff involved in the clearing and exploration works;
- Providing supervision of the clearing to ensure all works are completed in accordance with the procedure;
- Using spotters to remove robber crabs and other fauna disturbed by the works;
- Replacing the cleared vegetation back over the exploration lines on completion of the drilling work and survey of drill holes (as above);
- Not significantly disturbing the topsoil layer during clearing and exploration works (no excavation to be completed during the exploration works);
- Completing the works within a period of three months from the start of clearing;
- Avoiding large habitat and other trees where encountered along the exploration lines by deviating around them;
- Felling or cutting logs that lie across the exploration lines so that access can be achieved without disturbing the adjacent vegetation; and
- Implementing the Christmas Island Phosphates Weed Management Plan (WMP) which includes the following management measures for exploration areas:
    - Implementation of CIP procedure ENV-SOP-026 Weed Management – Vehicle Hygiene.
    - An inspection in the first spring following clearing with follow-up control and monitoring at the discretion of the CIP environmental department.
    - Management of high priority weed species as identified by the WMP, including listed noxious weed species.

In accordance with Significant Impact Guidelines 1.2 the impact in terms of intensity is considered to be of low intensity.

Timing, duration and frequency

The clearing of native vegetation in relation to the exploration drilling is a one off operation and is scheduled to be completed between October 2016 and December 2017 depending on receipt of approvals. The exact timing of the clearing of native vegetation will be dependent on the following factors:

- The 2016 to 2017 wet season: access to the areas to be cleared will not be possible during the wet season; and
- The Red crab migration: Clearing will not occur during the annual red crab migration to avoid any impacts on the crabs as they leave the forest. (Traffic movements on the island as a whole are restricted during this time).

It is anticipated that the clearing will take approximately four weeks to complete and that the exploration programme should be completed within a period of three months. On completion of the works the cleared vegetation will be replaced over the access tracks to minimise erosion, assist rehabilitation and prevent unauthorised access to the rain forest.

The proposed work (clearing and drilling) is a one off action and will not be repeated. The access tracks are not permanent and cleared vegetation will be re-spread across the tracks on completion of the works to promote revegetation (refer Figure 7) and prevent unauthorised access.

In accordance with Significant Impact Guidelines 1.2 the impact in terms of timing, duration and frequency is considered to be one-off, short term and reversible.

Table 8 summarise the key elements in respect to the severity of the proposed action. The proposed action is considered. This assessment concludes that impacts on Commonwealth land will be “Minor” as defined in Significant Impact Guidelines 1.2 (SEWPaC 2013).

Table 8 Summary of the *Severity* of the Proposed Action

Consideration of the Severity of Impact	Conclusion	Comments
Scale	One-off, small scale and localised	• 44 lines, each individually ranging in area between 0.024 ha and 0.477 ha. • Total clearing of vegetation 6.83ha • Lines geographically separated and distributed
Intensity	Low intensity	• All lines have been previously cleared • Majority of vegetation cleared will be ground cover and understorey (large trees will be avoided) • Earth disturbance will be the minimum needed to allow access by 4WD vehicle (i.e. no cut and fill)
Timing, duration and frequency	Short term and reversible	• Temporary tracks only • Drilling operations likely to be completed within 3 months of clearing • Cleared vegetation will be pulled back over tracks to assist areas revegetate naturally • On Christmas Island there is rapid recovery of vegetation due to tropical conditions • Re-colonisation by fauna (i.e. crabs and birds) is likely to be rapid once activity is completed on the tracks.

3.6.2 Impact Significance

This section considers the potential *significance* of impacts to Commonwealth land. Table 9 below considers and summarises the potential impacts against recommended considerations as set out in the Significant Impact Guidelines 1.2 (SEWPaC 2013).

