Tropicana Gold Project

Conservation Significant Species Report

Prepared for:

TROPICANA JOINT VENTURE

ANGLOGOLD ASHANTI AUSTRALIA

INDEPENDENCE GROUP NL

September 2009

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CONSERVATION SIGNIFICANT SPECIES REPORT

SEPTEMBER 2009

PREPARED FOR

TROPICANA JOINT VENTURE

This report has been prepared for **Tropicana Joint Venture** on the basis of instructions and information provided by **Tropicana Joint Venture** and therefore may be subject to qualifications which are not expressed.

This report has been checked and released for transmittal to **Tropicana Joint Venture**.

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1. EXECUTIVE SUMMARY

The Tropicana Joint Venture (Tropicana JV) plans to develop the Tropicana Gold Project (TGP), an open pit gold mining operation, located approximately 330 kilometres east north-east of Kalgoorlie on the western edge of the Great Victoria Desert in Western Australia (Figure 1). The Tropicana JV is between AngloGold Ashanti Australia Limited (70% stakeholder and Manager) and Independence Group NL (30% stakeholder).

The TGP consists of three main components:

- Operational Area - This area contains the mine, processing plant, aerodrome, village and other associated infrastructure.
- Water Supply Area - Two basins have been investigated, the Minigwal Trough and Officer Basin.
- Infrastructure Corridors - Two options are under consideration, Tropicana-Transline Infrastructure Corridor (TTIC) and Pinjin Road options.

In preparation for the project's Environmental Impact Assessment, the Tropicana JV commissioned a series of baseline flora and fauna surveys to determine the environmental values of the proposed TGP footprint and the surrounding environment. This work was undertaken by a number of environmental and specialist consultants who often focused on a single environmental aspect. All surveys were designed to meet the requirements of Environmental Protection Authority (EPA) Guidance Statements 51 and 56 and Position Statement No. 3. Species of conservation significance with a high likelihood of occurring in the TGP area were specifically targeted in comprehensive surveys. About 230,000 hectares of land was surveyed for flora and vegetation aspects.

This document reviews and consolidates the results of specialist surveys of terrestrial flora, vegetation and vertebrate fauna of the TGP area with the aim to complete a consolidated impact assessment of conservation significant species and communities that might be adversely affected by the TGP. Species and communities of conservation significance not affected by the TGP and outside of this scope are addressed within other documents.

Desktop surveys identified that 54 flora species of conservation significance may be present within the TGP area. Surveys identified 20 conservation significant flora species occurring within the proposed TGP survey areas, comprising one Federally Endangered and Declared Rare Flora (DRF) species (*Conospermum toddii*), 18 State Priority flora species and one State species of interest. Consolidation of the data from all the surveys found that:

- Sixteen Species of Conservation Significance were found within the Operational Area, 11 in the Pinjin Infrastructure Corridor, 10 in the TTIC and seven in the Borefield and Pipeline survey areas (as defined in this document).
- No Federally listed or DRF species (*Conospermum toddii*) will be impacted. Mitigation measures will ensure DRF populations in the Operational Area are not impacted.
- No Priority 1 species will be impacted. Mitigation measures will ensure populations of Priority 1 species in the Operational Area are not impacted.

- Four Priority 2, six Priority 3, three Priority 4 and one species of interest are located in the proposed areas of infrastructure development.
- Eleven Priority flora species were located during the surveys that are not within the defined survey areas (as defined in this document).
- Potential disturbance to Priority flora species ranges from 0.01 to 46.5% of known plant numbers.
- Three flora species have a predicted disturbance of greater than 5% of known plants numbers.

It is considered unlikely that the TGP will have a significant negative impact on the status of any Priority flora species in the region for the following reasons:

- The majority of Priority flora populations recorded are outside the proposed areas of disturbance.
- Many Priority flora species located in the TGP area are well represented in local Nature Reserves.
- It is possible that some species identified in these surveys may be de-listed due to improved knowledge gained through the surveys, the high number of specimens identified and increases in their known distribution.

Fauna and habitat surveys confirmed the historical and/or current presence of 11 of the 32 conservation significant fauna species considered likely to be found in the TGP area. The presence of the Greater Stick-nest Rat (historical presence), Southern Marsupial Mole, Malleefowl, Peregrine Falcon, Australian Bustard, Woma Python, Rainbow Bee-eater, Crested Bellbird, Wood Sandpiper, Common Greenshank and Fork-tailed Swift was confirmed. In summary, the surveys identified:

- Evidence of the Southern Marsupial Mole (*Notoryctes typhlops*), Malleefowl (*Leipoa ocellata*), Australian Bustard (*Ardeotis australis*), Rainbow Bee-eater (*Merops ornatus*), Fork-tailed Swift (*Apus pacificus*), Peregrine Falcon (*Falco peregrinus*), Woma Python (*Aspidites ramsayi*) and abandoned Greater Stick-nest Rat (*Leporillus conditor*) nests in the Operational Area.
- Evidence of the Southern Marsupial Mole, Malleefowl, Australian Bustard, Rainbow Bee-eater, Crested Bellbird (*Oreoica gutturalis)*, Wood Sandpiper (*Tringa glareola*) and Common Greenshank (*Tringa nebularia*) in the Pinjin Infrastructure Corridor.
- A number of habitats were identified as being significant to fauna in the survey area.
- Evidence of the Southern Marsupial Mole, Mallefowl and potential habitat for Mulgara (*Dasycercus cristicauda/blythi*) and Sandhill Dunnart (*Sminthopsis psammophila*), as well as stands of large trees providing good nesting hollows for parrots on the TTIC. Other significant habitat was identified on the TTIC as being a potential Priority 3 Ecological Community (PEC) - Yellow Sandplains Community of the Great Victoria Desert.
- Evidence of the Southern Marsupial Mole, Malleefowl and Australian Bustard in the Water Borefield and Pipeline Corridor.
- No Sandhill Dunnarts or Mulgara's were recorded, but potential suitable habitat was identified in the Operational Area and adjacent to the Pinjin Infrastructure Corridor

(for the Sandhill Dunnart) and along the TTIC and Pinjin Infrastructure Corridor (for the Mulgara).

It is considered unlikely the TGP will have a significant negative impact on these fauna species for the following reasons:

- The Greater Stick-nest Rat is considered extinct in the region.
- The Peregrine Falcon, Woma Python, Australian Bustard, Rainbow Bee-eater, Crested Bellbird, Wood Sandpiper, Common Greenshank and Fork-tailed Swift are relatively common and mobile species with preferred habitats well represented outside the TGP.
- Habitat for Marsupial Moles (sand dunes) will be avoided where possible outside the main resource area, and impact to these areas will be minimised.
- Mulga Woodland habitat for Malleefowl and Malleefowl mounds will be avoided where practical.
- Although the Sandhill Dunnart and Mulgara were not observed, several areas of potential habitat were identified. These areas will also be avoided where practical outside the main resource area.

No Threatened Ecological Communities (TEC) were identified in surveys of the TGP. The Priority 3 PEC Yellow Sandplains Community of the Great Victoria Desert potentially crosses the TTIC and the Pinjin Infrastructure Corridor, but was not identified in the Borefield and Pipeline Corridor or Operational Area. To date, little information is available about the plant assemblages of this PEC (J. Pryde pers com). Potential impacts to the PEC will be reduced by minimising disturbance of known locations of the PEC through practical avoidance and planning of infrastructure placement. As this PEC supports high numbers of conservation significant flora and fauna in the region, this approach will also reduce impacts to species that utilise dune habitats.

The conservation significant species and communities risk assessment identified that:

- The highest inherent impacts on species of conservation significance are related to land disturbance, fire impacts and introduced fauna. This is because:
  - Even with management measures implemented, land disturbance is required to undertake the operations, and occasionally impacts on conservation significant species cannot be avoided.
  - Fire is already present in the landscape and has adverse impacts on some species of conservation significance. It may reduce in its extent, severity and impact with the implementation of fire management measures planned for the TGP.
  - Introduced fauna are already present in the area and have adverse impacts on some species of conservation significance. The TGP may cause a decrease in their impacts as a result of implementation of feral fauna management.

The risks to conservation significant species identified through the flora, fauna and habitat surveys have been minimised through management measures planned for the project. The residual risks to conservation significant flora and fauna species are seen as generally minimal.

2. INTRODUCTION

2.1 LOCATION AND INFRASTRUCTURE

The Tropicana Joint Venture (Tropicana JV) plans to develop the Tropicana Gold Project (TGP), an open pit gold mining operation, located approximately 330 kilometres east north east of Kalgoorlie on the western edge of the Great Victoria Desert in Western Australia (Figure 1).

Access to the site's Operational Area (defined by the blue polygon), which comprises the mine and associated infrastructure (e.g. processing plant and administration block), will be via either:

- The Pinjin Infrastructure Corridor: A 215 kilometre road which extends northeast from Pinjin homestead to the proposed Tropicana Gold Project (TGP) Operational Area.
- The Tropicana-Transline Infrastructure Corridor (TTIC): A combination of a track upgrade and new road that travels south from the Operational Area, west of the boundary of the Plumridge Lakes Nature Reserve (south-east of the Operational Area) to the Trans Australian Access Road.

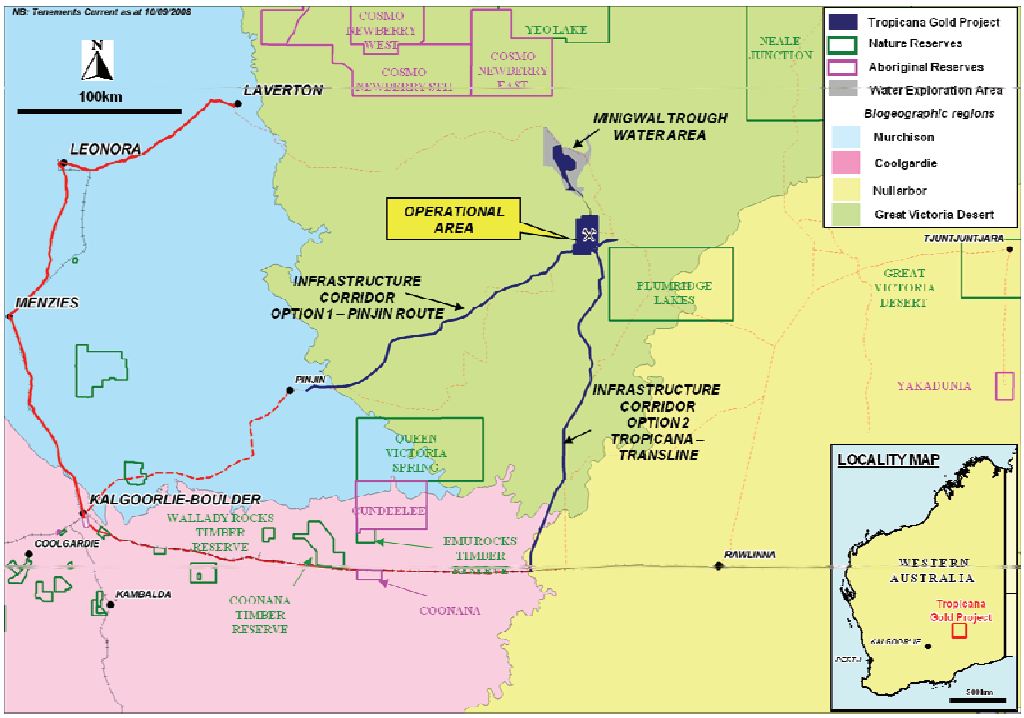
Development of an access road to the project requires either the upgrading or establishment of up to 220 kilometres from either Pinjin Station or Kitchener siding on the Trans Australian Railway line.

A bypass road is proposed 25 kilometres south of the Operational Area to divert public traffic around the east of the project to an existing track that leads northwest to Laverton or south-east to Plumridge Lakes Nature Reserve.

A water borefield and associated pipeline corridor will also be developed as part of the project. These are situated to the north of the Operational Area.

The locations of the proposed Operational Area, infrastructure corridors, public bypass road, water borefield and pipeline are shown in Figure 1.

Figure 1: Site Layout Showing Locations of the Project Area, Water Borefield and Pipeline Corridor, Pinjin and Tropicana-Transline Infrastructure Corridors and Public Bypass Road



2.2 CLIMATE

The TGP is located at the junction of the Great Victoria Desert, Nullarbor Plain and Murchison IBRA regions, with the majority of the area encompassed by the Great Victoria Desert.

The climate of Great Victoria Desert is arid to semi-arid with erratic year-round rainfall. The project area experiences dry conditions all year with approximately 200 to 300 millimetres of rainfall per annum. The majority of rainfall occurs during the summer months and is associated with cyclonic rainfall events that can result in heavy falls.

Average weather conditions for Tropicana are interpreted from Laverton to the north-west, and Balgair to the south-east. A summary of climatic data for these two locations is provided in Table 1, Chart 1 and Chart 2.

Table 1: Climatic Data for Balgair and Laverton, Taken from BOM (2008)

Description	Balgair	Laverton
Mean Annual Rainfall (mm)	273.2	232.5
Highest Annual Rainfall (mm)	518.8 (1992)	525.6 (2000)
Lowest Annual Rainfall (mm)	140.7 (1991)	65.6 (1928)
Mean Annual Max Temp (°C)	26	27.3
Highest Max Temp Recorded (°C)	47.6 (1991)	46.1 (1957)
Lowest Min Temp Recorded (°C)	-5.0 (2006)	-2.4 (1969)

Chart 1: Average Climatic Data for Laverton

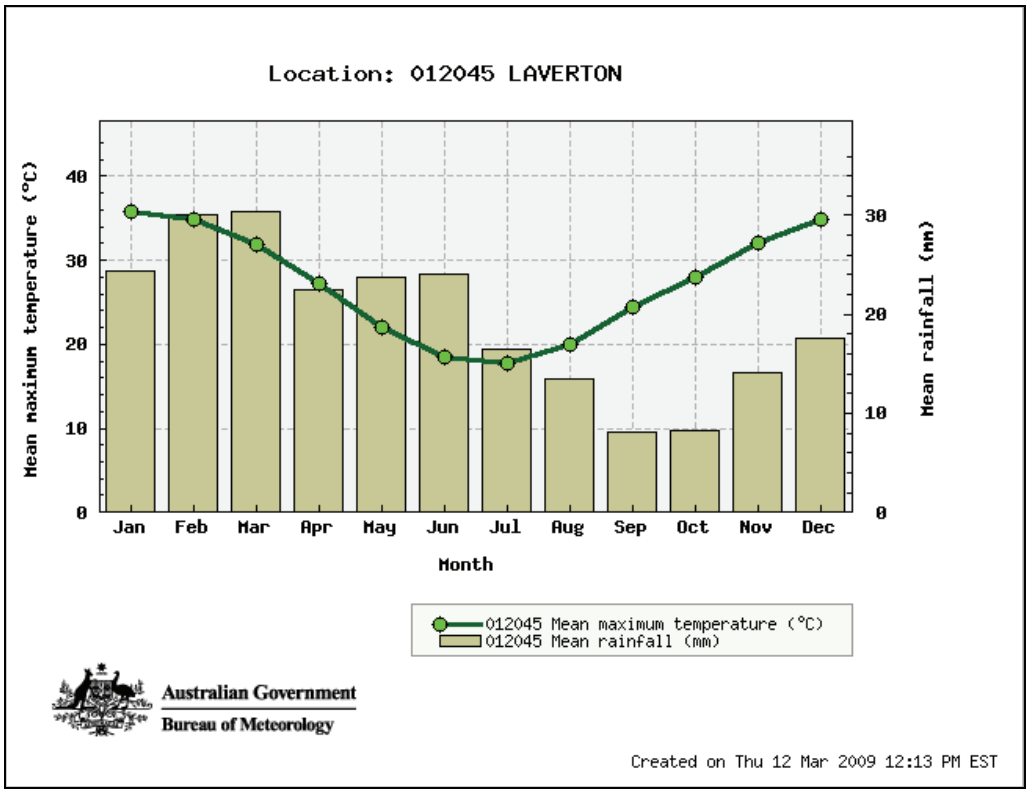
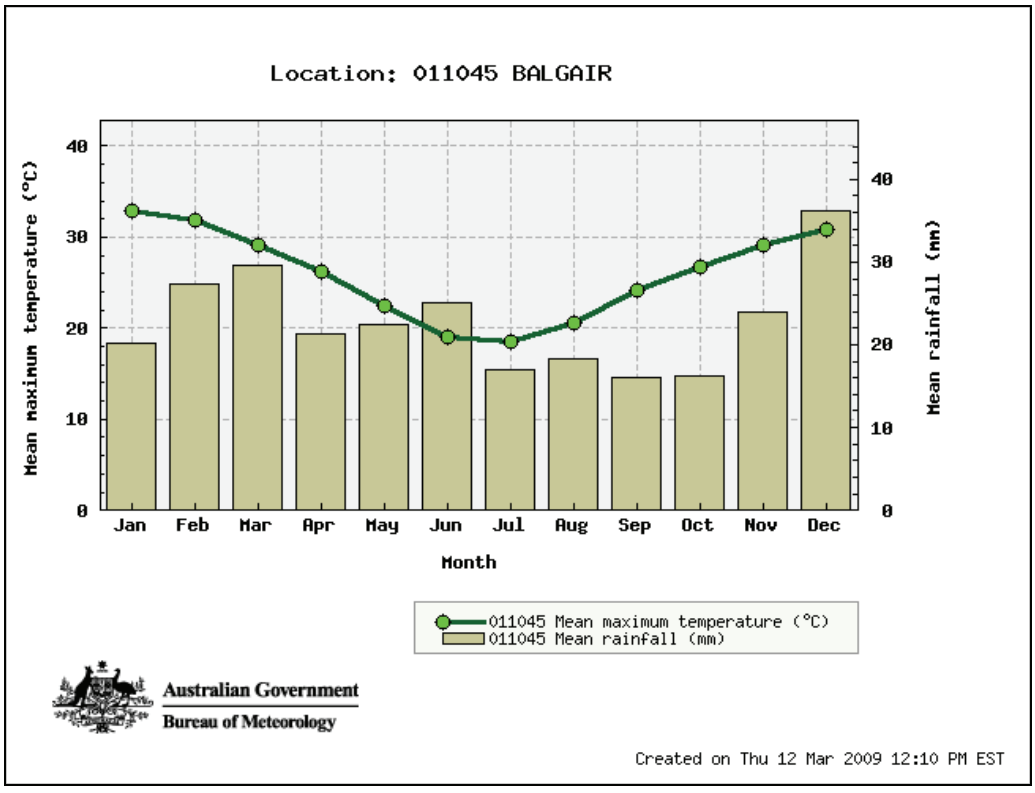


Chart 2: Average Climatic Data for Balgair



2.3 TOPOGRAPHY AND SOILS

The Great Victoria Desert is dominated by sandplains with longitudinal and ring dunes separated by interdunal corridors and plains. These sandplains sit at an elevation of 350 to 500 metres AHD dropping to less than 300 metres in the south (Tille, 2006).

The sandplains contain occasional outcrops of sandstones, laterites and silcretes, some calcareous mounds, and occasional salt pans. Also present are scarpland-breakaways and residuals of various forms (cuestas, mesas, buttes, stony hillocks and hills). These are usually surrounded by stone and gravel pavements, shallow valleys (with lakes, claypans, salt pans, calcrete platforms, sand dunes, kopi dunes and calcareous dunes) and are usually a relatively minor component of the landscape. Some prominent salt lakes also occur in the area (Tille, 2006).

2.4 BOTANICAL DISTRICT

The Operational Area and proposed infrastructure corridors are situated in the Helms Botanical District near the border of the Great Victoria Desert, the Nullarbor Plain within the Eremaean Botanical Province, and the Austin Botanical District of the Eremaean Province (Beard, 1990).

The Helms Botanical District is characterised by undulating topography with longitudinal dunes, between which soils are shallow and earthy overlying red brown hardpan. Other soils are red earthy sands or red brown sand of the dunes. The geology is characterised by quaternary sand plain over Permian and Mesozoic rocks (Beard 1990).

The vegetation of the Helms Botanical District is very consistent and characterised by tree steppe of *Eucalyptus gongylocarpa* and *Triodia basedowii*. Overall, the sandy areas are a mosaic of tree and shrub communities; *Eucalyptus gongylocarpa* is dominant in the dune systems where it occurs locally between the dunes (Beard, 1990).

2.5 CONSERVATION SIGNIFICANT SPECIES

A number of conservation significant species and communities protected under State and Federal legislation as well as international agreements, have the potential to occur in the TGP area. Between 2006 and 2009, the Tropicana JV commissioned 15 surveys to be undertaken by specialist consultants to ascertain the presence of these species and associated habitat within and outside the proposed areas of infrastructure development. A summary of the conservation significant species surveys undertaken is provided in Table 2.

Table 2: Summary of the Conservation Significant Species Surveys Conducted

Title of Report	Consultant	Date of Report	Survey Target
Flora			
Tropicana Project Project Area Threatened Flora Assessment.	Ecologia Environment	July 2009	Level 2 Flora Survey.
Tropicana Gold Project Flora and Vegetation Assessment of the Proposed Operational Area and its Surroundings.	Ecologia Environment	July 2009	Level 2 Baseline Flora and Vegetation Survey.
Tropicana Gold Project: Tropicana - Transline Infrastructure Corridor: Vegetation and Flora Survey.	Ecologia Environment	July 2009	Level 1 Flora and Vegetation Survey.
Flora and Vegetation Survey of Proposed Mine Access Road and Infrastructure Corridor - Pinjin Option L31/57, L39/185, Tropicana Mine - Pinjin Station.	Mattiske Consulting	June 2009	Level 2 Flora and Vegetation Survey.
Tropicana Gold Project Minigwal Trough Water Supply Area and Pipeline Corridor Vegetation and Flora Survey.	Botanica Consulting	June 2009	Level 2 Vegetation and Flora Survey.
Threatened Flora Survey for Regional Context, Tropicana JV and Adjacent Nature Reserves.	AngloGold Ashanti	June 2009	Level 1 Flora Survey.
Threatened Species Assessment of areas adjacent to the Tropicana Gold Project.	Mattiske Consulting	July 2009	Level 2 Flora Survey.
Fauna			
Tropicana Gold Project Vertebrate Fauna Assessment – Operational Area.	Ecologia Environment	July 2009	Level 2 Vertebrate Fauna Survey of the Tropicana Lease, Targeted Marsupial Mole Survey.
Tropicana Gold Project Tropicana-Transline Infrastructure Corridor Fauna Survey.	Ecologia Environment	July 2009	Level 1 Fauna Survey Access Road.
A Level 1 Survey of Vertebrate Fauna for the Proposed Tropicana - Pinjin Access Track.	Ninox	June 2009	Level 1 Fauna Survey of the Access Road.
Marsupial Mole Survey: Proposed Access Road Route Tropicana Gold Project.	URS	February 2009	Level 2 Fauna Survey of the Pinjin Access Road.
Malleefowl and Mulgara Survey Tropicana Gold Project.	URS	July 2009	Level 2 Fauna Survey of the Operational Area and Access Road.
Tropicana Gold Project Sandhill Dunnart Survey of the Proposed Project Area, Access Road and Public Bypass.	Gaikhorst and Lambert	July 2009	Level 2 Fauna Survey.
Tropicana Joint Venture Minigwal Sub Basin Water Area and Pipeline Corridor Level 1 Fauna Survey.	Ecologia Environment	July 2009	Level 1 Fauna Survey.
Survey of the underground signs of marsupial moles in the WA Great Victoria Desert.	Benshemesh & Schulz	September 2008	Level 1 Fauna Survey.

2.6 OBJECTIVES OF THIS REPORT

The objectives of this report are to:

- Summarise the key findings of all conservation significant species surveys conducted for the TGP.
- Assess the impact of the proposal on conservation significant species, habitats and communities.
- Suggest measures to mitigate and manage these impacts based on best practice.
- Undertake a risk assessment for conservation significant species, habitats and communities to determine the level of residual risk once mitigation measures are implemented.

3. REGULATORY ENVIRONMENT

3.1 COMMONWEALTH

Conservation significant flora and fauna in Australia are protected at a national level by the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). The *EPBC Act* is the Federal Government's environmental legislation that protects matters of national environmental significance including nationally and internationally important flora, fauna, ecological communities and heritage places and is administered by the Department of the Environment, Water, Heritage and the Arts (DEWHA).

Schedule 1 of the *EPBC Act* categorises conservation significant species as one of the following:

- **Ex** - Extinct.
- **ExW** - Extinct in the wild.
- **CE** - Critically endangered.
- **E** - Endangered.
- **V** - Vulnerable.
- **CD** - Conservation dependant.

The *EPBC Act* requires the Minister to establish a list of Threatened Ecological Communities (TECs) divided into the following categories:

- **Critically Endangered** - If, at that time, the community is facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered** - If, at that time, the community is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
- **Vulnerable** - If, at that time, the community is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

The *EPBC Act* also lists migratory species as matters of national environmental significance. This includes species listed under the following conventions to which Australia is a signatory:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).
- China-Australia Migratory Bird Agreement (CAMBA).
- Japan-Australia Migratory Bird Agreement (JAMBA).
- Republic of Korea - Australia Migratory Bird Agreement (ROKAMBA).

Projects that have potential to significantly impact matters protected under the *EPBC Act* are referred to DEWHA for assessment. If a project is deemed to be a Controlled Action, it requires formal assessment by the Commonwealth. The TGP was deemed a Controlled

Action under Part 9 of the *EPBC Act* and requires approval under the *EPBC Act*. The decision was triggered under the controlling provisions Part 3, Division 1 namely:

- Sections 18 and 18A (listed Threatened species and communities).

The Western Australian and Federal governments entered a Bilateral Agreement on environmental impact assessment in 2002. The agreement aims to "minimise duplication of environmental impact assessment processes, strengthen intergovernmental cooperation and promote a partnership approach to environmental protection and biodiversity conservation" (Australian Government, 2002). The agreement endorses the State assessment process at the Public Environmental Review and Environmental Review and Management Plan levels such that one assessment document satisfies both State and Federal requirements. The TGP will be assessed under this agreement at the Public Environmental Review (PER) level.

3.2 WESTERN AUSTRALIA

The Western Australian *Environmental Protection Act 1986* (*EP Act*) is state legislation for "the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing" (EPA, 2009). It is administered by the Environmental Protection Authority (EPA). Part IV of the Act refers to Environmental Impact Assessment (EIA), under which proposals are referred and assessed. This document provides information pertaining to conservation significant flora and fauna surveyed in the TGP to assist with assessment of the Project under the Act.

The Western Australian *Wildlife Conservation Act 1950* (*WC Act*) is state legislation for flora and fauna protection administered by the Department of Environment and Conservation (DEC). DEC maintains a list of Priority fauna and flora consisting of species not listed under the *WC Act*, but for which DEC feels there is cause for concern. DEC also maintains a list of TECs (and PECs) that have been endorsed by the Minister, as there is no state legislation which covers them. TECs that occur in Western Australia can be nominated to be listed under the *EPBC Act*.

Priority status levels and conservation categories for flora, fauna and communities are defined in the following subsections.

3.2.1 Flora Protection

Rare Flora species are gazetted under subsection 2 of Section 23F of the *WC Act* and are defined as:

- **Declared Rare Flora (DRF) - Extant** - "Plants which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such."
- **Declared Rare Flora – Presumed Extinct** – "Plants which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently and have been gazetted as such."

Where plants appear to be rare or threatened, but for which there is insufficient scientific information to make a proper evaluation of their conservation status, a Priority status is assigned. Levels of Priority are defined as follows:

- P1 - **Priority One – Poorly Known Taxa -** Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
- P2 - **Priority Two – Poorly Known Taxa -** Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
- P3 - **Priority Three – Poorly Known Taxa -** Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but need further survey.
- P4 - **Priority Four – Rare Taxa -** Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

3.2.2 Fauna Protection

In 2008, the list of conservation significant species was reviewed and the Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2) was published. The Schedules defined under this legislation comprise:

- **Schedule 1** - fauna that is rare or is likely to become extinct.
- **Schedule 2 -** fauna presumed to be extinct.
- **Schedule 3** - birds protected under an international agreement such as JAMBA, CAMBA or ROKAMBA.
- **Schedule 4** - other specially protected fauna.

Where fauna appear to be rare or threatened, but for which there is insufficient scientific information to make a proper evaluation of their conservation status a Priority status is assigned. Levels of Priority are defined as follows:

- P1 - **Priority One -taxa with few, poorly known populations on threatened lands** - Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- P2 - **Priority Two - taxa with few, poorly known populations on conservation lands** - Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. National Parks, Conservation Parks, Nature Reserves, State Forest, Vacant

Crown land, Water Reserves. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

- P3 - **Priority Three - taxa with several, poorly known populations, some on conservation lands** - Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- P4 - **Priority Four - taxa in need of monitoring** - Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
- P5 - **Priority Five - taxa in need of monitoring** - Taxa which are not considered threatened, but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

3.2.3 Threatened Ecological Communities

TECs are endorsed by the Minister as being subject to processes that threaten to destroy or significantly modify the community across much of its range, hence fitting into one of the following categories:

- **Presumed Totally Destroyed (PD)** - Adequately searched for but no occurrences located with no occurrence likely to recover its species composition or structure in the foreseeable future.
- **Critically Endangered (CR)** - Subject to major contraction in an area, or was already of limited distribution, facing severe modification or destruction in the near future, is degraded but capable of restoration/rehabilitation.
- **Endangered (EN)** - Subject to major contraction in an area, or was already of limited distribution, in danger of severe modification or destruction in the near future. It is not critically endangered but faces a high risk of total destruction in the near future.
- **Vulnerable (VU)** - Adequately surveyed and found to be declining/has declined in range and/or condition, and whose ultimate security has not been assured, or a community that is widespread but is likely to move into a category of higher threat soon if threatening processes continue or start in its range as it faces a high risk of total destruction/severe modification in the medium to long term future.
- **Priority Ecological Communities:**
  - **Priority 1** - Poorly known ecological communities with apparently few, small occurrences, all or most not actively managed for conservation for which current threats exist.
  - **Priority 2** - Poorly known ecological communities from a few small occurrences all or most of which are actively managed for conservation and not under immediate threat of destruction or degradation.

- **Priority 3** - Poorly known ecological communities from several to many occurrences not under threat; from a few widespread occurrences which are large or within significant remaining areas of habitat where other occurrences may occur, not much under imminent threat; large and/or widespread communities, may or not be represented in the reserve system, under threat across much of their range.
- **Priority 4 -** Adequately known communities that are rare, but not threatened or near threatened, or have recently come off the threatened list. Require regular monitoring.
- **Priority 5 -** Conservation dependent communities under conservation programs which would become threatened within five years without the conservation program.

3.2.4 EPA Guidance Statements (51 and 56)

In 2004, the EPA released two sets of guidelines to assist proponents and consultants in deciding on the level and standard of survey to complete for the EIA Process. Guidance Statement 51 and 56 provide frameworks for the assessment of environmental factors for terrestrial flora and vegetation surveys and terrestrial fauna surveys, respectively.

Both statements outline the requirements of:

- Level 1 desktop study and reconnaissance surveys.
- Level 2 surveys including detailed survey.
- Planning and design of flora and vegetation and fauna and faunal assemblage surveys.
- Presentation and reporting.

The Guidance Statements were formulated to address the principles outlined in EPA Position Statement 3 (2002) which addresses the requirements for protection of biodiversity and the requirements of terrestrial biological surveys as part of the EIA process.

3.3 INTERNATIONAL AGREEMENTS AND GUIDELINES

3.3.1 JAMBA, CAMBA and ROKAMBA

Australia has entered into international agreements for the protection of migratory birds. These agreements provide protection to listed species even though they may not be considered threatened in either of the countries party to the agreement. The agreements are:

- Japan-Australia Migratory Bird Agreement (JAMBA).
- China-Australia Migratory Bird Agreement (CAMBA).
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Birds listed under these agreements are also protected under the *EPBC Act, 1999*.

3.3.2 IUCN Red List

The International Union for the Conservation of Nature (IUCN) Red List is a comprehensive inventory of the conservation status of the world's plant and animal species. It uses a set of scientific criteria to determine species' extinction risk. These criteria are applicable to all species in all countries. The overall aim of the Red List is to reduce extinctions through raising awareness of the urgency and scale of the problem. The basic classifications are summarised as follows:

- **Extinct (EX)** Taxon for which there is no reasonable doubt that the last individual has died.
- **Extinct in the Wild (EW)** Taxon which are know to only survive in cultivation, in captivity or as a naturalised population well outside the past range and it has not been recorded in known or expected habitat despite exhaustive surveys over a timeframe appropriate to its like cycle and form.
- **Critically Endangered (CR)** Taxon facing an extremely high risk of extinction in the wild.
- **Endangered (EN)** Taxon facing a very high risk of extinction in the wild.
- **Vulnerable (VU)** Taxon facing a high risk of extinction in the wild.
- **Near Threatened (NT)** Taxon which have been evaluated but does not qualify for CR, EN or VU, but is close to qualify for a threatened category in the near future.
- **Least Concern (LC)** Taxon has been evaluated against the criteria and does not qualify for CR, EN, VU or NT. Widespread and abundant taxa are included in this category.
- **Data Deficient (DD)** Taxon for which there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.

3.3.3 Bonn Convention

The convention on the Conservation of Migratory Species (CMS) of Wild Animals is an intergovernmental treaty which aims to conserve terrestrial, marine and avian migratory species throughout their range. It is conducted under the aegis of the United Nations Environment Program, concerned with conservation of wildlife and habitats on a global scale.

It focuses mainly on migratory species at risk of extinction, listed as Appendix I, and migratory species that need or would significantly benefit from international cooperation are listed as Appendix II to the convention.

4. CONSERVATION SIGNIFICANT SPECIES SURVEYS AND METHODOLOGY

4.1 OPERATIONAL AREA

4.1.1 Flora and Vegetation - *Ecologia*

Ecologia (2009b) undertook a two-phase baseline survey of vegetation and flora of the Tropicana Operational Area. The primary objective of this study was to provide sufficient information for the EPA to assess the impact of the project on vegetation and flora of the area as part of the PER process.

Surveys were conducted in two phases. The first between 8 and 17 November 2006 focussed on the area of major prospecting and proposed infrastructure; the second was conducted in two surveys from 8 to 15 June 2007 and 2 to 16 July across the broader area. Eighty eight sampling quadrats were established during the initial phase with 165 quadrats surveyed in the second phase (of which 49 had previously been surveyed in Phase 1).

4.1.2 Targeted Threatened Flora - *Ecologia*

Ecologia (2009f) was commissioned to undertake a targeted survey of the Operational Area to determine the occurrence of conservation significant flora species. The survey was undertaken over at least three field trips between 2007 and the end of 2008. The initial assessment targeted the dunes within close proximity to the Tropicana and Havana Resource area and then was expanded to cover the proposed operational footprint and the surrounding environment.

The primary objective of this study was to provide sufficient information to assess potential impacts of the project on conservation significant flora taxa occurring on sand dunes and proposed disturbance areas located within the Operational Area. The first phase of work was to allow Tropicana JV to plan activities and infrastructure that avoided DRF populations and subsequent phases were aimed specifically at identifying and quantifying potential impacts on Priority flora.

4.1.3 Vertebrate Fauna Assessment - *Ecologia*

A three phase vertebrate fauna survey of the Operational Area was conducted by *Ecologia* (2009b) in November 2006, March 2007 and March 2008, with sampling targeting Marsupial Moles also conducted between 24 to 31 August 2007. Additional targeted surveys for Southern Marsupial Mole holes were carried out in two separate surveys, from 21 to 26 September 2007 and 29 January to 8 February 2008. Forty one sites were surveyed in the region between the Operational Area and the proposed Minigwal Trough Water Supply Area.

Eighteen survey sites were established in the Operational Area covering all major fauna habitats and areas of proposed disturbance. Each site comprised a combination of pit fall traps, elliot traps, funnel traps and cage traps. Traps remained open for a period of ten

nights. Bird surveys were conducted as per Birds Australia guidelines at each of the survey sites and opportunistically throughout the Operational Area. Bat recordings were undertaken using an ANABAT detector. Reptiles and mammals were actively searched for during the day and night. Two trapping sites specifically targeting Sandhill Dunnarts were established during the second phase of the survey. Two hundred and twenty four survey trenches were dug in the Operational Area to determine the presence of the Southern Marsupial Mole.

4.1.4 Malleefowl and Mulgara Survey - URS

URS (2009) was commissioned to undertake a targeted survey for Malleefowl and Mulgara in the Operational Area to determine the presence or absence of Mulgara and Malleefowl.

The objectives of the survey were to:

- Determine whether Malleefowl and Mulgara are likely to occur in the study area.
- Collect information on the Southern Marsupial Mole by collecting predator scats.
- Record information on other conservation significant fauna species and suitable habitat for these species.

Prior to the field component, a desktop assessment was undertaken using aerial photographs to identify potential Malleefowl and Mulgara habitat for traverses by foot. A field survey was undertaken between April and August 2008 comprising a road survey and foot transects, consistent with DEC requirements and Malleefowl survey protocol.

Predator scats were collected opportunistically and provided to TGP personnel for analysis by Tropicana JV.

4.2 INFRASTRUCTURE CORRIDORS

4.2.1 Flora and Vegetation - *Ecologia* (Tropicana - Transline Infrastructure Corridor)

Ecologia (2009a) was commissioned to conduct a Level 1 flora and vegetation survey along the proposed TTIC. The survey objectives were to:

- Survey the flora and vegetation along the proposed corridor to determine whether any species or ecological communities of conservation significance were present along the access road and indicate management options to prevent or minimise impacts due to disturbance.
- Map the main vegetation units occurring along the length of the proposed access road.

A baseline survey of the vegetation and vascular flora of the TTIC was undertaken between 13 and 22 July 2007 and 20 and 24 August 2007.

One hundred and fourteen quadrats and 59 transects were surveyed along the proposed infrastructure corridor.

4.2.2 Flora and Vegetation - Mattiske (Pinjin Infrastructure Corridor)

Mattiske Consulting (2009a) was commissioned to define the flora and vegetation values of the proposed Pinjin Infrastructure Corridor and public bypass road. Flora and vegetation was described and sampled systematically at each survey site in accordance with EPA (2004) Guidance Statement 51, Level 2 survey. Four botanists completed the survey during three trips, between 2 and 7 December 2007, 9 and 15 March 2008 and 6 and 9 May 2008.

The specific objectives were to:

- Collect and identify vascular plant species present within the proposed corridor.
- Review the conservation status of vascular plant species by reference to current literature and listings (DEC, DEWHA and plant collections held at the WA Herbarium).
- Define and map the native vegetation communities and their condition.

4.2.3 Fauna and Habitat - Ninox (Pinjin Infrastructure Corridor)

Ninox Wildlife Consulting (2009) was commissioned to assess the significance of vertebrate fauna and their habitats along the proposed Pinjin Infrastructure Corridor and public bypass road. Fauna and habitat was assessed in accordance with a Level 1 Reconnaissance Survey as defined in Guidance Statement No 56 (EPA, 2004). The survey was conducted over two periods (2 to 7 December 2007 and 10 to 15 March 2008 inclusive) and involved driving the entire length of the proposed infrastructure corridor with investigations of different habitats on foot.

The main objectives of this vertebrate fauna assessment were to:

- Provide a list of species recorded during the reconnaissance survey.
- Provide a predicted list of all vertebrate fauna that might occur within the survey area.
- Provide an assessment of the regional and local conservation value of rare, threatened and vulnerable species that could occur in the survey area as listed under:
  - *EPBC Act, 1999*.
  - *WC Act, 1950*.
  - DEC Priority Fauna list.

4.2.4 Vertebrate Fauna Assessment - *Ecologia* (Tropicana - Transline Infrastructure Corridor)

Ecologia (2009c) was commissioned to conduct a fauna and habitat assessment of the proposed TTIC. The assessment was undertaken in accordance with a Level 1 Reconnaissance Survey as defined in Guidance Statement No 56 (EPA, 2004).

Desktop searches identified 12 conservation significant species with the potential to inhabit the area. A field survey was conducted between 23 July and 3 August 2007. The objectives of the survey were to:

- Determine the suitability of the habitat to support Southern Marsupial Mole, Sandhill Dunnart, Mulgara, Malleefowl and other conservation significant fauna.

- Search for secondary evidence where suitable habitat was identified (including mounds, holes and burrows).
- Document habitat trees to provide nesting sites for rare parrots.
- Complete mole survey work from a previous Marsupial Mole hole survey in March 2007.

4.2.5 Southern Marsupial Mole - URS (Pinjin Infrastructure Corridor)

URS (2008) was commissioned to conduct a study to determine the presence of the Southern Marsupial Mole along the proposed Pinjin Infrastructure Corridor. A preliminary list of sites within potentially suitable habitat along the proposed infrastructure corridor was established through a desktop assessment of aerial photography. A field survey was then conducted between 22 and 28 November 2007, 4 to 10 March 2008 and 22 to 29 April 2008.

The main objective of the survey was to determine whether the Southern Marsupial Mole is likely to occur within the infrastructure corridor. A secondary objective of the study was to opportunistically collect information on:

- The Southern Marsupial Mole through the collection of predator scats.
- The following conservation significant fauna species:
  - Sandhill Dunnart.
  - Malleefowl.
  - Mulgara.

The field survey consisted of surveying 27 sites for Marsupial Moles by digging trenches in suitable habitat and identifying mole holes following the methodology of Benshemesh (2005). Thirty-eight other sites with suitable habitats were surveyed using a penetrometer. In addition to this, predator scats were collected for examination and information was recorded on conservation significant fauna species and potentially suitable habitat.

4.2.6 Sandhill Dunnart - Gaikhorst and Lambert (Operational Area and Pinjin Infrastructure Corridor)

Two experienced zoologists, Glen Gaikhorst and Cathy Lambert (2009), were commissioned to conduct a study to identify the presence or absence of the Sandhill Dunnart within potentially suitable habitat of the Operational Area, Pinjin Infrastructure Corridor and the public bypass road.

Potential habitat for the Sandhill Dunnart was identified through a desktop assessment of aerial photography. Following identification of these areas, ground truthing of each site was undertaken and fauna surveys were then conducted in identified areas of interest. Two surveys took place over a 10 day period from 5 to 14 March 2008, and an eight day period from 21 to 28 May 2008. Opportunistic sightings of other fauna were also recorded.

Fauna surveys consisted of trapping at likely sites with elliot and pit-fall traps. Opportunistic data was also recorded from the sites, including observations, tracks and scats.

4.3 WATER BOREFIELD AND PIPELINE - MINIGWAL

4.3.1 Vertebrate Fauna Assessment - *Ecologia*

Ecologia (2009d) undertook a Level 1 fauna survey in the Minigwal Sub Basin Water Area and Pipeline Corridor.

The Level 1 fauna survey was undertaken between 11 and 25 March 2008. Twenty six fauna surveys were undertaken by two zoologists, and comprised 580 minutes of bird surveying and 780 minutes of foraging for reptiles, mammals and amphibians. Searches were arranged to focus on fauna habitats that were suited to conservation significant species potentially occurring in the area. In addition, a total of 240 minutes was spent conducting nocturnal surveys, and 185 minutes of bat recordings were made. Secondary evidence of animals was also recorded, as were opportunistic sightings of fauna.

4.3.2 Vegetation and Flora Survey - Botanica

Botanica completed a Level 2 vegetation and flora survey of the Water Borefield and Pipeline between 7 and 15 November and 10 and 12 December 2008. The objectives of the survey were to:

- Compile broad scale vegetation community and flora mapping and compile a species list of the survey area.
- Document and map locations of DRF, Priority species and TECs in the survey area.
- Identify and GPS occurrences of any Declared and Environmental Weeds in the survey area.

Fifty three vegetation survey quadrats (50 metres by 50 metres) were established throughout the survey area with a minimum of three quadrats per vegetation group. Non permanent quadrats (10 metres by10 metres) were established at sample points where Priority species were present. Calculations of Priority species density were applied to the relevant vegetation unit to estimate Priority species numbers for the entire borefield survey area.

4.4 REGIONAL INFORMATION

4.4.1 Targeted Threatened Flora - AngloGold Ashanti

AngloGold Ashanti (2009) completed three targeted threatened flora searches of the following locations outside the TGP:

- Vacant Crown Land between Operational Area and Queen Victoria Spring (Independence Track and Conrad Straight), from 7 to 11 December 2008.
- Queen Victoria Springs Nature Reserve, from 14 to 18 December 2008.
- Plumridge Lakes Nature Reserve, from 16 to 18 January 2009.

The objective of the surveys was to provide population distribution data on a broader scale for threatened species outside the proposed areas of impact.

Known and new populations of threatened species outside of the Operational Area were visited and quadrats (generally 50 metres by 50 metres) were surveyed to determine population density. Data was then extrapolated for the estimated size of the population where it exceeded the quadrat area. Voucher specimens from each population were collected.

4.4.2 Targeted Threatened Flora - Mattiske

Mattiske Consulting (2009b) completed a targeted search for threatened flora species in two surveys between 5 to 8 May and 16 to 19 June, 2009. The aim of the search was to locate, addition locations of key threatened flora populations outside the project area. The surveys targeted species most impacted by the project, namely:

- *Dicrastylis cundeeleensis.*
- *Acacia eremophila var. variabilis.*
- *Acacia eremophila numerous nerved variant.*
- *Comesperma viscidulum.*
- *Eucalyptus pimpiniana.*
- *Grevillea secunda.*
- *Daviesia purpurascens.*

4.4.3 Southern Marsupial Mole - Benshemesh and Schultz

Benshemesh and Schultz (2008) completed a survey for the presence of the Southern Marsupial Mole in the Great Victorian Desert from 28 April to 14 May 2008. The objective was to provide new information on the distribution and abundance of the Southern Marsupial Mole in order to assess the conservation status of the species across this land system.