Table 9. Significant Impact Assessment

Significant Impact Guidelines 1.2 (SEWPaC 2013)		Assessment of the Proposed Action
Issue	***Action may have a Possible Impact by***	
Landscape and soils	• *Substantially altering natural landscape features* • *Causing subsidence, instability or substantial erosion* • *Involve medium or large scale excavation of soil or minerals.*	The proposed action will result in the temporary clearing of up to 6.73 ha of native vegetation. The work will be completed in accordance with an operational procedure for native vegetation clearing that includes the following key measures to minimise potential impacts on the landscape and soils: • No excavation will be undertaken; • Whilst the works are to be completed in the dry season, site drainage measures are to be implemented in accordance with PRL procedures to minimise runoff and erosion after periods of rainfall; • Cleared vegetation will be respread across the cleared area on completion of works; and • Implementation of ENV-SOP-026 Weed Management – Vehicle Hygiene. Following completion of the works, vegetation is anticipated to quickly re-establish along the access tracks with full coverage being achieved in less than 2 years (refer Figure 7). The action is considered unlikely to have a significant environmental impact on the landscape and soils.
Impacts on coastal landscapes and processes	• *Alter coastal processes, including wave action, sediment movement or accretion, or water circulation patterns* • *Permanently alter tidal patterns, water flows or water quality in estuaries* • *Reduce biological diversity or change species composition in estuaries, or* • *Extract large volumes of sand or substantially destabilise sand dunes?*	The exploration drill lines are all approximately 0.5km or more from the coast and there will be no direct impacts on coastal estuaries and processes. Due to the small scale and temporary nature of the disturbance, it is unlikely that there will be any indirect impact as a result of erosion of hydrological changes.

Impacts on ocean forms, ocean process and ocean life	• *Reduce biological diversity or change species composition on reefs, seamounts or in other sensitive marine environments* • *Alter water circulation patterns by modification of existing landforms or the addition of artificial reefs or other large structures* • *Substantially damage or modify large areas of the seafloor or ocean habitat, such as sea grass* • *Release oil, fuel or other toxic substances into the marine environment in sufficient quantity to kill larger marine animals or alter ecosystem processes, or* • *Release large quantities of sewage or other waste into the marine environment?*	All exploration drill lines are distant from the ocean. No impacts through discharge (runoff, hydrocarbons, waste water etc) into the ocean will occur and existing operational procedures will be implemented to prevent any such occurrences. The action is considered unlikely to have any environmental impact on the marine environment.
Impacts on water resources	• *Measurably reducing the quantity, quality or availability of surface or ground water.* • *Channelise, divert or impound rivers or creeks.* • *Measurably alter water tables.*	Christmas Island geomorphology is characterised by a lack of surface drainage. The majority of rainfall mostly infiltrates, is utilised by plants and contributes to soil water stores or recharges to groundwater. There is no significant surface drainage network. Christmas Island's soils are generally highly permeable and there is consequently little runoff or erosion (Hollingsworth, 2003). As a result of the small scale and dispersed nature of the clearing, and low surface and sub-surface impact of the drilling works, the action is considered unlikely have a significant environmental impact on surface and ground water resources.
Pollutants, chemicals and toxic substances	• *Generate smoke, fumes, chemicals, nutrients, or other pollutants which will substantially reduce local air quality or water quality* • *Result in the release, leakage, spillage, or explosion of flammable, explosive, toxic, radioactive, carcinogenic, or mutagenic substances, through use, storage, transport, or disposal* • *Increase atmospheric concentrations of gases which will contribute to the greenhouse effect or ozone damage, or* • *Substantially disturb contaminated or acid-sulfate soils?*	All fuels and chemicals will be used in accordance with established procedures for the operation of plant by PRL across the island. No drilling fluids are necessary for this operation. No fuels or chemicals will be stored on site during the works and refuelling will take place offsite in approved operational areas. Spill kits will be located on site for use in accordance with the EMP for minor spills should they occur. Emissions that will be released are considered typical for the operation of drilling equipment. There are no known occurrences of acid sulfate soils on Christmas Island or within the vicinity of the exploration drill lines that are the focus of the proposed action. The limestone would buffer any such soils and reduce any possible impacts. The action will have no environmental impact as a result of pollution.