Thirty five sites were sampled at which a total of 89 trenches were excavated. Over 170 backfilled tunnels were recorded in these trenches and at least 95% of these tunnels were considered to have been made by the Southern Marsupial Mole.

4.4.4 Additional Regional Data

In addition to information obtained during specialist surveys, existing information pertaining to the presence of threatened flora populations was obtained from the Tropicana JV and Florabase. This included regional data lodged with Florabase and additional data provided by Tropicana JV that had been collected during exploration inspections and threatened species searches of the Neale Junction Nature Reserve.

4.5 VARIATIONS

As this report contains data from multiple data sources, potential exists for information in this report to vary from that presented in the stand alone documents. For example, it is possible that this report suggests that more species occur in a given area than that of the stand alone documents. This could be a result of:

- Areas being redefined for the purpose of this report compared to individual reports.
- Additional data has become available following recent studies.
- Presentation of data through merging of nearby populations.
- A change in status of species over the life of the survey.

The report aims to provide a realistic estimation of threatened species within and outside the proposed Tropicana Project Area.

5. SIGNIFICANT FLORA AND VEGETATION COMMUNITIES

5.1 SIGNIFICANT FLORA - REGIONAL CONTEXT

Desktop searches of the DEC Threatened and Priority Species Database, *EPBC Act* Protected Matters Database and flora and vegetation surveys identified a total of 54 conservation significant flora species that may potentially be present in the survey areas.

Flora surveys confirmed a total of 20 conservation significant flora species to be present in the defined survey areas (as defined in this report), with 16 in the Operational Area, 11 in the Pinjin Survey Corridor, 10 in the TTIC and seven in the Borefield and Pipeline survey area.

The locations of all conservation significant flora species surveyed are presented in Figure 2 through to Figure 7. Full descriptions of conservation significant flora species that were recorded, their distributions and photographs are provided in Appendix 1.

Table 3 provides a complete list of all DRF and Priority flora expected and recorded from the Operational Survey Area, Infrastructure Corridor Survey Areas, Water Borefield and Pipeline Survey Area. It includes:

- A population and plant count estimate where possible.
- Species regional distribution in Nature Reserves and other known locations outside the TGP.
- Records held by Florabase.

It should be noted that the survey areas defined in Table 3 do not constitute proposed disturbance areas. The areas represent survey areas defined in this document as follows:

- Operational Area: Includes all species found within the blue polygon shown in Figure 2 and Figure 3. This is a reduced area to the survey area defined by Ecologia.
- Pinjin Infrastructure Corridor: Includes all species found within 200 metres of the central alignment of the proposed corridor (i.e. - 100 metres either side of the central alignment).
- Tropicana - Transline Infrastructure Corridor: Includes all species found within 200 metres of the central alignment of the proposed corridor (i.e. - 100 metres either side of the central alignment).
- Borefield and Pipeline: Priority species numbers were calculated by extrapolating the results of quadrats (10 metre by 10 metre) established at sample points where Priority species were present. Calculations of Priority species density were applied to the relevant vegetation unit to estimate Priority species numbers for the entire borefield survey area (as viewed in Figure 7).
- Other: Includes species records from other nearby areas outside the above defined survey areas. This includes Tropicana JV data from Conrad Straight and Independence Track, exploration areas and other opportunistic records.

- Nature Reserves: This includes threatened species estimations from surveys undertaken in Neale Junction Reserve, Queen Victoria Springs Nature Reserve and Plumridge Lakes Nature Reserve. Quadrats were established where Priority species were present and counts undertaken to establish a density per square metre. This data was then extrapolated for the estimated extent of the population to provide an approximate species count.

Due to redefining of survey areas and merging of data (see notes below) in this report, small discrepancies between this report and specialist reports may exist in population and plant counts for a particular area.

The results presented in Table 3 do not indicate actual disturbance by the operation. Proposed disturbance areas (conceptual disturbance footprint) are defined and discussed in Section 8.

Review of the data in Table 3 shows that:

- One of the 20 species of significance, *Conospermum toddii*, located in the Operational Area is of Federal significance (Endangered). One other species of Federal significance was located during the survey (*Eucalyptus articulata*), however the location is outside of the TGP survey areas.
- All of the 20 species of conservation significance located in the TGP survey areas are of State significance. Of these:
  - One species is listed as DRF (*Conospermum toddii).*
  - Two species are listed as Priority 1 (*Baeckea* sp. Sandstone and *Dampiera eriantha*).
  - Seven species are listed as Priority 2 (*Baeckea* sp Great Victoria Desert, *Dicrastylis nicholasii*, *Grevillea secunda*, *Isotropis canescens*, *Malleostemon* sp. Officer Basin, *Olearia arida* and *Physopsis chrysotricha*).
  - Six species are listed as Priority 3 (*Acacia eremophila* numerous nerved variant, *Acacia eremophila* var. *variabilis*, *Dicrastylis cundeeleensis*, *Eucalyptus pimpiniana*, *Microcorys macredieana* and *Micromyrtus stenocalyx*).
  - Three species are listed as Priority 4 (*Comosperma viscidulum*, *Daviesia purpurascens*, and *Lepidobolus deserti*).
  - One species was listed as a species of interest (*Caesia* talinkya ms).
- Eleven species of State conservation significance were located during the TGP surveys, but were not located within proposed survey areas. These included *Eucalyptus articulata* (DRF), *Grevillea phillipsiana* (P1), *Minuria ?tridens* (P1), *Haegiela tatei* (P2), *Phlegmatospermum eremaeum* (P2), *Thryptomene eremaea* (P2), *Diocirea actutifolia* (P3), *Diocirea ternata* (P3), *Melaleuca coccinea* (P3), *Micromyrtus serrulata* (P3) and *Thryptomene nealensis* (P3).

It should be noted, that for the purpose of standardising data received by a number of survey teams, the following process was applied to data to obtain population estimates:

- All duplicates were removed.

- Points (populations) within 100 metres were merged (defined as one population) and the sum of plant counts was taken for each point to provide the most accurate measure of plant numbers.

Advice from DEC indicated no DRF or Priority flora species listed below, surveyed in the TGP, were presently recommended for review of their conservation status (M. Harding, pers com 17 September, 2008).

Table 3: Conservation Significant Flora Species Recorded and their Regional Context

Species	Populations Observed in Tropicana Gold Project Area (No. Plants Recorded)					Populations Recorded in Nature Reserves (Estimated No. of Plants)^			Flora Base Records			Conservation Status		
	Operational Area	Pinjin *	TTIC *	Bore-field & Pipe-line**	Other***	Neale Junction	PLNR	Queen Victoria Springs	No. Records	No. Plants	Description	WA	Federal	IUCN
Conospermum toddii	15 (1,329)	×	×	×	8 (188)	×	8 (41,346)	14 (>60,000)	29	>3000	Occasional to Abundant	DRF	EN	EN
Eucalyptus articulata	×	×	×	×	1	×	×	×	×	×		DRF	VU	VU
Thryptomene wittweri	×	×	×	×	×	×	×	×	×	×		DRF	-	-
Caesia rigidifolia	×	×	×	×	×	×	×	8 (>70,000)	×	×		P1	-	-
Baeckea sp. Sandstone	4 (90)	×	×	×	5 (5)	×	×	×	5	Unknown	Occasional to locally common	P1	-	-
Dampiera eriantha	23 (226)	×	×	×	11 (28)	×	×	×	5	~15		P1	-	-
Eremophila aureivisca	×	×	×	×	×	×	×	×	×	×		P1	-	-
Grevillea phillipsiana	×	×	×	×	6 (~1550)	×	×	×	×	×		P1		
Labichea deserticola	×	×	×	×	×	×	×	×	×	×		P1	-	-
Leschenaltia aphylla	×	×	×	×	×	×	×	×	1	Unknown	Common on roadside near Cue	P1	-	-
Minuria ?tridens	×	×	×	×	2 (~10)	×	×	×	×	×		P1	-	-
Micromyrtus helmsii	×	×	×	×	×	×	×	×	×	×		P1	-	-
Philotheca linearis	×	×	×	×	×	×	×	×	×	×		P1	-	-
Philotheca tubiflora	×	×	×	×	×	×	×	×	×	×		P1	-	-
Phyllanthus baekeoides	×	×	×	×	×	×	×	×	×	×		P1	-	-
Verticorda mirabilis	×	×	×	×	×	×	×	×	×	×		P1	-	-
Baeckea sp. Great Victoria Desert	88 (3,437)	16 (145)	11 (167)	10 (811,545)	36 (>400,000)	×	8 (>10,000)	3 (>50,000)	7	>250	Occasional to common	P2	-	-
Calytrix warburtonensis	×	×	×	×	×	×	×	×	×	×		P2	-	-
Dicrastylis nicholasii	302 (14,916)	3 (22)	27 (681)	36 (8,775,527)	43 (>15,000)	×	17 (>250,000)	×	8	Unknown	Occasional to common	P2	-	-
Eremophila undulata	×	×	×	×	×	1	2 (159)	×	×	×		P2	-	-
Grevillea secunda	1 (5)	7 (47)	9 (30)	×	83 (>15,000)	×	2 (159)	10 (>5,000)	16	>90	Occasional to frequent	P2	-	-

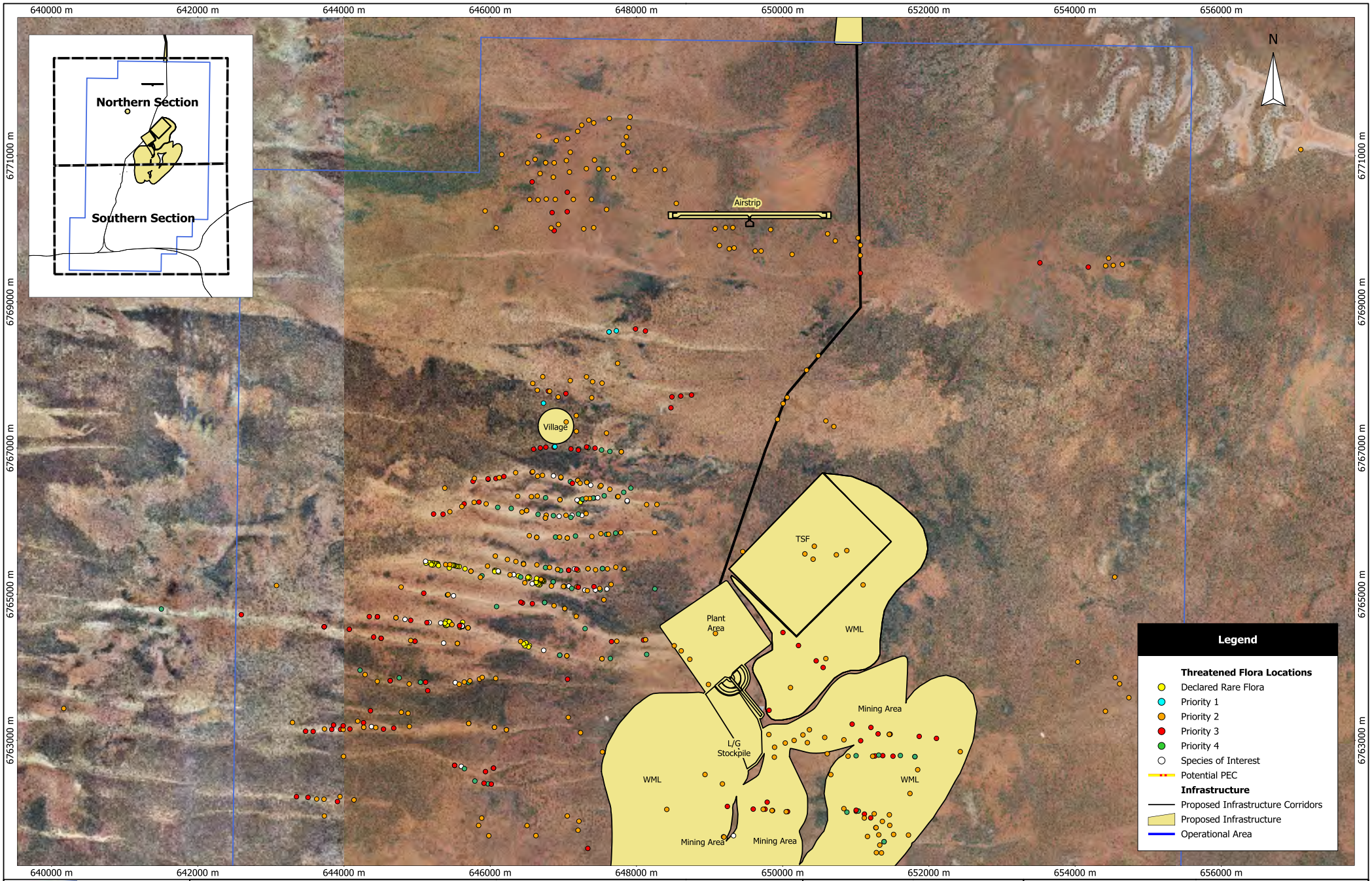
Species	Populations Observed in Tropicana Gold Project Area (No. Plants Recorded)					Populations Recorded in Nature Reserves (Estimated No. of Plants)^			Flora Base Records			Conservation Status		
	Operational Area	Pinjin *	TTIC *	Bore-field & Pipe-line**	Other***	Neale Junction	PLNR	Queen Victoria Springs	No. Records	No. Plants	Description	WA	Federal	IUCN
Haegiela tatei	×	×	×	×	2 (unknown)	×	×	×	×	×		P2		
Isotropis canescens	×	×	1 (1)	×	×	×	×	×	4	Unknown	Occasional to abundant	P2	-	-
Malleostemon sp. Officer Basin	18 (465)	×	×	×	7 (49)	×	×	×	4	Unknown	Occasional to frequent	P2	-	-
Olearia arida	61 (1,224)	4 (9)	7 (39)	55 (545,771)	35 (2,449)	1 (9)	1 (1)	1 (1)	7	Unknown	Frequent	P2	-	-
Phlegmatospermum eremaeum	×	×	×	×	2 (unknown)	×	×	×	×	×		P2		
Physopsis chrysotricha	×	×	2 (~12)	×	1 (unknown)	×	×	×	3	Unknown	Very rare	P2	-	-
Thryptomene eremaea	×	×	×	×	1 (80)	×	×	×	8	Unknown	Occasional to frequent to common	P2	-	-
Trachymene pyrophila	×	×	×	×	×	×	×	×	×	×		P2	-	-
Acacia eremophila numerous nerved variant	21 (731)	×	×	×	25 (605)	1 (2,000)	11 (366)	×	7	Unknown	Frequent to patchy	P3	-	-
Acacia eremophila var. *variabilis*	3 (45)	×	×	×	7 (143)	×	×	×	16	Unknown	Few plants to variable	P3	-	-
Calandrinia porifera	×	×	×	×	×	×	×	×	×	×		P3	-	-
Calotis latiscula	×	×	×	×	×	×	×	×	×	×		P3	-	-
Calytrix praecipua	×	×	×	×	×	×	×	×	×	×		P3	-	-
Diocirea actutifolia	×	×	×	×	12 (unknown)	×	×	×	×	×		P3	-	-
Dicrastylis cundeeleensis	54 (6,078)	15 (518)	6 (73)	6 (2075)	32 (1,224)	1 (1)	6 (435)		11	Unknown	Uncommon to very common	P3	-	-
Diocirea ternata	×	×	×	×	40 (>2,000)	×	×	×	×	×			-	-
Eucalyptus pimpiniana	×	11 (554)	×	×	7(157)	×	×	×	11	>600	Limited distribution to locally frequent	P3	-	-
Eucalyptus sparsa	×	×	×	×	×	×	×	×	×	×		P3	-	-

Species	Populations Observed in Tropicana Gold Project Area (No. Plants Recorded)					Populations Recorded in Nature Reserves (Estimated No. of Plants)^			Flora Base Records			Conservation Status		
	Operational Area	Pinjin *	TTIC *	Bore-field & Pipe-line**	Other***	Neale Junction	PLNR	Queen Victoria Springs	No. Records	No. Plants	Description	WA	Federal	IUCN
Frankenia georgei	×	×	×	×	×	×	×	×	×	×		P3	-	-
Melaleuca apostiba	×	×	×	×	×	×	×	×	×	×		P3	-	-
Melaleuca coccinea	×	×	×	×	2 (2)	×	×	×	×	×		P3	-	-
Menkea draboides	×	×	×	×	2 (unknown)	×	×	×	×	×		P3	-	-
Melaleuca nanophylla	×	×	×	×	×	×	×	×	×	×		P3	-	-
Microcorys macredieana	42 (1,213)	5 (58)	7 (160)	16 (44,145)	67 (>30,000)	12 (12)	3 (>5,000)	7 (>30,000)	24	Unknown	Common, abundant, frequent	P3	-	-
Micromyrtus serrulata	×	×	×	×	6 (332)	×	×	×	14	Unknown	Rare, frequent, locally dominant	P3	-	-
Micromyrtus stenocalyx	94 (2017)	9 (101)	×	×	15 (>100,000)		2 (>50,000)	3 (>10,000)	17	>70	Occasional	P3	-	-
Sauropus ramosissimus	×	×	×	×	×	×	×	×	×	×		P3	-	-
Thryptomene nealensis	×	×	×	×	2 (unknown)	×	×	×	×	×		P3	-	-
Comesperma viscidulum	×	7 (24)	2 (9)	×	24 (>20,000)	×	×	×	9	>30	Mostly common	P4	-	-
Daviesia purpurascens	7 (520)	19 (81)	×	13 (22,789)	46 (326)	×	×	×	51	>300	Scattered to frequent to common	P4	-	-
Eucalyptus nigrifunda	×	×	×	×	×	×	×	×	×	×		P4	-	-
Lepidobolus deserti	78 (4,541)	15 (440)	4 (159)	2 (7)	102 (>100,000)		×	11 (>800,000)	19	>100	Scattered to frequent	P4	-	-
Caesia talinyka ms	61 (668)	×	×	×	7 (87)	×	5 (6,251)	×	×	×		SOI	-	-

* Includes all species found within 200 metres of the central alignment of the proposed road (i.e. - 100 metres either side of the central alignment).

** Includes extrapolated data for the entire borefield survey area.

*** Includes species records from other nearby areas outside the defined survey areas (described above) **Excludes** Queen Victoria Springs Nature Reserve and Plumridge Nature Reserve and Neale Junction Reserve & requires confirmation of identification.



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Scale: 1:45000
Original Size: A3
Air Photo Date: 2005
Grid: Australia MGA94 (51)

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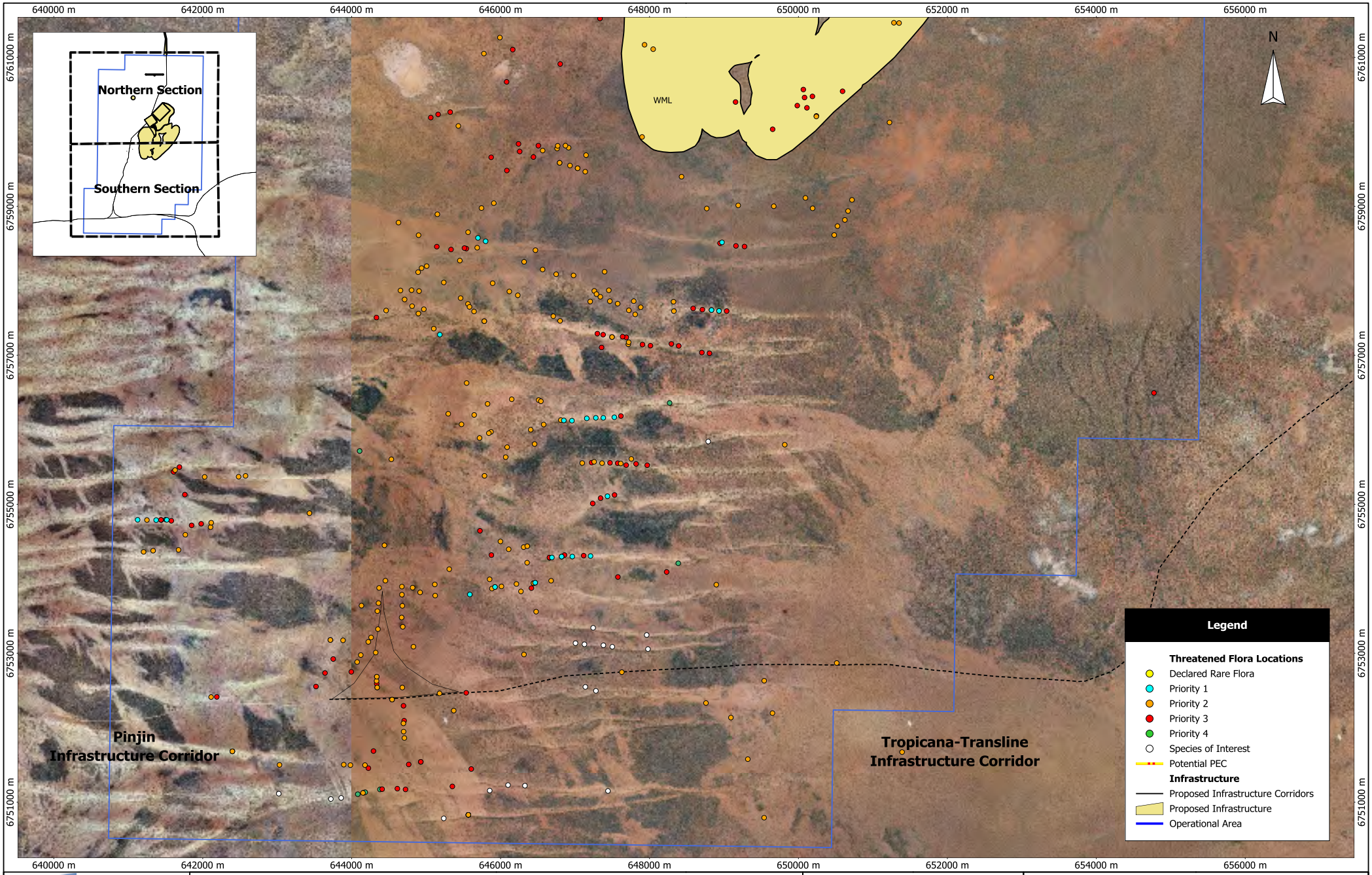
Tropicana Gold Project
Conservation Significant Species Report

Operational Area: Conservation Significant Flora Species (Northern Section)

Figure 2

W:\Tropicana\Drawings\Flora Maps 2009 07 09.map 23/07/2009 F2 - Flora Op Area A3 Nth



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Scale: 1:45000
Original Size: A3
Air Photo Date: 2005
Grid: Australia MGA94 (51)

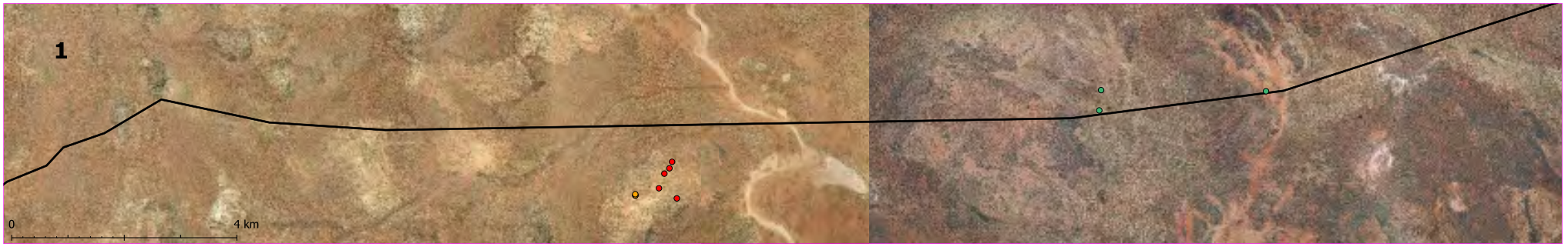
0 2 km

Tropicana Gold Project
Conservation Significant
Species Report

Operational Area: Conservation Significant Flora Species (Southern Section)

Figure 3

W:\Tropicana\Drawings\Flora Maps 2009 07 09.map 23/07/2009 F3 - Flora Op Area A3 Sth

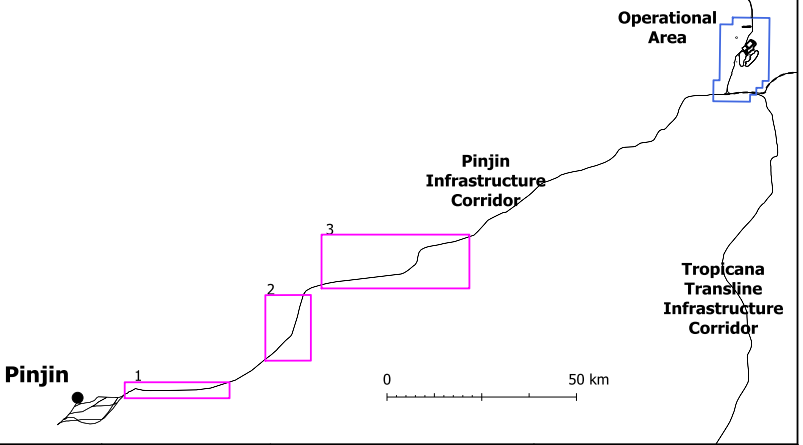


Legend

Threatened Flora Locations
- Declared Rare Flora
- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Species of Interest
- Potential PEC

Infrastructure
- Proposed Infrastructure Corridors
- Proposed Infrastructure
- Operational Area

N



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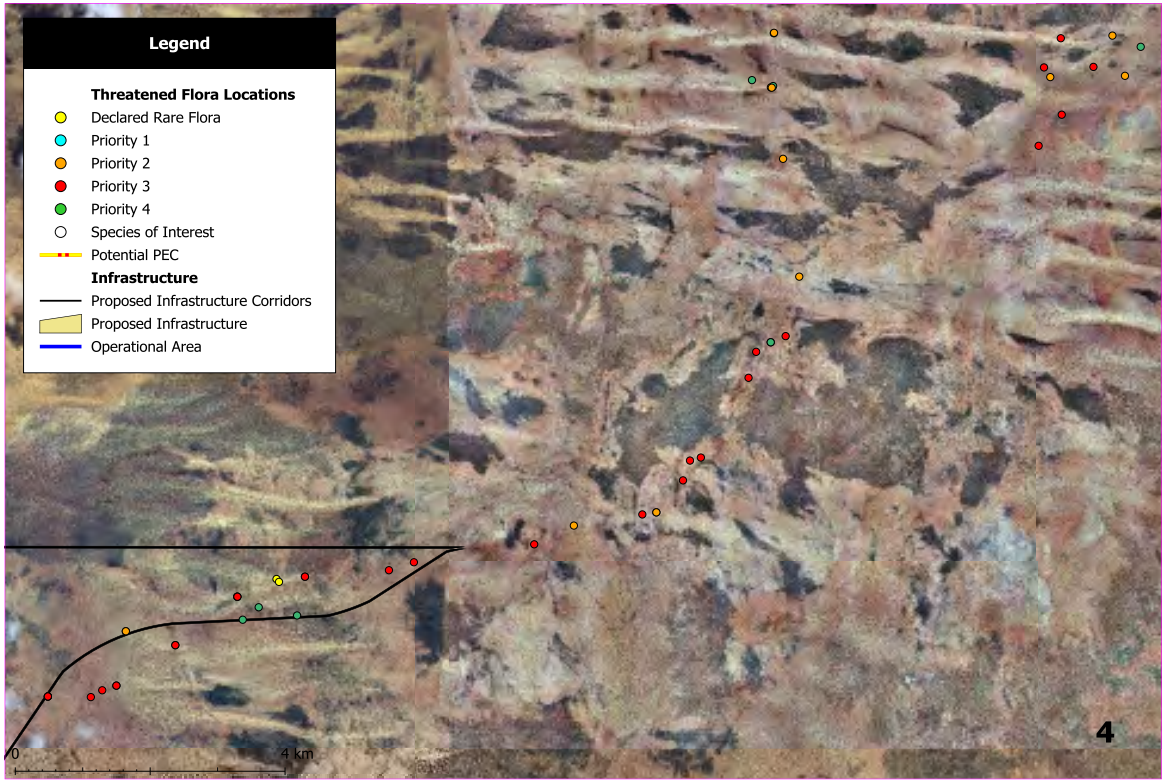
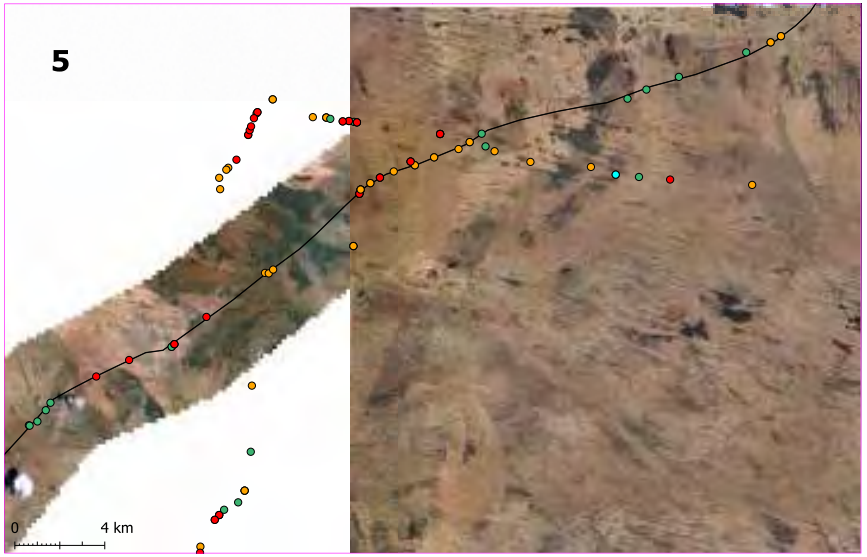
Tropicana Gold Project
Conservation Significant Species Report

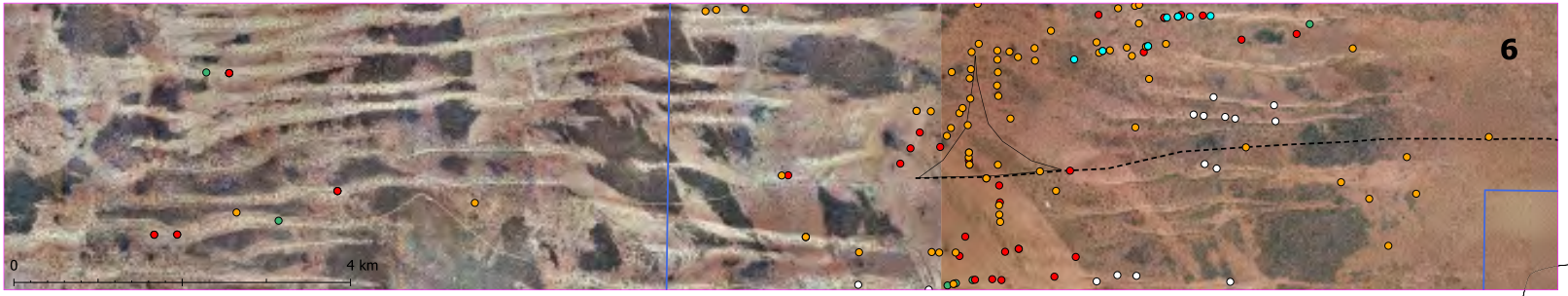
Pinjin Infrastructure Corridor: Conservation Significant Flora Species on the Southern Section (1 - 3)

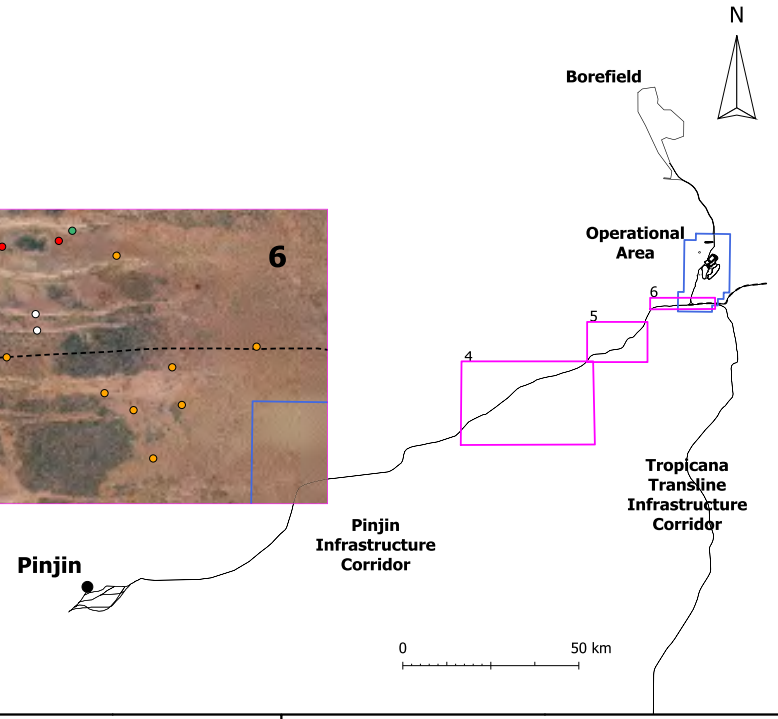
Figure 4

W:\Tropicana\Drawings\Flora Maps 2009 07 09.map 22/07/2009 F4 - Pinjin Road Layout 1-3 A3









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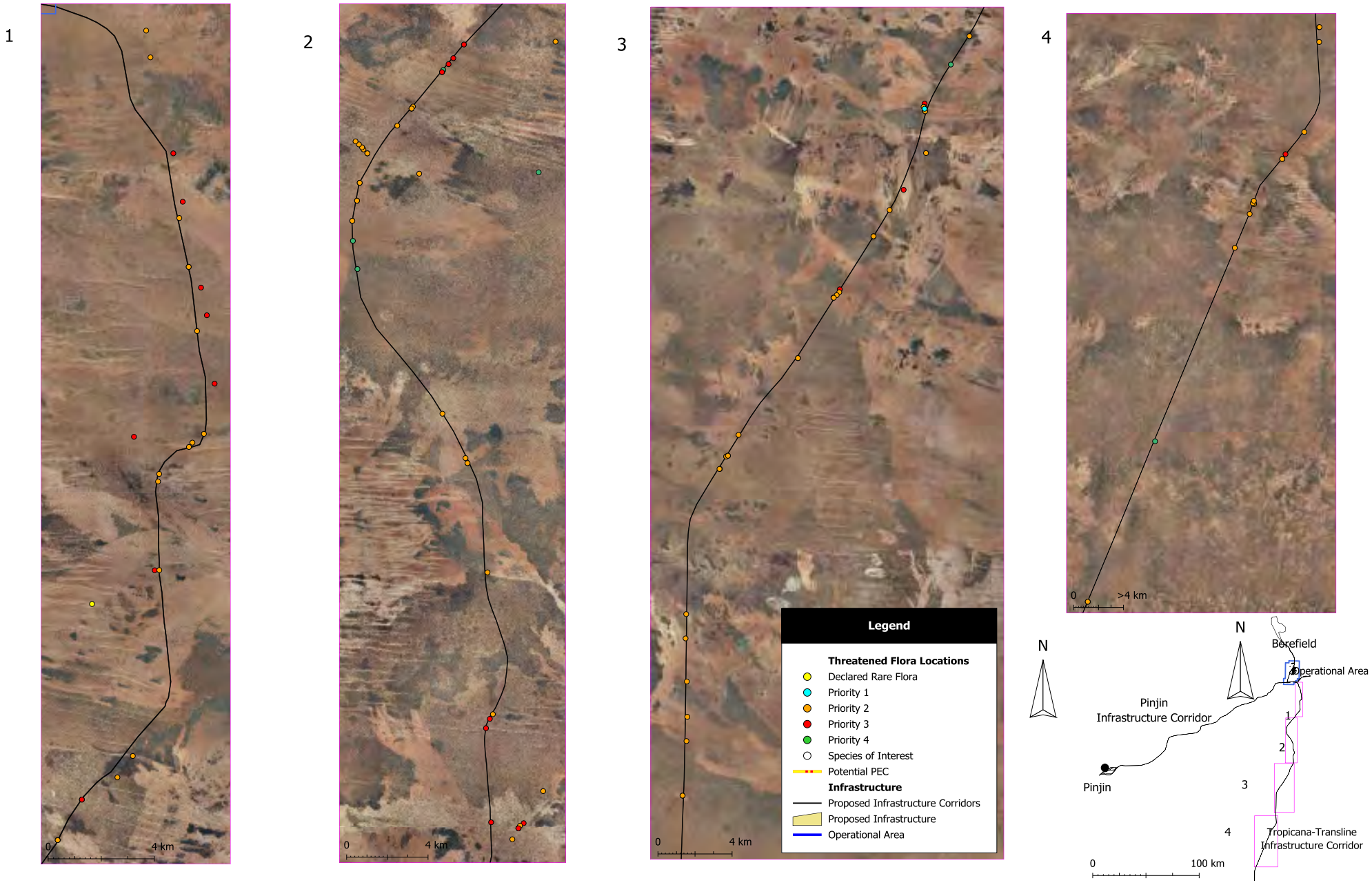
Tropicana Gold Project
Conservation Significant
Species Report

Pinjin Infrastructure Corridor: Conservation Significant Flora Species on the Northern Section (4 - 6)

Figure 5

W:\Tropicana\Drawings\Flora Maps 2009 07 09.map 22/07/2009 F5 - Pinjin Road Layout 4-6 A3



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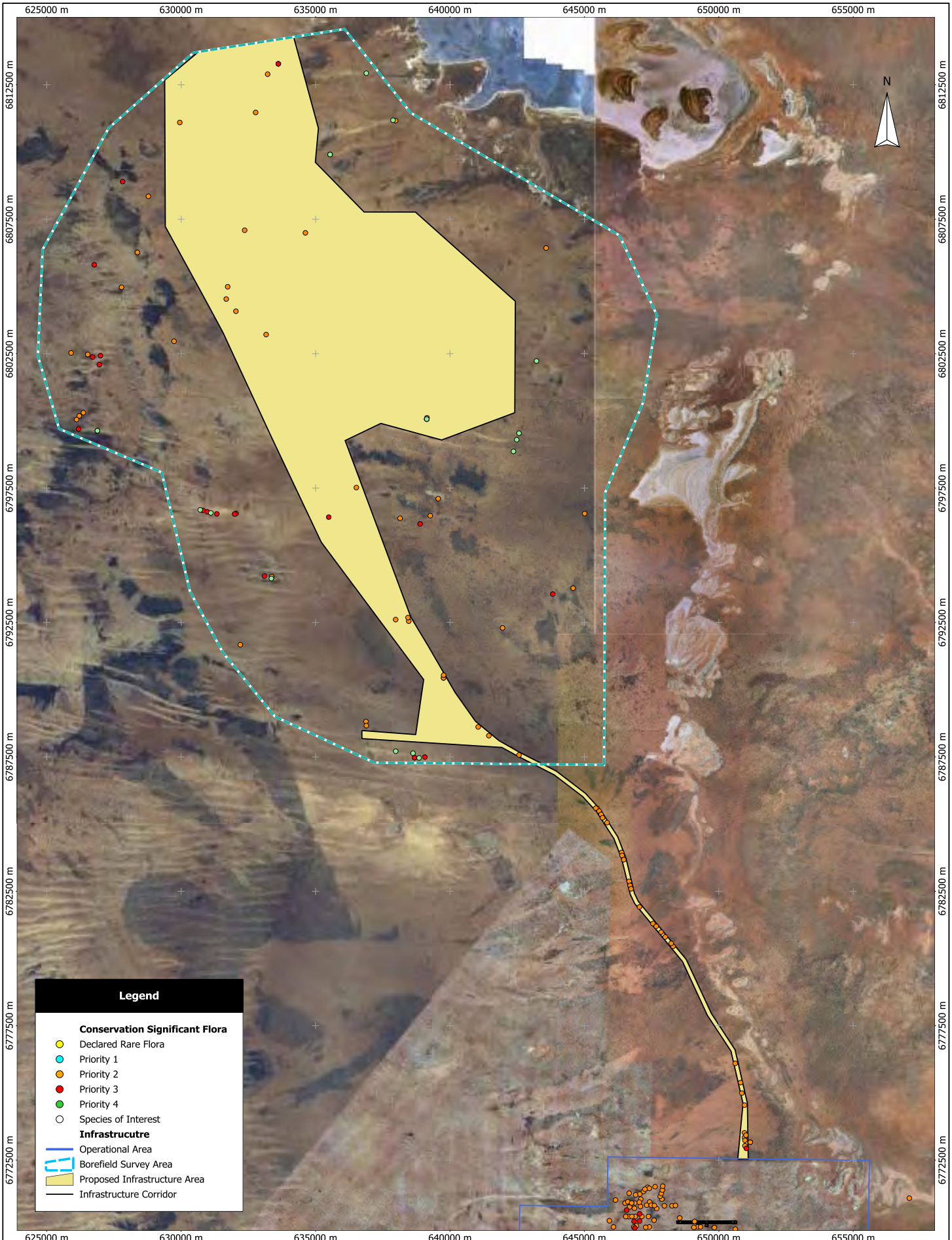
Tropicana Gold Project
Conservation Significant
Species Report

Tropicana-Transline Infrastructure Corridor:
Conservation Significant Flora Species

Figure 6

W:\Tropicana\Drawings\Flora Maps 2009 07 09.map 23/07/2009 F7 - Cable Haul Road Map



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0 5 km

Tropicana Gold Project Conservation Significant Species Report

Borefield and Water Pipeline Corridor: Conservation Significant Flora Species

Figure 7

5.2 SIGNIFICANT VEGETATION

5.2.1 Operational Area

Surveys of the Operational Area (*Ecologia*, 2009b) identified 11 major vegetation communities, incorporating 18 vegetation sub-types. Beard (1975) previously described five vegetation units within the Operational Area. Two of these units have restricted distribution within the GVD and on this basis can be considered to have higher regional conservation significance:

(i) Unit a_1c_2Lr t_2Hi; Tree steppe *Acacia aneura* (mulga) / *Casuarina pauper* (sheoak) [syn. *C. cristata*] woodland on sandplain.

(ii) Unit k_1,k_2Ci; Lightly wooded succulent steppe: *Acacia aneura* (mulga) with *Atriplex* (Saltbush) or *Kochia* (now *Maireana*).

Casuarina pauper woodlands, noted by Pearson (1994) as uncommon at a regional level, are also relatively restricted locally, comprising only 4% of the total area surveyed by Ecologia. However the most restricted assemblages are; those within the saline clay pan complex, accounting for less than 2% of the total area; shrublands associated with rocky breakaways (0.2%); and narrow drainage channel (0.2%). The saline complex in particular supports species which are not present elsewhere in the survey area.

Community 3 (xS.t_2t_7H) supported the DRF species *Conospermum toddii*, and as such is deemed regionally significant. Communities one (*e*$_x$L.t_2H), two, three, four, six and eight support Priority flora and are therefore considered locally significant. Locally and regionally significant vegetation communities are described in Table 4 and are numbered as in *Ecologia* (2009b).

Table 4: Conservation Significant Vegetation Communities in the Operational Area

	Vegetation Description	Vegetation Code
1.	**Mixed Eucalypt woodlands over mixed open shrubs and *Triodia basedowii* ($e_xL.t_2H$).**	
(i)	Open to sparse *Eucalyptus youngiana, E. trivalva* or *E. leptopoda* over an open tall shrub stratum of *Acacia murrayana* over open to moderately dense *Triodia basedowii.*	$e_xL.t_2H$
(ii)	Open *Eucalyptus youngiana* and sparse *Callitris preissii* over mixed shrubs over open to moderately dense *Triodia basedowii.*	
(iii)	*Eucalyptus trivalva* over *Acacia* and *Eremophila* dominated shrubland over sparse to open *Triodia basedowii*.	
2.	***Eucalyptus gongylocarpa* (marble gum) over *Triodia desertorum* or *T. basedowii.***	
(i)	*Eucalyptus gonglyocarpa* over open shrubland over open *Dodonaea viscosa* subsp. *angustissima*/*Eremophila platythamnos* subsp. *platythamnos* shrubland over *Triodia desertorum* or *T. basedowii.*	$e_{19}L.d_3er_1S.t_2t_7H$
(ii)	*Eucalyptus gonglyocarpa/E. youngiana/E. concinna* over open mixed shrubland over *Triodia desertorum.*	$e_{19}e_xL.xS.t_7H$
3.	**Dunes: Scattered *E. gongylocarpa* over mixed shrubs and *Triodia desertorum* or *T. basedowii*.**	
(i)	Occasional *Eucalyptus gongylocarpa* over mixed upper stratum over *Daviesia grahamii/Pityrodia loricata/Chrysocephalum puteale* low shrubland over sparse to open *Triodia desertorum* or *T. basedowii* and *Lomandra leucocephala* subsp. *robusta.*	$xS.t_2t_7H$
(ii)	Occasional *Eucalyptus gongylocarpa* over *Callitris collumelaris/Grevillea juncifolia* over *Acacia ligulata/Thryptomene seriata/Anthotroche pannosa* over *Triodia desertorum* or *T. basedowii.*	
4.	**Undulating plains: Open mallee *Eucalyptus concinna* over sparse to open low shrubs over open *Triodia scariosa* ($e_{71}L.sZ.t_8H$).**	
6.	**Minor Clay Pan: Scattered *Acacia nyssophylla/Grevillea sarissa* over open herbs and grasses ($a_{33}g_3S.xG$).**	
8.	**Open to moderately dense *Casuarina pauper* woodland over open mixed shrubs and scattered soft grasses and/or *Triodia scariosa* ($C_2e_xL.xS$).**	

5.2.2 Tropicana - Transline Infrastructure Corridor

Surveys of the TTIC (Ecologia, 2009c) identified nine major vegetation communities, incorporating 22 vegetation sub-types. Vegetation Community 1 (exL.t7t12H), which occurs on sand hills and undulating plains contained nine of the fourteen Priority species across the survey area. The Priority 4 species *Comesperma viscidulum* and *Daviesia purpurascens* were only recorded within this community type. Vegetation communities 2 and 5, which are closely related to dunal landforms, have potential to support several of the Priority species recorded during the survey and are therefore considered to be locally significant. Communities 1, 2 and 5 are described in Table 5 (as numbered by Ecologia, 2009c).