Impact on plants	• *Involve large or medium scale native vegetation clearing.* • *Involve any clearance of any vegetation contain listed threatened species which is likely to result in a long-term decline in population of which threatens the viability the species.* • *Introduce potentially invasive species.* • *Involve large scale controlled burning.*	The total area of clearing is 6.83 ha (of which 6.73 ha is native vegetation). All of this vegetation is considered to be regrowth (vegetation that has established following exploration prior to 1976). The clearing has been assessed by the Department of Environment and Regulation (DER) and clearing permits issued in accordance with the *Environmental Protection Act 1986 (WA) (CI)*. The majority of the island's undisturbed vegetation and fauna habitats remain adequately protected within the Christmas Island National Park. A targeted survey for threatened species was undertaken along and in areas adjacent to the proposed exploration drill lines. The action has been modified to remove exploration drill lines in their entirety or partially where there is the potential to impact on listed threatened species. A minimum buffer of 50 m to known locations of listed threatened flora species (based on advice from DER, the 2013/2015 IWS and 2015 and 2016 environmental surveys) will be established. The action will have no impact on threatened flora. Weed management post action will be implemented in accordance with the CIP Weed Management Plan, PRL procedures and the EMP.
Impact on animals	• *Cause a long-term decrease in, or threaten the viability of, a native animal population or populations, through death, injury or other harm to individuals* • *Displace or substantially limit the movement or dispersal of native animal populations* • *Substantially reduce or fragment available habitat for native species;* • *Reduce or fragment available habitat for listed threatened species which is likely to displace a population, result in a long-term decline in a population, or threaten the viability of the species* • *Introduce exotic species which will substantially reduce habitat or resources for native species, or* • *Undertake large-scale controlled burning or any controlled burning in areas containing listed threatened species*	The final footprint for the proposed action and associated clearing of native vegetation has been determined through the implementation of an iterative risk assessment process to avoid threatened species and any critical habitats. The final area to be cleared is 6.83 ha. As the clearing is small scale, low impact and the vegetation will recover rapidly, the proposed action will not have a significant impact on fauna habitats. Risks to threatened fauna species are covered in detail in Section 3.4. Proposed mitigation strategies are proposed for the Christmas island giant gecko.
Impacts on peoples and communities	• *Substantially increase demand for, or reduce the availability of, community services or infrastructure which have direct or indirect impacts on the environment, including water supply, power supply, roads, waste disposal, and housing* • *Affect the health, safety, welfare or quality of life of the members of a community, through factors such as noise, odours, fumes, smoke, or other pollutants*	The exploration drill lines are located on the eastern seaboard of Christmas Island in UCL covered by Exploration Lease ECI 70/2. As the exploration drill lines are within and amongst areas of existing mine activity and active mining leases, access is only permitted by authorised members of PRL and associated companies. No residents will be displaced by these activities. No changes in staff numbers will result from the exploration so there will be no change in demand for community services or infrastructure.

	• *Cause physical dislocation of individuals or communities, or* • *Substantially change or diminish cultural identity, social organisation or community resources?*	Exploration drilling will not cause noise, odours, fumes, smoke or other pollutants to impact upon the community. Christmas Island's settled history and culture have arisen as a consequence of phosphate mining on the island so there will be no alteration to this as a consequence of further exploration. As a consequence of the location of the exploration lines the proposed action will have no impact on peoples and communities in the manner listed.
Impact on heritage	• *Permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures, contents, and objects) of a heritage place* • *Involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place* • *Involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place* • *Substantially diminish the heritage value of a heritage place for a community or group for which it is significant* • *Substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place, or* • *Substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site?*	Based on the output of the protected matters search tool and other searches there are no sites on the Australian Heritage List in the vicinity of the exploration drill lines and where the proposed exploration works are to be completed. The nearest (cultural) Commonwealth Heritage site is the South Point Settlement which is located approximately 3km from the nearest exploration drill line. No impact is anticipated on this site. The action overlaps the 'Christmas island Natural Areas' site which was listed under the Register of the Natural Estate. The values of this listing are addressed through assessments of the impacts to Commonwealth land. The action is considered unlikely to have a significant impact on cultural and heritage matters as listed.

3.6.3 Red Crabs

Listing advice and primary threats

Red crabs (*Gecarcoidea natalis*) are widespread and highly abundant across Christmas island (DNP 2013, 2015). The distribution and abundance of the Red crab population is believed to have been impacted by the YCA (EWG 2010). Other impacts are related to clearing of the forest in relation to mining and construction activities.

Presence/absence of species

Red crabs are the most numerous, widespread and ecologically important of the terrestrial crabs on Christmas Island. Figure 8 shows the general distribution of red crabs and the relative densities of burrows across the whole of the island. Recent estimates put the total red crab population on Christmas Island at between 45 and 50 million individuals (DNP 2014). The most recent Parks Australia surveys indicate that the red crab population has increased.