Table 5: Conservation Significant Vegetation Communities of TTIC

Vegetation ID	Landform	Vegetation Description
1. Mixed *Eucalyptus* woodland over hummock grassland (exL.t7t12H).		
E1A (sites 32, 36, 51, 74, 104, 112)	Sand hills and undulating plains, occasionally flat plains.	Open to sparse mixed *Eucalyptus youngiana* / *Eucalyptus trivalva / Eucalyptus ceratocorys / E. gracilis / E. horistes* mallees, over open tall *Acacia ligulata* / *Grevillea juncifolia* subsp. *temulenta* / *Duboisia hopwoodii* / *Aluta maisonneuvei* subsp. *auriculata* shrubs, over moderately dense *Keraudrenia velutina* subsp. *elliptica* / *Acacia helmsiana* / *Hannafordia bissillii* subsp. *bissillii* / *Dicrastylis nicholasii* low shrubs, over moderately dense *Triodia desertorum* hummock grasses.
E1B (sites 39, 48, 81)	Flat to undulating plains, red/orange soil.	Sparse mixed *Eucalyptus youngiana* / *Eucalyptus concinna* trees, over sparse to open *Acacia ligulata* / *Grevillea juncifolia* subsp. *temulenta* / *Acacia murrayana* tall shrubs, over open to moderately dense *Keraudrenia velutina* subsp. *elliptica* / *Aluta maisonneuvei* subsp. *auriculata* / *Acacia helmsiana* / *Hannafordia bissillii* subsp. *bissillii* / *Acacia sibina*, over sparse to open mixed *Triodia* spp. hummock grasses.
E1C (sites 40, 41, 82)	Undulating plains to minor dunes.	Open *Eucalyptus gongylocarpa* mallees, over sparse *Acacia aneura* / *Acacia ligulata* / *Grevillea juncifolia* subsp. *temulenta* tall shrubs, over open to moderately dense *Bertya dimerostigma* / *Acacia helmsiana* / *Keraudrenia velutina* subsp. *elliptica* shrubs, over moderately dense *Triodia tomentosa* hummock grasses.
2. *Callitris preissii* tall shrubland (p2S).		
E2A (sites 23, 71A, 82, 99)	Undulating plains to dunes.	Sparse to open *Eucalyptus mannensis / Eucalyptus youngiana* mallees, over open *Callitris preissii / Thryptomene biseriata / Acacia ligulata* tall shrubs, over open *Anthotroche pannosa / Hakea francisiana* shrubs, over sparse to open *Triodia tomentosa / Triodia scariosa* hummock grasses.
E2DC (sites 70, 77, 99)	Dunes to dune crests.	Sparse to open *Eucalyptus trivalva* / *Eucalyptus youngiana* mallees, over open *Callitris preissii / Thryptomene biseriata / Leptospermum fastigiatum* tall shrubs, over sparse *Anthotroche pannosa / Microcorys macrediana / Pityrodia loricata* shrubs, over scattered *Glischrocaryon aureum* herbs.
E2B (sites 48, 69, 98, 100)	Flat dune crests / high points to undulating plains	Sparse *Eucalyptus gongylocarpa / Eucalyptus youngiana* mallees, over open *Callitris preissii* / *Thryptomene biseriata / Acacia ligulata* tall shrubs, over open *Anthotroche pannosa / Hakea francisiana / Eremophila decipiens* subsp. *decipiens* shrubs, over scattered mixed *Triodia* spp. hummock grasses.

Vegetation ID	Landform	Vegetation Description
5. *Triodia rigidissima* hummock grasslands.		
T5A (sites 109, 110)	Flat dune crest / high point to undulating plain.	Open *Eucalyptus eremicola* subsp. *peeneri* mallees, sometimes with *E. concinna*, over scattered *Gyrostemon ramulosus* tall shrubs, over scattered *Rulingia craurophylla* shrubs, over open *Zygophyllum apiculatum* herbs with open *Triodia irritans* hummocks.
T5B (sites 68, 84, 105, 106, 107, 108)	Flat dune crest / high point to undulating plain.	Open *Eucalyptus concinna / Eucalyptus youngiana* mallees, over scattered *Acacia ligulata / Acacia hemiteles* tall shrubs, over scattered *Scaevola spinescens / Grevillea nematophylla / Acacia rigens / Grevillea acuaria*, over open to moderately dense *Triodia rigidissima* hummock grassland.
T5C (sites 86, 91, 103)	Flat dune crest / high point to undulating plain.	Sparse *Acacia ligulata / Acacia hemiteles* tall shrubs, over scattered *Scaevola spinescens / Senna artemisioides / Eremophila georgei* shrubs, over sparse *Ptilotus obovatus* var. *obovatus* low shrubs, over dense *Triodia rigidissima* hummock grassland.

5.2.3 Pinjin Infrastructure Corridor

Surveys of the Pinjin Infrastructure Corridor (Mattiske, 2009a) identified 37 plant communities. Four vegetation communities support either DRF or Priority species and as such are identified as being either regionally or locally significant. These communities are listed in Table 6 (communities are named and numbered as in Mattiske (2009a)).

Table 6: Conservation Significant Vegetation Communities in the Pinjin Infrastructure Corridor

Vegetation Unit	Vegetation Description
Eucalypt Woodland **E11**: *Eucalyptus gongylocarpa* woodland over mixed low shrubs.	Low Open Woodland of Eucalyptus gongylocarpa with *Callitris preissii* over *Bertya dimerostigma*, *Dicrastylis cundeeleensis* (P3), *Lomandra leucocephala*, *Dodonaea viscose* subsp. *angustissima* and mixed low shrubs. This community occurs on orange sand dunes.
Shrubland **S5**: Mixed low shrubs over grasses and occasional *Eucalyptus gongylocarpa*.	Open Shrubland of *Grevillea juncifolia*, *Cryptandra distigma*, *Acacia desertorum* var. *desertorum* and mixed low shrubs over *Triodia desertorum*, *Lepidobolus deserti* (P4) and *Chrysitrix distigmatosa* with occasional emergent *Eucalyptus gongylocarpa*. This community occurs on yellow to yellow-orange sand on slopes.
Shrubland **S9**: Mixed low Shrubland with occasional emergent *Eucalyptus* species.	Low Shrubland of *Leptosema chambersii*, *Baeckea* sp. Great Victoria Desert (P2), *Homalocalyx thryptomenoides*, *Enekbatus eremaeus*, *Cryptandra distigma* with mixed low shrubs and occasional emergent *Eucalyptus* spp. This community occurs on yellow-orange sandy loams on lower and mid slopes.
Shrubland **S11**: Mixed shrubland over grasses with occasional emergent *Eucalyptus* spp.	Low Open Shrubland of *Thryptomene biseriata, Lomandra leucocephala, Pityrodia lepidota, Scaevola basedowii, Chrysocephalum puteale* with mixed low shrub over *Triodia spp*. and *Lepidobolus deserti (P4)* with occasional emergent Eucalyptus spp. This community occurs on yellow or yellow-orange sand dunes.

5.2.4 Water Borefield and Pipeline Corridor

Flora and vegetation survey of the Water Borefield and Pipeline area identified 13 vegetation communities. None of these communities supported DRF species and as such are not considered regionally significant. Seven communities supported Priority species, and as such are considered to have local significance. Two communities are restricted to distinct landforms and are therefore considered locally significant. These communities are presented in Table 7 (as numbered by Botanica, 2009).

Table 7: Conservation Significant Vegetation Communities in the Water Borefield and Pipeline Corridor

Vegetation Unit	Vegetation Description
1. Longitudinal Red Sand Dunes.	
E1	Scattered *Eucalyptus gongylocarpa* over mixed shrubs over *Triodia basedowii.*
2. Sandy Flats and Swales.	
E2	*Eucalyptus gongylocarpa* over mixed *Acacia* over mixed moderately open to moderately dense shrubs over *Triodia basedowii*.
E3	Mixed Eucalypt woodlands dominated by *Eucalyptus gongylocarpa* and *E. youngiana* over mixed open shrubs and *Triodia basedowii*.
E4	Open mallee *Eucalyptus concinna* over sparse to open *Triodia basedowii*.
A1	Moderately dense to dense *Acacia aneura* woodland over isolated shrubs over scattered *Triodia basedowii*.
T1	Open to moderately open mixed shrubs over *Triodia basedowii*.
A2	Open to moderately open *Acacia aneura* over *Aluta maisonneuvei subsp auriculata* over scattered *Triodia basedowii*.
3. Rocky Breakaway and Stony Rise.	
A5	Moderately dense to dense mixed *Acacia* woodland over mixed shrubs dominated by *Eremophila latrobei* ssp *filiformis* over *Caustis dioca*.
4. Lake Edge Community	
E5	Moderately dense *Eucalyptus mannensis ssp mannensis* over isolated shrubs and scattered *Triodia basedowii.*
5. Dry Clay Pan	
E6	Sparse *Eucalyptus horistes* over low mixed shrubs dominated by *Atriplex vesicaria.*

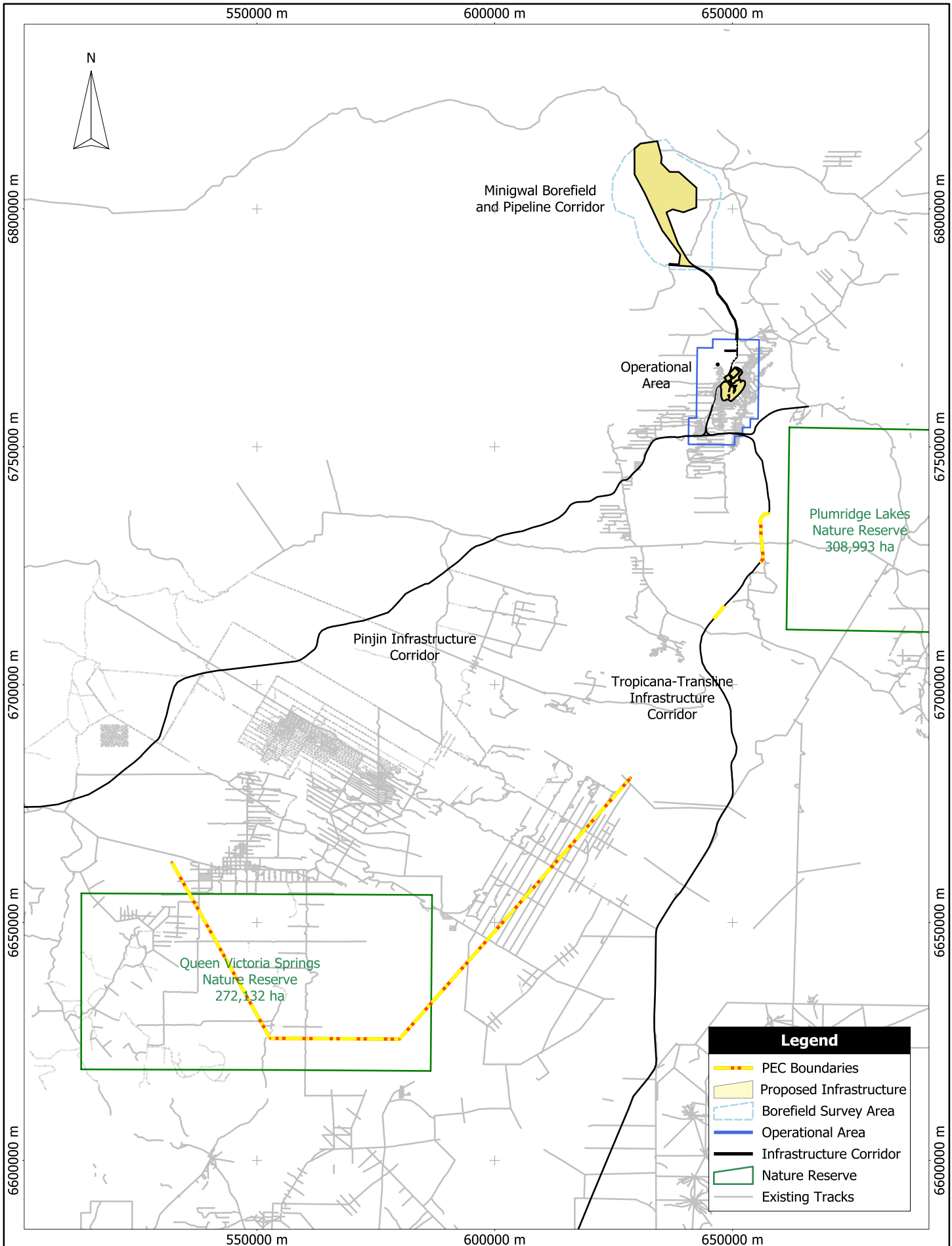
5.3 PRIORITY AND THREATENED ECOLOGICAL COMMUNITIES

The DEC has listed the yellow sand plains community near the Queen Victoria Nature Reserve as a Priority 3 PEC due to the high diversity of small vertebrates, unusual combinations of species and large numbers of threatened species (Mulgara sp., Marsupial Mole, Sandhill Dunnart, Woma Python, Malleefowl, Scarlet-chested Parrot, Princess Parrots and Major Mitchell's Cockatoo) as well as the presence of rare and poorly known plant species' this habitat supports. The current gazetted location of the PEC is provided in Figure 8.

It is possible that this PEC has a resemblance to an area within the TTIC (See Figure 8) and communities S9 and/or S11 defined by Mattiske on the Pinjin Infrastructure Corridor.

However, to date, little information is available about the plant assemblages of this PEC (J. Pryde pers. comm.).

Some discrepancies between the gazetted PEC and the potential PEC along TTIC have been noted, including variations in species present in the gazetted PEC compared to that of the potential PEC. DEC is unsure at this stage whether this community can be defined on floristic grounds.



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Scale: 1:1000000
Original Size: A4
Grid: MGA94(51)

0 25 km

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Gazetted PEC and Potential PECs Located in the Tropicana-Transline Infrastructure Corridor

Figure 8

6. SIGNIFICANT FAUNA AND HABITAT

6.1 SIGNIFICANT FAUNA - REGIONAL CONTEXT

Desktop searches of the DEC Threatened and Priority Species Database and the *EPBC Act* Protected Matters Database identified 32 conservation significant fauna species potentially present in the survey areas (including those presumed to be extinct in the local area). Field surveys identified 11 of these species as being present, or historically present, in the TGP area. A summary of the results of the database searches, Level 1 and Level 2 fauna surveys are presented in Table 8.

Of the conservation significant species identified as present in the Operational Area, six were listed by the State government as being significant:

- Southern Marsupial Mole (Schedule1, Vulnerable).
- Malleefowl (Schedule 1).
- Australian Bustard (Priority 4).
- Greater Stick-nest Rat (Schedule 1).
- Woma Python (Schedule 4 - Other specially protected fauna).
- Peregrine Falcon (Schedule 4).

Five species present were also listed Federally under the *EPBC Act*:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).
- Rainbow Bee-eater (Migratory).
- Greater Stick-nest Rat (Vulnerable).
- Fork-tailed Swift (Migratory, JAMBA, CAMBA).

Eight species present were listed internationally by the IUCN:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).
- Australian Bustard (Near Threatened).
- Rainbow Bee-eater (Least Concern).
- Greater Stick-nest Rat (Vulnerable).
- Peregrine Falcon (Least Concern).
- Woma Python (Endangered).
- Fork-tailed Swift (Migratory, JAMBA, CAMBA).

Of the conservation significant species surveyed in the Pinjin Infrastructure Corridor, four species identified were listed as being of State significance:

- Southern Marsupial Mole (Schedule1).
- Malleefowl (Schedule 1).
- Australian Bustard (Priority 4).
- Crested Bellbird (Priority 4).

Five species present were also listed as being of Federal significance:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).
- Rainbow Bee-eater (Migratory).
- Common Greenshank (Migratory).
- Wood Sandpiper (Migratory).

Five species present were listed by the IUCN as being of international conservation significance:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).
- Australian Bustard (Near Threatened).
- Rainbow Bee-eater (Least Concern).
- Crested Bellbird (Least Concern).

Of the conservation significant species identified as being present in the TTIC, two species are listed by the State:

- Southern Marsupial Mole (Schedule1).
- Malleefowl (Schedule 1).

Two species were also listed as being of Federal significance:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).

And two were also listed as having international conservation significance by the IUCN:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).

Of the conservation significant species identified as being present in the Water Borefield and Pipeline Corridor, three were listed by the State:

- Southern Marsupial Mole (Schedule1).
- Malleefowl (Schedule 1).
- Australian Bustard (Priority 4).

Two species are also listed as being of Federal significance:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).

Three species present were listed by the IUCN as being of international conservation significance:

- Southern Marsupial Mole (Endangered).
- Malleefowl (Vulnerable).
- Australian Bustard (Near Threatened).

Locations of all conservation significant fauna species recorded are presented in Figure 9 through to Figure 13.

Many species identified as being potentially present in the TGP area through database searches were not identified in any Level 1 or Level 2 surveys. This is due to some species being recognised as extinct, extinct on the mainland or locally extinct, having not been surveyed in many years.

Full descriptions of each conservation significant fauna species, their distributions and photographs are provided in Appendix 1.

Table 8: Conservation Significant Fauna Species Recorded in Tropicana Surveys and their Regional Context

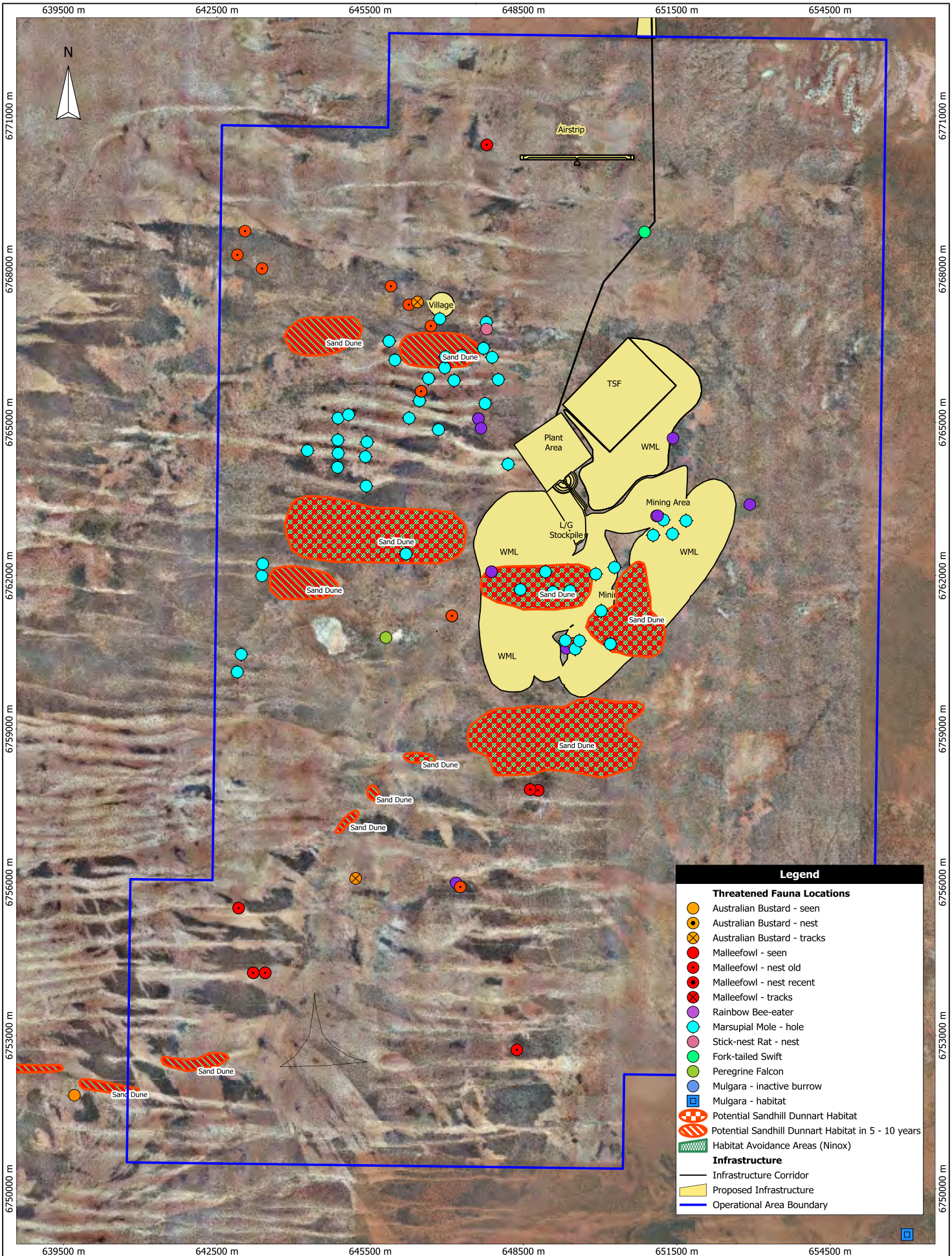
Species	Recorded in Site Specific Surveys				WA Status	Federal Status	IUCN	Surveyed Locally Y/N/ Unknown	Evidence Surveyed on Tropicana Gold Project	Suitable Habitat Present Y/N	Mitigation Measure Effective Y/N	Represented in Region Y/N/ Unknown	Residual Risk Level H/M/L
	Operational Area	Pinjin Access Rd	TTIC	Borefield & Pipeline									
Southern Marsupial Mole (*Notoryctes typhlops*)	✓*	✓*	✓*	✓*	S1	EN	EN	Y	149 Op. Area 10 Pinjin 26 TTIC 12 Borefield	Y	Y	Y	H - L
Malleefowl (*Leipoa ocellata*)	✓%	✓	✓	✓%	S1	VU MIG	VU	Y	1 bird, 22 mounds (1 active) and tracks.	Y	Y	Y	M - L
Australian Bustard *(Ardeotis australis*)	✓	✓	×	✓^	P4	-	NT	Y	7 birds, 1 nest, with egg, and tracks.	Y	Y	Y	M - L
Rainbow Bee-eater (*Merops ornatus*)	✓	✓	×	×	-	Mig Mar JAMBA	LC	Y	58 sightings.	Y	Y	Y	L
Sandhill Dunnart (*Sminthopsis psammophila)*	×	×	×	×	S1	EN	EN	Y	N	Y	Y	Y	M - L
Mulgara *Dasycercus cristicauda*)	×	×	×	×	S1	VU	VU	Y	N	Y	Y	Y	M - L
Brush-tailed Mulgara/Ampurta (*Dasycercus blythi*)	×	×	×	×	P4	-	LC	Y	N	Y	Y	Y	M - L
Chuditch (*Dasyurus geoffroyii*)	×	×	×	×	S1	VU	NT	N	N	Y	n/a	Locally extinct	L
Numbat (*Myrmecobius fasciatus*)	×	×	×	×	S1	VU	EN	N	N	Y	n/a	Locally extinct	L