Importance of the exploration areas for the species

Red crab habitat includes the inland central plateau and the coastal terraces. Red crabs are considered a keystone species on Christmas Island's due to the important roles they fulfil on the island's ecology (Expert Working Group 2010). These roles include nutrient recycling, aeration of the soil (by burrowing) and determination of the unique structure and composition of the Christmas Island forest as a result of their grazing on seeds, seedlings and leaf litter.

The proposed exploration drill lines are located within areas of tall evergreen and semi-deciduous forest and well developed areas of secondary forest habitats which are suitable habitat for the red crab. R2R surveys indicate that whilst widespread, the red crabs were observed in relatively low densities along and in the vicinity of the proposed exploration drill lines.

Potential impacts due to the proposed action

Figure 8 presents information with respect to the estimated distribution of occupied red crab burrows (DNP 2016). The proposed exploration drill lines are located in areas where the following densities of burrows per 100m^2 are estimated:

- 0 to 20 occupied burrows per 100m^2: 1 to 6, 11 to 13, 20 to 26, 35, 36, 50 to 60, 63, 64, 66, 67 and 69 to 70.
- 21 to 50 occupied burrows per 100m^2: 10 to 17, 33, 34, 61 and 65.

With respect to the areas to be cleared to provide access for the proposed exploration drilling it is anticipated that between 3,474 and 18,241 (or less than 0.05%) of red crab burrows may be affected by the proposed action. The impacts are likely to include some mortality in the clearing operation, and temporary loss of habitat. Based on observations post similar exploration clearing on the Island, red crabs would be expected to recolonise the tracks following the completion of the proposed action and re-establish burrows in the disturbed areas. The impacts on red crab habitat is likely to be temporary in nature.

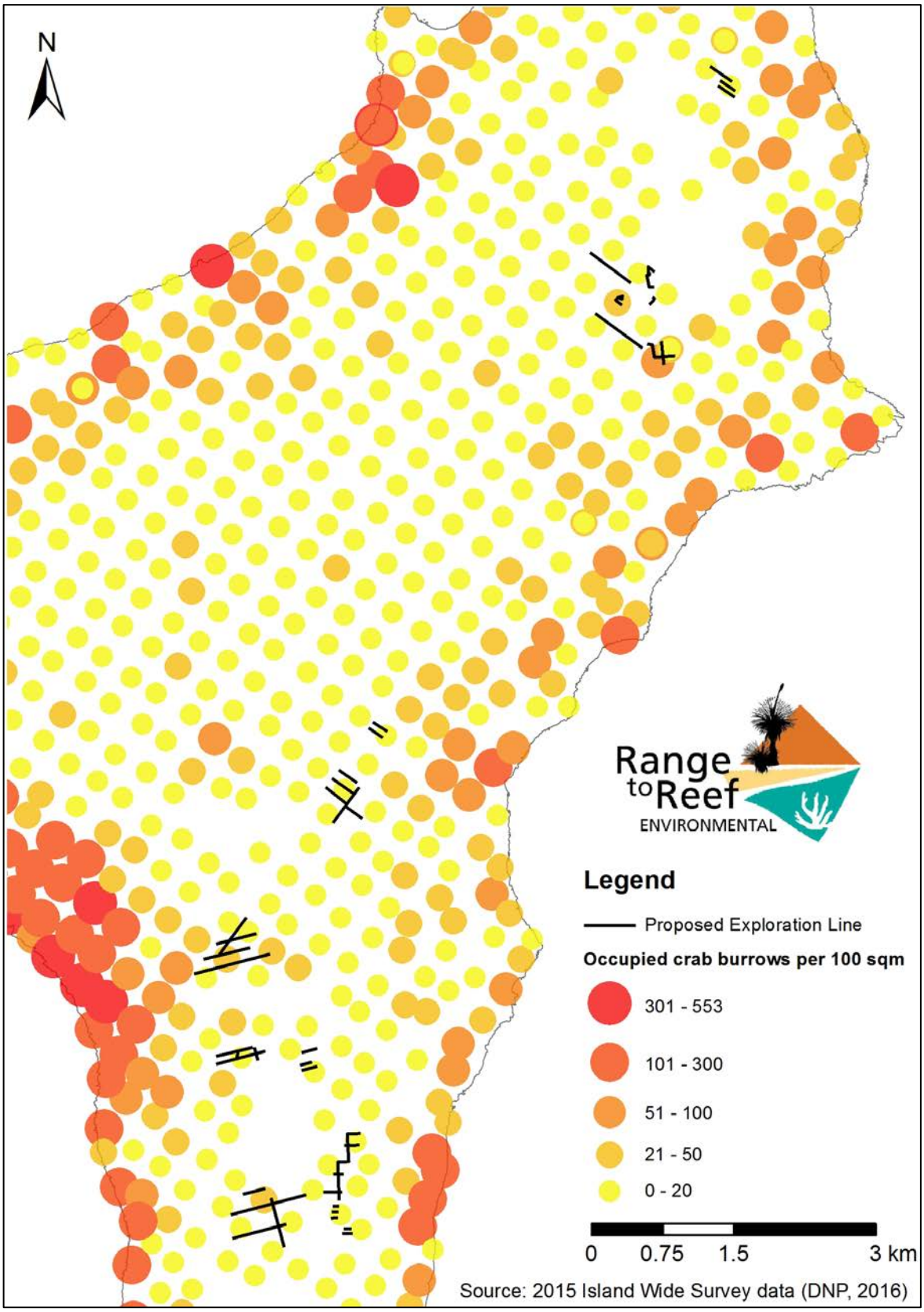

Figure 8. Red crab distribution map

Proposed mitigation measures

The impact of the proposed action is negligible and not significant in terms of the island wide population (estimated at between 45 and 50 million DNP 2014) of red crabs, the action is small scale, low intensity, is occurring on sites with relatively low density of occupied burrow, and is temporary with habitat likely to be recolonised by crabs after the action has been completed. The proposed action will be completed during the dry season and work will be suspended during the wet season to ensure no activities occur during the annual migration or when crabs are active.

The proposed action will be completed in accordance with the organisation's Environmental Management Plan (EMP). This plan outlines existing procedures and measures to minimise mortality during the red crab migration. These measures include using alternative routes when crabs are migrating, restricting vehicle movement at peak times (early mornings and evenings), monitoring of mortality, amending mining, clearing and road maintenance schedules to minimise risks, and encouraging car-pooling to minimise vehicle numbers. These measures are undertaken in close consultation with Parks Australia.

3.6.4 Conservation Significant Species

There are a number of other flora and fauna species that have been identified in the Draft Christmas Island Biodiversity Conservation Plan (DotE 2014) as being endemic or otherwise important to the Christmas Island ecosystem. Three species have not been considered here as they are distant to the exploration lines and/or the habitat conditions along the exploration lines do not exist to support the species. These include two mangrove species with specific habitat requirements only provided in the Hosnie's Spring area (*Bruguiera gymorhiza & Bruguiera sexangula*) and the Coastal skink (*Emoia atrocostata)* which is found in the intertidal zone.

Table 10. Potential Impacts on non-listed species which have special values

	Species	Common Name	Comment
Birds	*Zosterops natalis*	Christmas Island white-eye	The Christmas Island white-eye is endemic to Christmas Island but is not a listed threatened species. The white-eye is the most common bird on the island, is (a habitat generalist, is common, wide spread and occurs across the entire island). This species is likely to be found in the vicinity of the exploration works, mainly in the small areas that have some natural regeneration. It is highly mobile and very abundant in disturbed areas. The minor disturbance of vegetation used by this species is unlikely to have a significant impact on the general distribution and population of this species. **Conclusion: No impact due to the small area of suitable habitat that may be impacted, the widespread and abundant nature of this species and capacity to recolonise disturbed areas.**
	Ducula whartoni	Christmas Island Imperial Pigeon	This species is widespread across the Island and occupies mainly primary forest and some secondary regrowth. The species is mobile and is not expected to be affected by the track clearing works. **Conclusion: This species may occur in the exploration areas, however the habitat preferences and previous surveys suggest that it is unlikely to be common in the areas. The proposed activities will not impact this species.**
Crabs	*Discoplax celeste*	Blue crab	This crab is a terrestrial species requiring perennially wet/moist areas (i.e. swampy areas, streams and springs). There is no suitable habitat for blue crabs in the exploration areas. **Conclusion: No impact**
	Birgus latro	Robber Crab	Robber crabs are mobile, common and widely distributed in forest areas, sometimes venturing into disturbed areas (Note: no distribution map available). There is potential for this species to be found in the exploration areas. Robber crabs were observed in the majority of exploration areas during the 2016 surveys. The clearing procedure includes a requirement to remove Robber Crabs prior to clearing works being undertaken. **Conclusion: No impact.**

4 Conclusion

PRL is proposing to undertake an exploratory drilling programme to obtain accurate information on phosphate resources in UCL. The exploration drilling will require the establishment of temporary access tracks which are expected to rapidly regenerate after drilling is completed. The total area of native vegetation to be cleared to facilitate access is 6.73 ha.