Species	Recorded in Site Specific Surveys				WA Status	Federal Status	IUCN	Surveyed Locally Y/N/ Unknown	Evidence Surveyed on Tropicana Gold Project	Suitable Habitat Present Y/N	Mitigation Measure Effective Y/N	Represented in Region Y/N/ Unknown	Residual Risk Level H/M/L
	Operational Area	Pinjin Access Rd	TTIC	Borefield & Pipeline									
Bilby (*Macrotis lagotis*)	✘	✘	✘	✘	S1	VU	VU	N	N	Y	n/a	Locally extinct	L
Boodie (*Bettongia lesuer*)	✘	✘	✘	✘	S1	VU	NT	N	N	Y	n/a	Locally extinct	L
Central Long-eared Bat (*Nyctophilus* sp. *(previously N. timoriensis*)	✘	✘	✘	✘	P4	-	DD	unknown	N	Y	Y	N	L
Greater Stick-nest Rat (*Leporillus conditor*)	✓@	✘	✘	✘	S1	VU	VU	Y	Old stick nests	Y	n/a	Locally extinct	L
Great Desert Skink (*Egernia kintorei*)	✘	✘	✘	✘	S1	VU	VU	unknown	N	Y	Y	unknown	L
Southern Desert Lerista (*Lerista puncticauda*)	✘	✘	✘	✘	P2	-	Not listed	Y	N	Y	Y	QVSNR	L
Woma (*Aspidites ramsayi*)	✓	✘	✘	✘	OSPS* P1 S4	-	EN	unknown	2 sightings	Y	Y	Neale Junction	L
Peregrine Falcon (*Falco peregrinus*)	✓	✘	✘	✘	OSPS*	-	LC	Y	Y	Y	Y	Y	L
Grey Falcon (*Falco hypoleucos)*	✘	✘	✘	✘	P4	-	NT	unknown	N	Y	Y	Unknown	L
Oriental Dotterel /Plover (*Charadrius veredus*)	✘	✘	✘	✘	-	Mig ROKAM BA/JAM BA	LC	unknown	N	N	Y	Unknown	L
Major Mitchell's Cockatoo	✘	✘	✘	✘	OSPS*	-	LC	unknown	N	Y	Y	Unknown	L

Species	Recorded in Site Specific Surveys				WA Status	Federal Status	IUCN	Surveyed Locally Y/N/ Unknown	Evidence Surveyed on Tropicana Gold Project	Suitable Habitat Present Y/N	Mitigation Measure Effective Y/N	Represented in Region Y/N/ Unknown	Residual Risk Level H/M/L
	Operational Area	Pinjin Access Rd	TTIC	Borefield & Pipeline									
(*Cacatua leadbeateri*)													
Princess Parrot (*Polytelis alexandrae*)	✗	✗	✗	✗	S1 P4	VU	NT	unknown	N	Y	Y	Unknown	L
Naretha Blue Bonnet (*Northiella haematogaster Narethae)*	✗	✗	✗	✗	S4	-	LC	unknown	N	Y	Y	Unknown	L
Night Parrot (*Pezoporus occidentalis*)	✗	✗	✗	✗	S1	EN	CE	unknown	N	Y	Y	Unknown	L
Striated Grasswren (*Amytornis striatus*)	✗	✗	✗	✗	P4	-	LC	Y	N	Y	Y	NJNR, QVSNR	L
Thick-billed Grasswren (*Amytornis textilis*)	✗	✗	✗	✗	P4	-	LC	unknown	N	-	Y	Unknown	L
Slender-billed Thornbill (*Acanthiza iredalei iredalei*)	✗	✗	✗	✗	S1 P4	VU	LC	unknown	N	Y	Y	Unknown	L
Fork-tailed Swift (*Apus pacificus*)	✓	✗	✗	✗	-	Mig JAMBA/ CAMBA	LC	Y	Y	Y	Y	Unknown	L
Cattle Egret (*Ardea ibis)*	✗	✗	✗	✗	-	Mig	LC	unknown	N	N	Y	Unknown	L

Species	Recorded in Site Specific Surveys				WA Status	Federal Status	IUCN	Surveyed Locally Y/N/ Unknown	Evidence Surveyed on Tropicana Gold Project	Suitable Habitat Present Y/N	Mitigation Measure Effective Y/N	Represented in Region Y/N/ Unknown	Residual Risk Level H/M/L
	Operational Area	Pinjin Access Rd	TTIC	Borefield & Pipeline									
Great Egret, White Egret (*Ardea alba)*	✗	✗	✗	✗	-	Mig	LC	unknown	N	N	Y	Unknown	L
Wood Sandpiper (*Tringa glareola)*	✗	✓	✗	✗	-	Mig	LC	Y	Y	Y	Y	Unknown	L
Common Greenshank (*Tringa nebularia*)	✗	✓	✗	✗	-	Mig	LC	Y	Y	Y	Y	Unknown	L
Crested Bellbird (*Oreoica gutturalis*)	✗	✓	✗	✗	P4 (southern sub-species)	-	LC	Y	Y	Y	Y	NJNR, QVSNR, PLNR	L
Total	**8**	**7**	**2**	**3**									

* Marsupial mole holes only; % - Malleefowl mounds only; ^ Bustard tracks only,
@ stick nest only (likely to be historical as species is considered extinct in the region), * OSPS - Other specially protected species.



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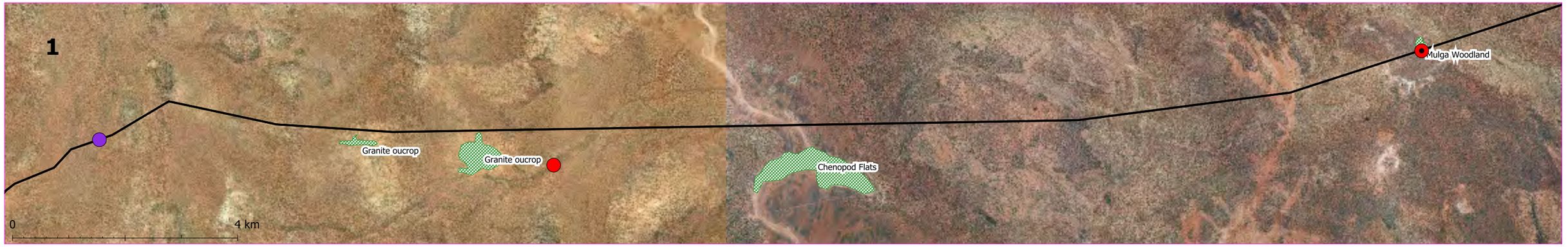
Scale: 1:65000
Original Size: A3
Grid: Australia MGA94 (51)
Air Photo Date: 2005
0 3 km

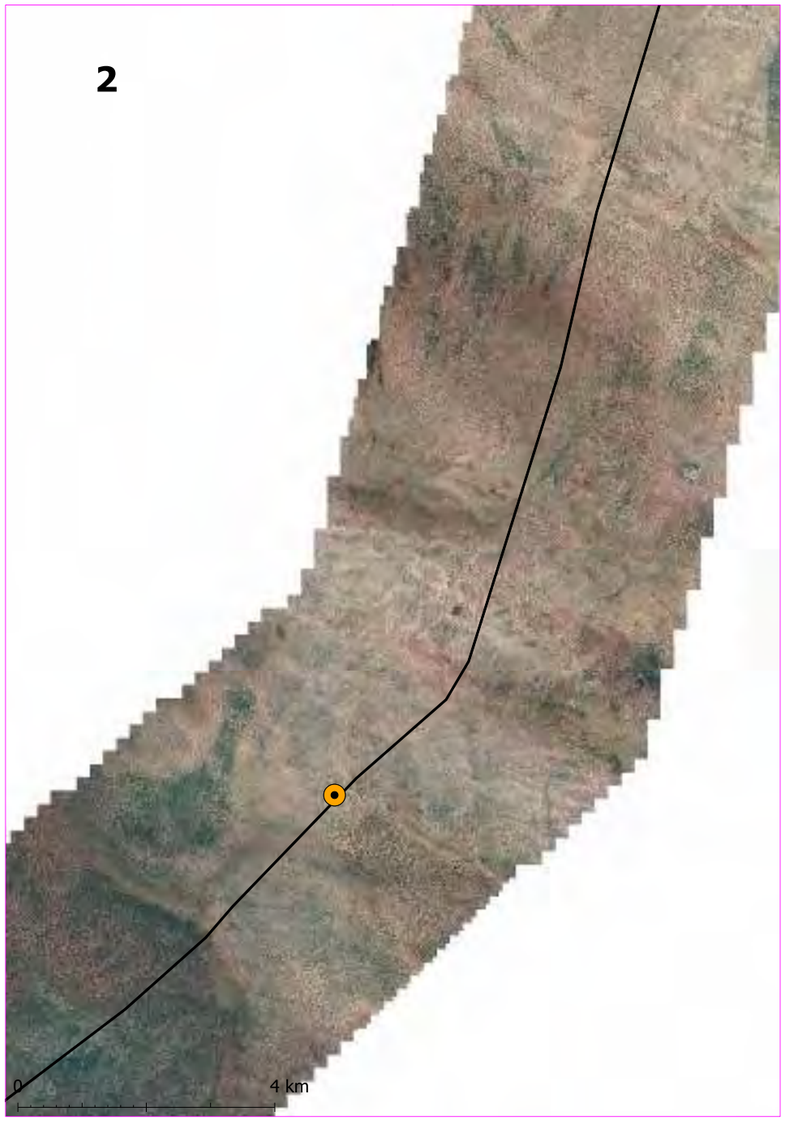
Tropicana Gold Project Conservation Significant Species Report

Operational Area: Conservation Significant Fauna Species and Significant Habitat

Figure 9

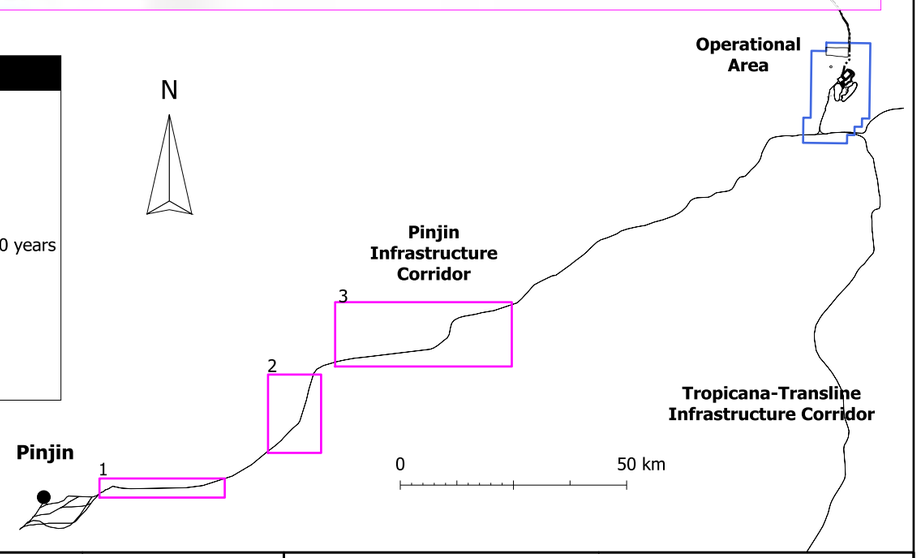
W:\Tropicana\Drawings\Fauna Maps 2009 07 09.map 23/07/2009 F10 - Operational Area - A3





Legend

Threatened Fauna Locations	Fork-tailed Swift
Australian Bustard - seen	Peregrine Falcon
Australian Bustard - nest	Mulgara - inactive burrow
Australian Bustard - tracks	Mulgara - habitat
Malleefowl - seen	Potential Sandhill Dunnart Habitat
Malleefowl - nest old	Potential Sandhill Dunnart Habitat in 5 - 10 years
Malleefowl - nest recent	Habitat Avoidance Areas (Ninox)
Malleefowl - tracks	**Infrastructure**
Rainbow Bee-eater	Infrastructure Corridor
Marsupial Mole - hole	Proposed Infrastructure
Stick-nest Rat - nest	Operational Area Boundary



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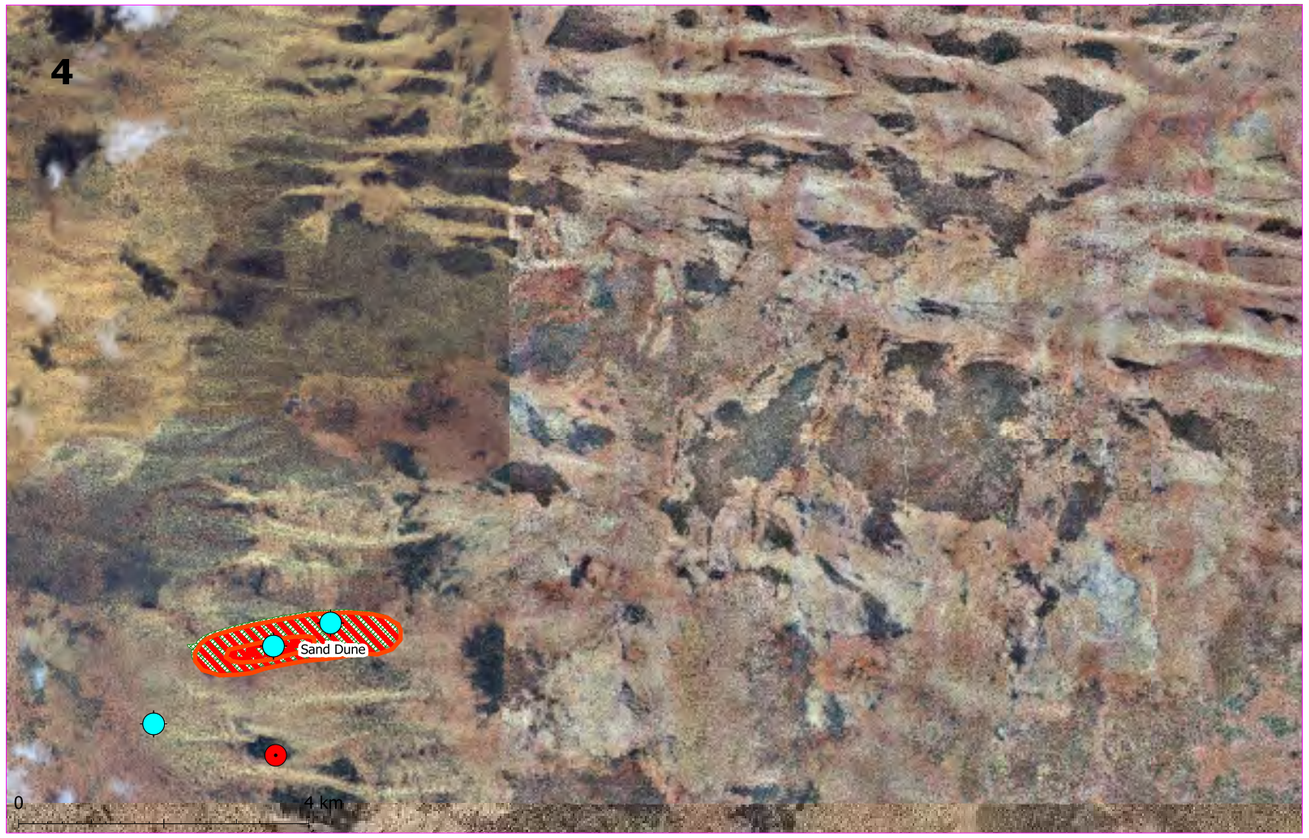
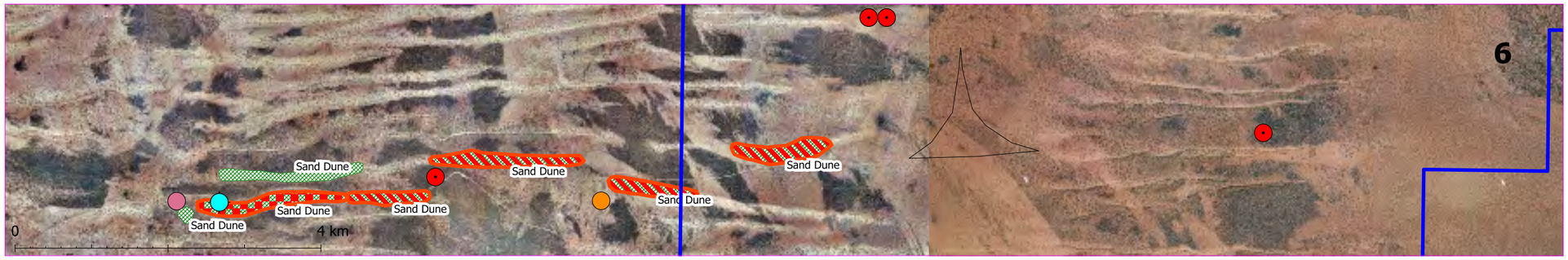
Tropicana Gold Project
Conservation Significant Species Report

Pinjin Infrastructure Corridor: Conservation Significant Fauna Species and Significant Habitat on the Southern Section (1 - 3)

Figure 10

W:\Tropicana\Drawings\Fauna Maps 2009 07 09.map 23/07/2009 F10 - Pinjin Infrastructure Corridor Map Layout





Legend

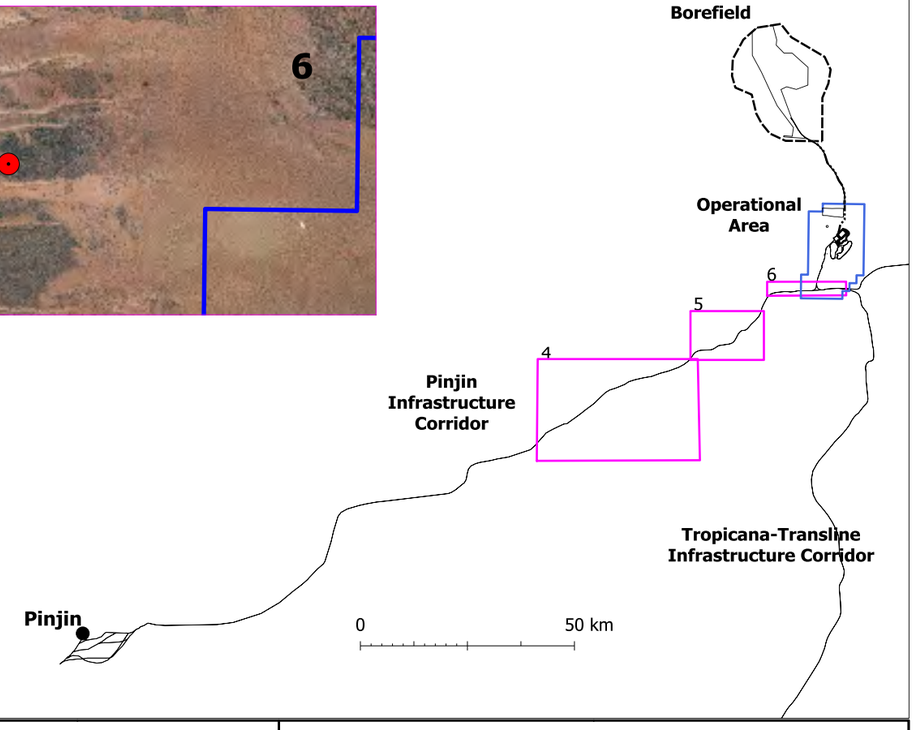
Threatened Fauna Locations

- Australian Bustard - seen
- Australian Bustard - nest
- Australian Bustard - tracks
- Malleefowl - seen
- Malleefowl - nest old
- Malleefowl - nest recent
- Malleefowl - tracks
- Rainbow Bee-eater
- Marsupial Mole - hole
- Stick-nest Rat - nest
- Fork-tailed Swift
- Peregrine Falcon
- Mulgara - inactive burrow
- Mulgara - habitat
- Potential Sandhill Dunnart Habitat
- Potential Sandhill Dunnart Habitat in 5 - 10 years
- Habitat Avoidance Areas (Ninox)

Infrastructure

- Infrastructure Corridor
- Proposed Infrastructure
- Operational Area Boundary

N



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Tropicana Gold Project
Conservation Significant Species Report

Pinjin Infrastructure Corridor: Conservation Significant Fauna Species and Significant Habitat on the Northern Section (4 - 6)

Figure 11

Legend

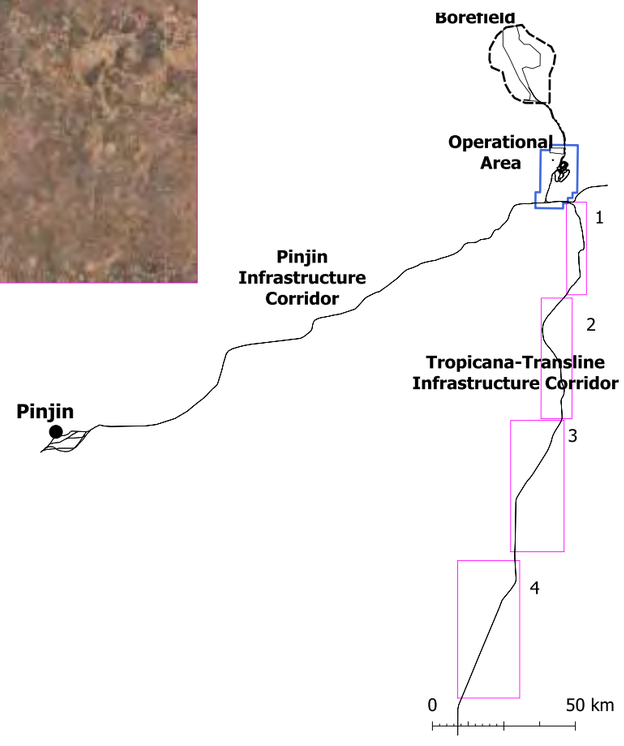
Threatened Fauna Locations

- Australian Bustard - seen
- Australian Bustard - nest
- Australian Bustard - tracks
- Malleefowl - seen
- Malleefowl - nest old
- Malleefowl - nest recent
- Malleefowl - tracks
- Rainbow Bee-eater
- Marsupial Mole - hole
- Stick-nest Rat - nest
- Fork-tailed Swift
- Peregrine Falcon
- Mulgara - inactive burrow
- Mulgara - habitat
- Potential Sandhill Dunnart Habitat
- Potential Sandhill Dunnart Habitat in 5 - 10 years
- Habitat Avoidance Areas (Ninox)

Infrastructure

- Infrastructure Corridor
- Proposed Infrastructure
- Operational Area Boundary

N



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Original Size: A3
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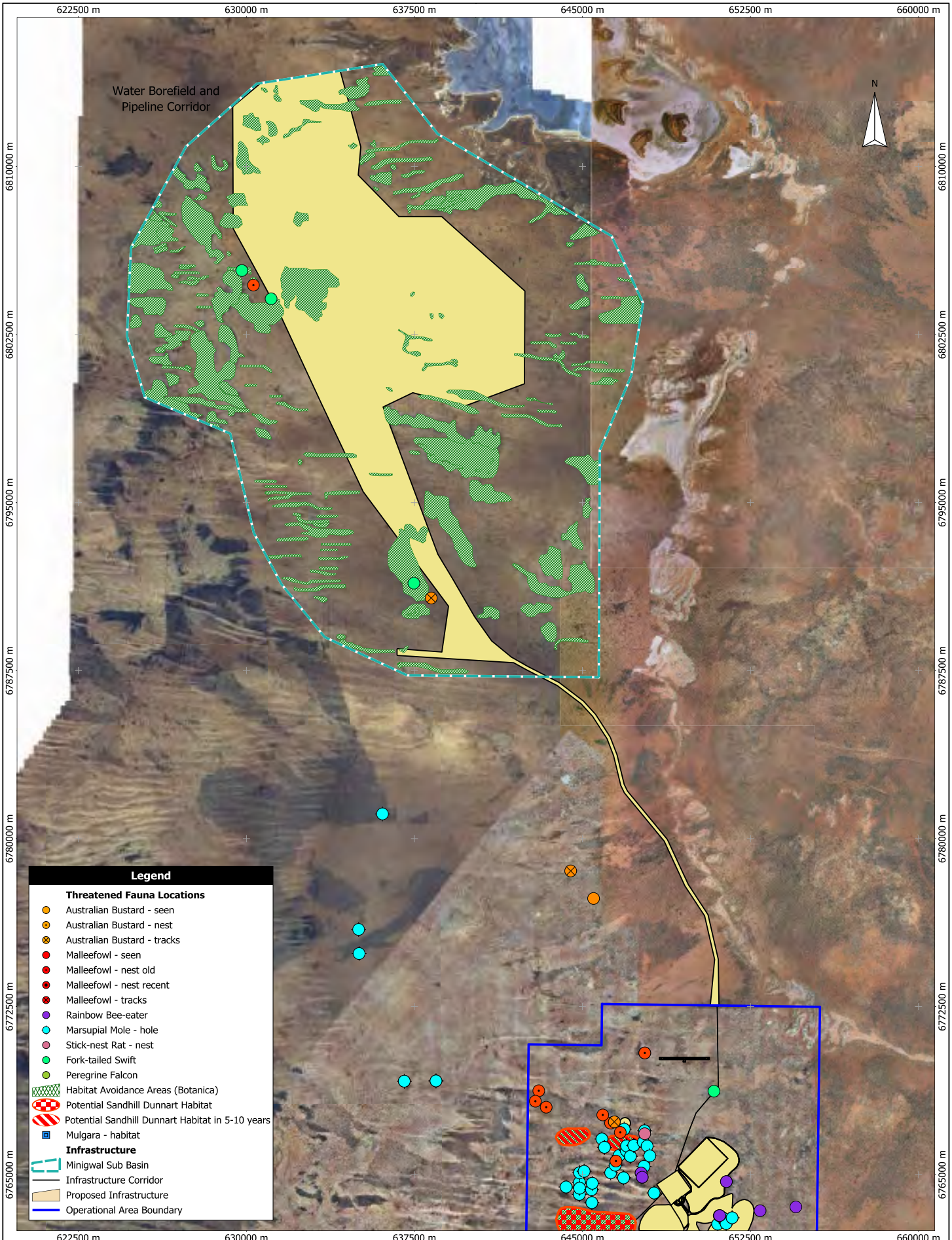
Tropicana Gold Project
Conservation Significant Species Report

Tropicana-Transline Infrastructure Corridor: Conservation Significant Fauna Species and Significant Habitat

Figure 12

W:\Tropicana\Drawings\Fauna Maps 2009 07 09.map 23/07/2009 F12 - TTIC Layout



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Original Size: A3
Air Photo Date: 2005
Grid: Australia MGA94 (51)

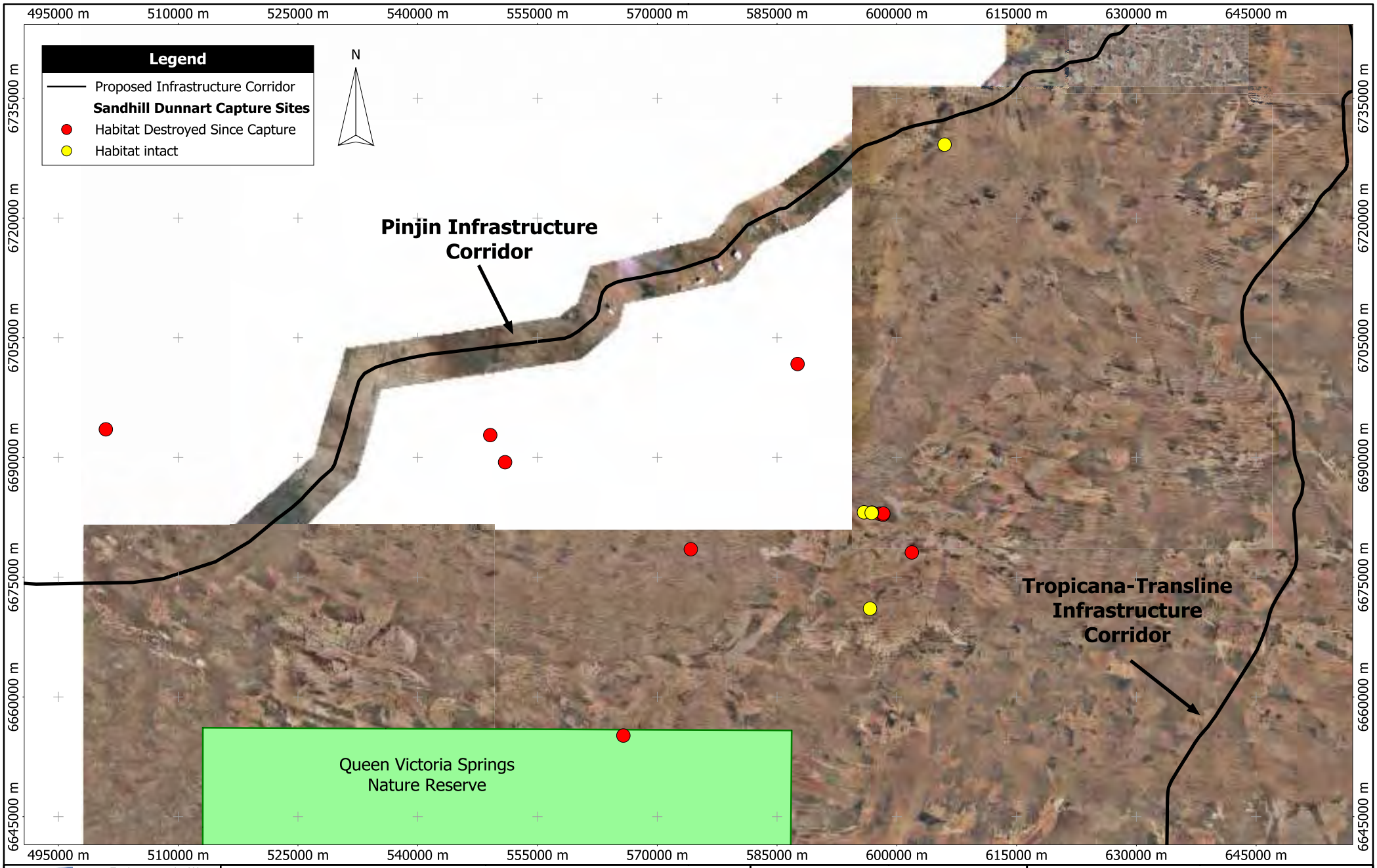
0 5 km

Tropicana Gold Project
Conservation Significant
Species Report

Borefield and Water Pipeline: Conservation Significant Fauna Species and Significant Habitat

Figure 13

W:\Tropicana\Drawings\Fauna Maps 2009 07 09.map 22/07/2009 F13 - Borefield Fauna



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Scale: 1:600000
Original Size: A4
Air Photo Date: 2005
Grid: Australia MGA94 (51)

0 20 km

Tropicana Gold Project
Conservation Significant Species Report

Location of all Known Sandhill Dunnart Captures in Western Australia

Figure 14

W:\Tropicana\Drawings\Fauna Maps 2009 07 09.map 17/07/2009 F15 - Sandhill Dunnart

6.1.1 Southern Marsupial Mole (Endangered)

No Southern Marsupial Moles were recorded during any surveys of the TGP area. The documented occurrence of the Southern Marsupial Mole in the Operational Area, Infrastructure Corridors and areas adjacent to the borefield was based on the presence and identification of Marsupial Mole holes. Direct observation and sampling of Marsupial Moles is extremely difficult because of their "cryptic subterranean habits". Instead, standard practice is to use indirect methods of assessment including searching for their holes and examining predator scats (Benshemesh & Schultz, 2008).

Techniques which use mole holes as an indication of Marsupial Mole presence give a rating of mole hole age as fresh, recent, oldish, old and very old based upon how freely sand flows from exposed mole holes when intersected by excavated trenches. Although recorded in all surveys, this measure is subjective and qualitative rather than a quantifiable measurement.

In the Operational Area, 139 mole holes were reported from two surveys. Of these 42 were located in areas of proposed infrastructure development with three fresh, 12 recent, 19 oldish and eight old. Mole presence was significantly correlated with dunes, yellow or yellow-red sand, and loose sand. The survey found that sand that is loose to a depth of 80 centimetres is required for mole presence.

In the TTIC, 26 mole holes from six sites were identified. Of these, one mole hole was within 50 metres of the TTIC alignment. This was classified as old. All mole holes were found on vegetated sand dunes.

In the Pinjin Infrastructure Corridor, ten mole holes were recorded from six sites. Of these, three occurred within 50 metres of the proposed road alignment. All three mole holes were classified as old to very old.

In the area surveyed adjacent to the borefield, 12 mole holes were surveyed ranging from recent to very old. None were located in areas of proposed infrastructure.

The locations of all sites where mole holes were recorded are presented in Figure 9 through to Figure 12.

6.1.2 Sandhill Dunnart (Endangered)

The only Sandhill Dunnart captures known to have been recorded within the greater Tropicana tenements were made by Gaikhorst and Lambert between 2001 and 2008 when 12 animals were captured at seven sites, with a further five animals being caught just outside the tenement area. These capture locations are shown on Figure 14.

Although the Sandhill Dunnart was not recorded during any surveys commissioned for the TGP, the Sandhill Dunnart has been recorded approximately 50 kilometres south west of the Operational Area (G. Gaikhorst and C. Lambert, pers comm.) and potentially suitable habitat occurs in the Operational Area and adjacent to the Pinjin Infrastructure Corridor.

6.1.3 Mulgara (Vulnerable, Schedule 1)

Recently the Mulgara genus (*Dasycercus)* has undergone taxonomic review and it was found that what has been known as the single species Mulgara *(Dasycercus cristicauda)* is now two distinct species, the Brush-tail Mulgara (*Dasycercus blythi)* and the Crest-tailed Mulgara *(Dasycercus cristicauda)*. The Survey Area lies within the Brush-tailed Mulgara's distribution. At the time of the survey, the Crest-tailed Mulgara *(Dasycercus cristicauda)* was considered extinct in Western Australia.

Surveys of the TGP did not identify any Brush-tail Mulgara, although suitable habitat was identified and a potential burrow was found in one section of the Pinjin Infrastructure Corridor on deep orange sands, but no footprints were noted nearby that could confirm the current existence of either Mulgara species. Five areas of Mulgara habitat were identified along the TTIC as well as one area of suitable habitat located one kilometre from the Pinjin Infrastructure Corridor. Secondary evidence of Mulgara was also recorded 2.5 kilometres east of the TTIC. Records of burrows and scats within the vicinity of the TGP suggest that Mulgara may occur within the Operational Area. Large areas in the eastern section of the Operational Area, which were mostly inaccessible at the time of surveying, appear to contain suitable habitat for this species.

The closest Mulgara that has been historically captured is in Mulga Rocks (which lies between the TTIC and Pinjin Roads, 15 kilometres north of Queen Victoria Springs Nature Reserve at the closest point) where one individual was caught (Martinick & Associates, 1986). One individual was also captured in the Queen Victoria Springs Nature Reserve, being the most modern southern occurrence in Western Australia (Pearson, 1991). Despite on-going trapping at Queen Victoria Springs Nature Reserve over a period of 15 years for about two weeks per year, this is the only Mulgara record for the site (D. Pearson, DEC, pers com). Secondary evidence of Mulgara in the form of active burrows and scats has been observed approximately 50 kilometres south west of the TGP area along the Plumridge West Track in 2005 (G. Gaikhorst, pers com, 2007). This area has since been burnt.

6.1.4 Malleefowl (Endangered)

Birds Australia has no modern records for Malleefowl in the vicinity of Tropicana however an individual bird was sighted south of Plumridge Lakes Nature Reserve in 2007 indicating that Malleefowl are likely to be present within the Operational Area in areas of suitable habitat.

Three surveys identified twelve inactive Malleefowl mounds located in the Operational Area and its surrounds. Eight inactive Malleefowl mounds were identified along the TTIC, and a fresh set of Malleefowl tracks were observed. One Malleefowl was observed along the proposed Pinjin Infrastructure Corridor alignment approximately 600 metres from the track at the southern end, near Pinjin. One active mound and four inactive mounds were surveyed along the track, as well as numerous fresh tracks. All Malleefowl mounds, tracks and bird sighting locations are presented in Figure 9 to Figure 13.

6.1.5 Peregrine Falcon (Schedule 4)

One Peregrine Falcon was observed during a survey of the Operational Area. The site it was viewed from is presented on Figure 9. This species is widespread in Australia with extensive suitable habitat outside of the survey area (*Ecologia*, 2009e).

6.1.6 Woma Python (Schedule 4)

The Woma Python has been opportunistically recorded on two occasions within the Operational Area. Populations extend from central Australia into the southwestern edge of Queensland, and into northern South Australia. Other populations are known from the Pilbara coast, and south-west Western Australia (Storr et al, 2002).

6.1.7 Australian Bustard (Priority 4)

Six Australian Bustards and fresh tracks were observed during surveys of the Operational Area. During surveys of the Pinjin Infrastructure Corridor, one Australian Bustard was seen, four sets of tracks were observed and a nest with one egg was recorded, being more than 50 metres from the proposed access Pinjin Infrastructure Corridor. Tracks were also observed on the TTIC. The bird sightings, tracks and nests are presented in Figure 9 to Figure 13. The Australian Bustard has a broad distribution covering much of Australia, but numbers have declined in recent years (Ecologia, 2009e).

6.1.8 Rainbow Bee-eater (Migratory)

The Rainbow Bee-eater was sighted on 56 occasions in surveys of the Operational Area and twice on the Pinjin Infrastructure Corridor. The locations of the sightings in relation to the proposed Pinjin Infrastructure Corridor and Operational Area are shown in Figure 9, Figure 10 and Figure 11. The Rainbow Bee-eater is a common Western Australian species with diverse and widespread habitat preferences (Ecologia, 2009e).

6.1.9 Fork Tailed Swift (Migratory)

Fork-tailed Swifts were sighted in the Operational Area and Minigwal Borefield and Water Pipeline area. The locations of the sightings are shown in Figure 9 and Figure 13. This species is nomadic, moving in response to broad-scale weather conditions, and spends most of its time in the air.

6.1.10 Wood Sandpiper (Migratory)

The Wood Sandpiper was opportunistically recorded from a freshwater lake southwest of Pinjin and north of Lake Rebecca. The locations of the sightings are shown in Figure 10. This species is migratory, visiting Australia as a summer migrant, and is an uncommon visitor to the southern region. Due to the bird's migratory nature, and that the Pinjin Infrastructure Corridor does not intersect the lake, this species is not expected to be impacted by the TGP.

6.1.11 Common Greenshank (Migratory)

The Common Greenshank was opportunistically recorded from a freshwater lake south of Pinjin and north of Lake Rebecca. This Greenshank is a summer visitor to Australia. Its preferred habitat is coastal regions, but moves inland when conditions are suitable. Due to the bird's migratory nature and the fact that the Pinjin Infrastructure Corridor does not intersect the lake, this species is not expected to be impacted by the TGP.

6.1.12 Crested Bellbird (Least Concern)

The Crested Bellbird was sighted in the Pinjin Infrastructure Corridor. The species is considered of Least Concern by the IUCN, but the southern subspecies is a Priority 4 species. The Crested Bellbird has been recorded from Nature Reserves in the region. The southern subspecies has not been positively identified in surveys.

6.2 SIGNIFICANT HABITAT

The fauna habitats present within the TGP area are likely to be well represented within the region. Without comparable data for the region, however, it is difficult to state this with any certainty. Superficially at least, the vegetation communities present within the TGP area are present within local Nature Reserves, including Plumridge Lakes Nature Reserve, and fauna communities are likely to be similar.

Significant habitat descriptions for conservation significant fauna species are provided in Table 9, along with the location and the report in which the source data can be found.

Table 9: Significant Habitats Identified in the Tropicana Gold Project Area

Species	Habitat	Description	Location in the TGP	Report
Various conservation significant species	Yellow Sandplain Communities of the Great Victoria Desert PEC #53.	Very diverse mammalian and reptile fauna, distinctive plant communities.	Potential resemblance to sections of the TTIC (as shown on Figure 8), vegetation units 9 and/or 11 in the Pinjin Infrastructure Corridor.	Ecologia - TTIC Fauna Survey. Mattiskes - Pinjin Infrastructure Corridor Survey.
Southern Marsupial Mole	Critical habitat for Marsupial Moles is described as continuous sand dunes and dune fields of soft loose dunes, of reddish to yellow sand.	Sand Dunes	Pinjin Infrastructure Corridor. Figures 3-1, 3-2 and Table 2-1 and 3-1 of URS report.	URS - Marsupial Mole Survey of the Pinjin Infrastructure Corridor
		Sand Dune Systems	Approximately 1.1% of the Water Borefield and Pipeline Corridor area.	Ecologia - Minigwal Sub Basin Water Area Survey.
		Continuous sand dunes and dune fields.	TTIC Figure 4.1 Provided in Table 2-1 of the report.	Ecologia - TTIC Fauna Survey.
		Soft loose dunes.	Operational Area. Figure 4.2 and Appendix A of the report.	Ecologia - Southern Marsupial Mole Report.
		Soft loose dunes.	Pinjin Infrastructure Corridor. Table 2-1 and Figure 3-1 of the report.	URS - Marsupial Mole Survey of the Pinjin Infrastructure Corridor.
Sandhill Dunnart	Deep yellow, occasionally orange, sands ranging from very gently undulating sandplains to well defined ridges up to 30 metres in height.	Suitable habitats for the Sandhill Dunnart include those suitable now, and those that will be suitable in 5 - 10 years.	Pinjin Infrastructure Corridor. Figure 5 and Table 1 of the report.	Sandhill Dunnart Survey Report.
	Occasionally flat sandplains with an association to an undulating or dunal system, tall mallee, tall open mallee, mixed shrubland or a combination of both mallee and shrubland.	Suitable habitats for the Sandhill Dunnart include those suitable now, and those that will be suitable in 5 - 10 years.	Operational Area. Figure 4, 5 and Table 1 of the report.	Sandhill Dunnart Survey Report.

Species	Habitat	Description	Location in the TGP	Report
	Beneath this layer is a 10 to 30 % cover of Spinifex, being seen as the critical requirement. The most important element is the fire regime, with sites unburnt between eight and 38 years being the most significant habitat.	Sand Dune Systems, most too recently burnt to provide suitable habitat.	Approximately 1.1% of the Water Borefield and Pipeline Corridor area.	Ecologia - Minigwal Sub Basin Water Area fauna Survey.
Mulgara	Mature Spinifex hummock grasslands with thick ground cover. Also the flat areas between sand dunes or on the low sides of sand dunes for burrows.	Mature Spinifex hummock grasslands of thick ground cover.	Pinjin Infrastructure Corridor. Figures 3-1, 3-2 and Table 3-4 of the report.	URS - Marsupial Mole Survey of the Pinjin Infrastructure Corridor.
		Potential Mulgara habitat.	Pinjin Infrastructure Corridor. Plate 3-2 of the report.	URS - Malleefowl and Mulgara Survey.
		Sand dunes or sand plains with a cover of Spinifex.	Pinjin Infrastructure Corridor Plate 3 of the report.	Ninox Wildlife Pinjin - Tropicana Fauna Report.
		Potential Mulgara habitat.	TTIC Figure 4.1 and Table 4.3 of the report.	Ecologia - TTIC Fauna Survey.
		Mature Spinifex hummock grasslands of thick ground cover.	Operational Area Figure 3-1, 3-2 and Table 3-4 of the report.	URS - Malleefowl and Mulgara Survey.
Malleefowl	Semi-arid to arid shrublands, and low woodlands dominated by mallee and/or *Acacia*.	Potential Malleefowl habitat.	Pinjin Infrastructure Corridor Figure 3-1 and Plate 3-2 of report (605813 mE 6732114 mN).	URS - Malleefowl and Mulgara Survey.
		Dense unburnt mulga.	TTIC Table 4.4 of TTCI survey.	Ecologia - TTIC Fauna Survey.
		Low woodlands dominated by mallee and/or acacia, some unburnt for 5+ years.	Pinjin Infrastructure Corridor. Plate 3-2, Figure 3-1 and Table 3-1 of report.	URS - Marsupial Mole Survey of the Pinjin Infrastructure Corridor.
		Mulga thickets	Water Borefield and Pipeline Corridor, 1.4% of the total area, shown in Figure 6.1 of the Minigwal report.	Ecologia - Minigwal Sub Basin Water Area fauna Survey.