The results of this risk assessment conclude the proposed action, if implemented with appropriate management and mitigation actions, is unlikely to have a significant impact on Matters of National Environmental Significance. The assessment also concludes that impacts on Commonwealth land will be "Minor" as defined in Significant Impact Guidelines 1.2 (SEWPaC 2013) and insignificant.

The impact of the proposed action is not likely to have a significant impact on the Matters of National Environmental Significance for the following reasons:

- The proposed action does not overlap with, or will have any impact on, Wetlands of International Significance, threatened Ecological Communities or Commonwealth Marine Areas.
- Surveys have been undertaken between November 2015 and June 2016 to provide up to date information on the presence and distribution of listed threatened species to accurately assess risks.
- The proposed action has subsequently been designed to avoid impacts to threatened species and any critical habitats of these species based on this information;
- Whilst there are a number of threatened species on Christmas Island that occur within the vicinity of the proposed action, impacts will be insignificant as a result of the small scale, temporary and low intensity nature of the proposed exploration works.
- Where potential for minor impacts has been identified (i.e. for the giant gecko), mitigation and management measures will be implemented to lower this risk.

In respect to the EPBC listed Christmas island giant gecko, the proposed exploration program has been amended to remove exploration drill lines where high abundance has been recorded to avoid the potential for impacts. By doing this the potential for impacts on this species are significantly reduced. There are, however, some proposed exploration drill lines where surveys have recorded very low numbers of giant geckos in the vicinity of the proposed clearing footprint. For these proposed exploration drill lines, the inherent risk of impact was assessed as 'Low' and mitigation strategies have been proposed to further reduce the risk of interaction with this species.

A Giant Gecko Management Plan (EPBC Referral-Attachment D) has been developed and will be implemented where exploration works are to be completed within 100 m of current records of giant gecko locations (based on the latest 2016 R2R survey data and IWS (DNP 2013 and 2015)). The Management Plan outlines processes to undertake surveys immediately prior to clearing operations by experienced fauna scientists to determine whether any giant geckos are located in the clearing footprint. If any individual geckos are located they will be captured and immediately moved a short but safe distance away from the clearing lines. This will be covered under a Part 13 EPBC Permit. Based on expert advice, the individuals are expected to be able to easily move back to the area after clearing. Based on abundance surveys, it is anticipated that the numbers of giant geckos likely to be encountered will be very low and in some cases none will be found on the exploration lines. However, by adopting this mitigation measure the residual risk of impact of the proposed action on the giant gecko will be reduced to a 'Negligible' level and be insignificant.

With respect to impacts on Commonwealth land, the proposed action is one off and small scale, of low intensity, short term and temporary in nature. It will occur on areas that have been previously cleared (prior to 1976), and a range of management measures will be implemented to minimise general environmental impacts in, and adjacent to, the action. Based on past experience on the Island, vegetation is likely to recover naturally and be quickly recolonised by birds, reptiles and crabs. While there will some localised impacts to red crabs these are negligible in the context of the large Island population and recolonization of the tracks is likely after the exploration activities are completed. The

proposed action will be timed to avoid the red crab migration to minimise localised impacts on red crabs. The risk assessment of the proposed action determined that the proposed exploration works will not have a significant impact on landscape and soils, coastal landscapes and processes, ocean forms, processes and life, water resources, plants, animals, peoples and communities and culture and heritage. In addition, the action will not introduce any pollutants, chemicals and toxic substances to the environment.

The likely impacts on Commonwealth land therefore would be considered as "*Minor*" as defined in the Significant impact guidelines 1.2 (i.e. a *Minor* impact is one that has two or more of the following characteristics*: short term/reversible; small-scale/localised; low intensity*), and insignificant.

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