Species	Habitat	Description	Location in the TGP	Report
Other Significant Habitats identified in the surveys	*Casuarina* woodland to 6 metres with mixed shrubs to 2 metres including *Acacia, Eremophila, Ptilotus, Maireana, Dodonaea, Solanum, Santalum, Scaevola* with emergent *Eucalyptus* and mulga on loamy sands with mixed rock, granite scatter and calcareous earth. A very diverse area with important summer flowering food resource for many birds and invertebrates (butterflies). Many honey-eaters and insectivorous birds present and evidence of macro fauna. May be considered an isolated island habitat.		Pinjin Infrastructure Corridor Map 24, Plate 5 in Ninox report; 483 630mE 6 672 250mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.
	Four Mile Dam – reported to be a permanent water source. Several species of waterbird were utilising the dam. *Melaleuca* and *Eucalyptus* surround the dam at high water mark. Important water source for a variety of fauna; if permanent then fauna will have become reliant on it. (Adjacent to defined survey area).		Pinjin Infrastructure Corridor Map 24, Plate 6 in Ninox report; 469 750mE 6 666 950mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.
	Granite boulders – open mulga shrubland to 3 metres over mixed *Acacia* and other shrubs to 1 metre on granite boulder outcropping with some exfoliation, on red loams and granite soils.		Pinjin Infrastructure Corridor. Map 22, Plate 7 in Ninox report; 491 500mE 6 674 150mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.
	Granite sheet – just to the south of planned road. Has low fringing open mulga and mixed small shrubs on very shallow granite soils.		Pinjin Infrastructure Corridor. Map 22, Plate 8 in Ninox report; 493 500mE 6 674000mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.
	Narrow section of chenopod salt flats and drainage line leading to/from a large expanse of salt flat covered in various chenopod species on silts. The area is lined with *Eucalyptus* and low mixed shrubs on gypsum levee-bank dunes.		Pinjin Infrastructure Corridor. Map 21, Plate 9 in Ninox report; 499 000mE, 6 674 250mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.
	Small patch of suitable mulga woodland utilised by this bird for Malleefowl nesting, the woodland is clearly seen on the map. Open mulga woodland to 4 metres with sparse shrub layer to 1.5 metres on brown loams with scattered quartz pebbles and gravels.		Pinjin Infrastructure Corridor. Map 20, Plate 10, 11 in Ninox report; 510 xxx mE 6 675 xxx mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.

Species	Habitat	Description	Location in the TGP	Report
	Yellow dunes that have mature and intact vegetation.		Pinjin Infrastructure Corridor. Map 6, Plate 12 in Ninox report; 618 000mE 6 738 500mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.
	Yellow dune system with isolated and unusual vegetation complex. The area in the swale is open mature and long unburnt eucalypt woodland with patches of mulga and *Callitris* on Spinifex and with scattered *Xanthorrhoea*.		Pinjin Infrastructure Corridor. Map 3A, Plate 13,14 in Ninox report; 634 000mE 6 751 650mN.	Ninox Wildlife Pinjin - Tropicana Fauna Report.

7. RISK-BASED IMPACT ASSESSMENT

Environmental risk assessment was undertaken to evaluate the likelihood and consequence of an event occurring as a result of exposure to one or more potential stressors. It provided an assessment of the inherent risks associated with the TGP on conservation significant species subsequently assisting in prioritising the development of management measures to achieve an overall acceptable reduced level of impact.

The following sections are set out as follows:

- Identification of potential risks/impacts to conservation significant species.
- Identification of management and mitigation measures to reduce impacts on conservation significant species.
- Residual impact assessment following implementation of management and mitigation measures.

7.1 POTENTIAL IMPACTS TO CONSERVATION SIGNIFICANT SPECIES

7.1.1 Land and Habitat Disturbance

Up to 3,440 hectares could be cleared for TGP, comprising up to 2,570 hectares for the Operational Area, 200 hectares for the Borefield and 670 hectares for infrastructure corridors.

Potential impacts resulting from clearing of native vegetation and development of infrastructure for the TGP are:

- The loss of individuals of conservation significant flora and fauna species.
- The loss of vegetation communities.
- The loss and degradation of habitats essential to survival of conservation significant fauna species.
- Fragmentation of populations of conservation significant flora and fauna species.
- Alteration to surface water flows resulting from infrastructure corridor development.

7.1.2 Fire

Activities associated with the TGP may result in an increased likelihood of accidental fire. Potential impacts on conservation significant species resulting from accidental fire include:

- Immediate death of conservation significant flora and fauna individuals and populations.
- Loss of habitat for conservation significant fauna species reliant on long unburnt vegetation, or mosaic/patch style burning, including Sandhill Dunnart, Mulgara and Malleefowl.

- Loss of breeding habitat.
- Loss of existing 'islands' of unburnt vegetation which provide refuge and habitat for conservation significant fauna species.
- Increased proliferation of weeds.
- Altered vegetation structure.
- Altered habitat unable to provide conditions for conservation significant flora species to recolonise.

7.1.3 Introduced Plants

The introduction of machinery, earthworks and disturbance in the area, increased traffic flows and water availability has the potential to introduce weeds into the area. The potential impacts of weeds include:

- Competition for resources with rare and Priority flora.
- Degradation of critical habitats for conservation significant flora and fauna species.
- Contribution to altered fire regimes resulting in altered habitats for conservation significant flora and fauna species.
- Reduced success of rehabilitation.

7.1.4 Introduced Fauna

Although feral species are already established in the region, the TGP may potentially increase the incidence of feral animals in the area which may impact conservation significant flora and fauna species in the following ways:

- Habitat degradation including compression of dunes, reducing the value of dunes as habitat.
- Feral herbivorous species (rabbits, goats) grazing conservation significant flora species.
- Direct predation of conservation significant fauna species from introduced carnivores (foxes, cats).
- Introduced species competing with conservation significant fauna species for resources (food, shelter).
- Grazing of rehabilitated areas.
- Introduction of disease to native species.

7.1.5 Dust

There is the potential for increased dust creation from earthworks for the road and mine, from general mining operations and erosion of exposed surfaces. Potential impacts of dust on conservation significant species include:

- Coverage of foliage reducing photosynthesis and transpiration, resulting in reduced productivity and increased plant death, particularly relevant in areas adjacent to tracks.
- Alteration of habitat negatively impacting on conservation significant flora and fauna species.

7.1.6 Vehicle Movements and Potential for Collisions

Development of a mining operation and construction of an access road will increase traffic flows in the area. Increased vehicle movements along the access road, especially large vehicles may result in the following impacts on conservation significant species:

- Mortality of individual fauna through direct collisions with vehicles.
- Injury of individual fauna through direct collisions with vehicles.
- Erosion and compaction from off-road driving can impact vegetation of sand dunes.

7.1.7 Waste, Hazardous Materials and Contamination

Development of the TGP will require the use and generation of materials that are potentially hazardous to the environment. These include:

- General and putrescible wastes and associated disposal facility.
- Workshops, hydrocarbon storage areas and other dangerous goods (e.g. cyanide).
- Tailings and associated Tailings Storage Facility (TSF).
- Water Storage Facilities (WSF).
- Saline groundwater which has the potential to damage vegetation.

Potential impacts to conservation significant species include:

- Contamination of soil, surface water and groundwater.
- Alien substances providing a poison or ingestion risk to native species.
- Alien objects providing injury and mortality risk to native species (strangulation, entanglement and entrapment).
- Attraction of fauna species to food scraps provides an increased risk of native animals becoming pests, and an increased road kill risk as native fauna travels to and from domestic waste facilities.
- Attraction of migratory avifauna to the large water expanse on the TSF and lined WSFs and liquor ponds, increasing the risk of fauna death, especially of birds, through drowning and/ or cyanide poisoning.

7.2 MANAGEMENT AND MITIGATION

The following management and mitigation measures will be applied to the TGP to minimise the impacts associated with the project on conservation significant species. In developing these management measures, consideration has been given to the following publications:

- Recovery Plan for Marsupial Moles *Notoryctes typhlops and N. caurinus,* 2005-2010 (Northern Territory Government, 2005).
- Recovery Plan for the Sandhill Dunnart (*Sminthopsis psammophila),* (Department of Environment and Heritage, 2001).
- National Recovery Plan for Malleefowl (Environment Australia, 2000).

7.2.1 Land and Habitat Disturbance

The following management measures are being considered by Tropicana JV to prevent or mitigate impacts of land and habitat disturbance on conservation significant flora and fauna populations:

- Disturbance to native vegetation will be minimised where possible and all areas requiring clearing will be clearly delineated and clearing will be undertaken in accordance with a clearing permit system.
- All infrastructure (including the access roads/corridors) will be designed and located to avoid significant impacts on all known populations of DRF species *Conospermum toddii.*
- All infrastructure (including the access roads/corridors) will be designed and located to minimise disturbance of Priority flora species.
- All infrastructure in the borefield area will be designed to minimise disturbance to the Longitudinal Sand Dune (E1) vegetation community and to avoid the Lake Edge (E5) and Clay Pan (E6) vegetation communities.
- Disturbance of critical habitats will be avoided (excluding the mining area). These include:
  - Sand dune systems suitable for Marsupial Moles, Sandhill Dunnarts, Mulgara and *Conospermum toddii*.
  - Mulga stands which have been unburnt for greater than five years, and may be suitable for Malleefowl.
  - Areas of Spinifex which have been unburnt for between eight and 38 years, and have the potential to provide habitat for Sandhill Dunnarts and Mulgara.
- Known locations of Malleefowl nests/mounds will be avoided.
- Known locations of Bustard nests will be avoided.
- The removal of large mature trees, particularly *Eucalyptus gongylocarpa,* with hollows providing nesting sites will be avoided where reasonably practical.
- Where the access road and other infrastructure intersects natural drainage lines, appropriate drainage measures (such as culverts and causeways) will be constructed to ensure surface water runoff to downstream environments is maintained. This

particularly relates to an area of the Pinjin Infrastructure Corridor that intersects chenopod salt flats and a drainage line leading to a large expanse of salt flat covered in various chenopod species on silts.

- Site inductions will include information about conservation significant flora, vegetation, fauna and habitat to ensure personnel are aware of the potential impacts associated with activities on these species.

7.2.2 Fire

The likelihood and severity of fires will be reduced on site through the following mechanisms:

- A fire management plan will be developed to minimise the risk of fire resulting from TGP activities. This plan will address:
  - Fire prevention as a result of activities conducted as part of the TGP.
  - Fire control with a specific focus on containing the spread of fires that may occur in the Operational Area.
  - Emergency response protocol.
  - Identification of fire sensitive vegetation and protection of these units. Fire sensitive vegetation will be clearly identified on all emergency response maps to prevent inadvertent impacts during fire emergency.
  - Regional fire control.
- Work presenting a fire risk will not be conducted on days deemed to have a high fire risk (e.g. high winds, high temperatures).
- Clearing and construction activities will take place during periods of low fire risk (i.e. April to September).

7.2.3 Introduced Plants

The risk of introducing exotic plant species may be minimised through the implementation of the following management measures:

- Strict vehicle hygiene practices will be adopted, with all machinery, vehicles and plant to be free of soil and vegetative matter upon arrival on site.
- Work in known weed infested areas will be undertaken separately to work in pristine areas. This relates mainly to work in the Pinjin area. Any vehicles moving between the Pinjin area and other areas during clearing and construction will be thoroughly cleaned of soil and vegetation matter.
- Implementation of existing TGP weed management measures during the design, operation and closure/rehabilitation phases.
- Clearing and construction activities will be undertaken during drier periods.
- Any fill used for construction purposes will be taken from a known clean source.
- Clean seeds will be used in rehabilitation. Seed will be harvested locally to reduce the risk of new weed species introduction.

- Personnel will be educated on weed management practices, particularly vehicle hygiene procedures.

7.2.4 Introduced Fauna

The risk of introducing feral fauna species to site may be mitigated in the following ways:

- No domestic animals or non-locally endemic plants will be brought to site.
- Access to water storage and putrescible waste disposal areas will be restricted either by fencing or installing some other suitable barrier.
- Rehabilitation of borrow pits along roads and pipelines to minimise water holding capability.
- Many introduced species already exist on the site. Methods to control existing populations of feral animals will include:
  - Implementation of a fauna control program to protect known individuals and populations of conservation significant species in the area.
  - A 'Pro-baiting' scheme may be devised after consultation with DEC.

7.2.5 Dust

Increased vehicle movements and mining operations have the potential to increase dust on the site. Dust management measures may include:

- Infrastructure will be designed and located to avoid all known locations of *Conospermum toddii* to minimise impacts of dust generation from disturbed areas.
- Internal site roads will be treated for dust suppression at a rate that reduces and minimises dust generation.
- Appropriate speed limits will be enforced in known or potential threatened species habitat areas to minimise dust generation from vehicle movement.
- Total disturbance at any one time will be minimised to reduce areas potentially producing windblown dust.
- Land clearing and growth medium stripping will be undertaken under appropriate weather conditions to limit growth medium loss (i.e. low winds).

7.2.6 Vehicle Movements and Potential for Collisions

Strategies to reduce the risk of vehicles on conservation significant fauna species include:

- Implementation and enforcement of appropriate speed limits on roads on the Mining Lease and associated access roads and infrastructure corridors.
- Infrastructure corridors (including access roads) will be designed to avoid bisecting critical habitats to reduce potential vehicle interaction with conservation significant fauna.
- The number and length of roads constructed will be minimised, their location will avoid bisecting critical habitats, thereby reducing fauna crossings and potential collision with vehicles.

- Appropriate signage will be erected warning drivers of potential fauna in the area.
- Any fauna killed by vehicle collision will be reported to site environmental personnel to be recorded. Specimens may be forwarded to the WA Museum.
- Special care will be taken when drilling activities are conducted near potential Marsupial Mole habitats.
- Borrow pits will be located a suitable distance from the road to limit potential interaction between animals and vehicles.
- Adequate site storm water management and drainage along roads will be implemented to minimise ponding of water near roads, thereby minimising attraction of species to roadways.
- Developing relationships with wildlife rescue and rehabilitation providers.

7.2.7 Waste, Hazardous Materials and Contamination

The risks posed by domestic waste will be minimised through:

- Implementation of strict domestic waste management practices, including disposal of domestic waste in a licensed facility to prevent seed invasion from food waste products, contamination and attraction of feral and native fauna species.
- Managing domestic waste sites according to relevant landfill regulations and best practice guidelines.
- Regular inspection of waste facilities for trapped fauna.
- Restricting access to water storage areas either by installing suitable barriers.
- Maintaining cyanide levels below that which may kill fauna (Tropicana JV are signatories to the International Cyanide Management Code).

7.3 SUMMARY OF MANAGEMENT AND MITIGATION MEASURES

Specific management and mitigation measures will be incorporated into the design, construction, operation and rehabilitation phases of the TGP. This will ensure that impacts on conservation significant species and communities are in the first instance avoided and where avoidance is not possible, the impact is minimised such that the distribution and status of species is not altered, as specified in EPA Guidance Statements 51 and 56. A summary of preliminary measures to this end made by Tropicana JV is provided in Table 10.

The full risk assessment showing inherent and residual risks for impacts on conservation significant species identified in surveys is provided as Appendix 2. The following sub-sections provide an impact assessment for each conservation significant species occurring within the conceptual footprint or whose habitat was noted during surveys. The assessment is based on the outcomes of the risk assessment.

Table 10: Preliminary Management and Mitigation Measures for Protection of Conservation Significant Species

Action Number	Action	Project Phase
1	Disturbance to native vegetation will be minimised where possible and all areas requiring clearing will be clearly delineated and clearing will be undertaken in accordance with a clearing permit system.	Design & Construction
2	All infrastructure (including the access roads/corridors) will be designed and located to avoid significant impacts on all known populations of DRF species *Conospermum toddii.*	Design
3	All infrastructure (including the access roads/corridors) will be designed and located to minimise disturbance of Priority flora species.	Design
4	All infrastructure in the borefield area will be designed to minimise disturbance to the Longitudinal Sand Dune (E1) vegetation community and to avoid the Lake Edge (E5) and Clay Pan (E6) vegetation communities.	Design
5	Disturbance of critical habitats will be avoided (excluding mining area). These include: • Sand dune systems suitable for Marsupial Moles, Sandhill Dunnarts, Mulgara and *Conospermum toddii*. • Mulga stands which have been unburnt for greater than five years, and may be suitable for Malleefowl. • Areas of Spinifex which have been unburnt for between eight and 38 years, and have the potential to provide habitat for Sandhill Dunnarts and Mulgara.	Design & Construction
6	Known locations of Malleefowl nests/mounds and Australian Bustard nests and will be avoided.	Design & Construction
7	The removal of large mature trees, particularly *Eucalyptus gongylocarpa*, with hollows providing nesting sites will be avoided where reasonably practical.	Design & Construction
8	Where the access road and other infrastructure intersects natural drainage lines, appropriate drainage measures (such as culverts and causeways) will be constructed to ensure surface water runoff to downstream environments is maintained.	Design & Construction
9	Site inductions will include information about conservation significant flora, vegetation, fauna and habitat to ensure personnel are aware of the potential impacts associated with activities on these species.	Life of Mine

Action Number	Action	Project Phase
10	A fire management plan will be developed to minimise the risk of fire resulting from TGP activities. This plan will address: • Fire prevention as a result of activities conducted as part of the TGP. • Fire control with a specific focus on containing the spread of fires that may occur in the Operational Area. • Emergency response protocol. • Identification of fire sensitive vegetation and protection of these units. Fire sensitive vegetation will be clearly identified on all emergency response maps to prevent inadvertent impacts during fire emergency. • Regional fire control.	Life of Mine
11	Work presenting a fire risk will not be conducted on days deemed to have a high fire risk (e.g. high winds, high temperatures).	Life of Mine
12	Clearing and construction activities will take place during periods of low fire risk (i.e. - April to September).	Construction
13	Strict vehicle hygiene practices will be adopted, with all machinery, vehicles and plant to be free of soil and vegetative matter upon arrival on site.	Life of Mine
14	Work in known weed infested areas will be undertaken separately to work in pristine areas. This relates mainly to work in the Pinjin area. Any vehicles moving between the Pinjin area and other areas during clearing and construction will be thoroughly cleaned of soil and vegetation matter.	Life of Mine
15	Implementation of existing TGP weed management measures during the design, operation and closure/rehabilitation phases.	Life of Mine
16	Clearing and construction activities will be undertaken during drier periods.	Construction
17	Any fill used for construction purposes will be taken from a known clean source.	Construction
18	Clean seeds will be used in rehabilitation. Seed will be harvested locally to reduce the risk of new weed species introduction.	Life of Mine
19	Personnel will be educated on weed management practices, particularly vehicle hygiene procedures.	Life of Mine
20	No domestic animals or non-locally endemic plants will be brought to site.	Life of Mine
21	Access to water storage and putrescible waste disposal areas will be restricted either by fencing or installing some other suitable barrier.	Life of Mine
22	Rehabilitation of borrow pits along roads and pipelines to minimise water holding capability.	Life of Mine

Action Number	Action	Project Phase
23	Many introduced species already exist on the site. Methods to control existing populations of feral animals will include: • Implementation of a fauna control program to protect known individuals and populations of conservation significant species in the area. • A 'Pro-baiting' scheme may be devised after consultation with DEC.	Life of Mine
24	Infrastructure will be designed and located to avoid all known locations of *Conospermum toddii* to minimise impacts of dust generation from disturbed areas.	Design & Construction
26	Internal site roads will be treated for dust suppression at a rate that reduces and minimises dust generation.	Life of Mine
27	Appropriate speed limits will be enforced in known or potential threatened species habitat areas to minimise dust generation from vehicle movement.	Life of Mine
28	Total disturbance at any one time will be minimised to reduce areas potentially producing windblown dust.	Life of Mine
29	Land clearing and growth medium stripping will be undertaken under appropriate weather conditions to limit growth medium loss (i.e. low winds).	Construction and Mining
30	Implementation and enforcement of appropriate speed limits on roads on the Mining Lease and associated access roads and infrastructure corridors.	Life of Mine
31	Infrastructure Corridors (including access roads) will be designed to avoid bisecting critical habitats to reduce potential vehicle interaction with conservation significant fauna.	Construction, Life of Mine
32	The number and length of roads constructed will be minimised, their location will avoid bisecting critical habitats, thereby reducing fauna crossings and potential collision with vehicles.	Design & Construction
33	Appropriate signage will be erected warning drivers of potential fauna in the area.	Life of Mine
34	Any fauna killed by vehicle collision will be reported to site environmental personnel to be recorded. Specimens may be forwarded to the WA Museum.	Life of Mine
35	Special care will be taken when drilling activities are conducted near potential Marsupial Mole habitats.	Life of Mine
36	Borrow pits will be located a suitable distance from the road to limit potential interaction between animals and vehicles.	Life of Mine
37	Adequate site storm water management and drainage along roads will be implemented to minimise ponding of water near roads, thereby minimising attraction of species to roadways.	Life of Mine
38	Developing relationships with wildlife rescue and rehabilitation providers.	Construction & Mining

Action Number	Action	Project Phase
39	Implementation of strict domestic waste management practices, including disposal of domestic waste in a licensed facility to prevent seed invasion from food waste products, contamination and attraction of feral and native fauna species.	Life of Mine
40	Managing domestic waste sites according to relevant landfill regulations and best practice guidelines.	Life of Mine
41	Regular inspection of waste facilities for trapped fauna.	Life of Mine
42	Restricting access to water storage areas either by installing suitable barriers.	Life of Mine
43	Maintaining cyanide levels below that which may kill fauna (Tropicana JV are signatories to the International Cyanide Management Code).	Life of Mine

8. RESIDUAL IMPACT ASSESSMENT

An impact assessment was conducted using a Conservation Significant Species Risk Matrix with the risk likelihood and consequence definitions shown in Table 11.

Table 11: Conservation Significant Species Risk Matrix

CONSERVATION SIGNIFICANT SPECIES RISK MATRIX							
			Likelihood				
			A **Almost Certain** Occurs in all circumstances/ planned event	**B** **Likely** 50 % chance of occurrence	**C** **Possible** 5 % chance of occurrence	**D** **Unlikely** Unusual or unexpected occurrence	**E** **Rare** Only occurs in exceptional circumstances
Consequence	**5**	**Catastrophic** Loss of a local population Extinction of a species or vegetation community Permanent loss of >/= 10% suitable habitat.	**E**	**E**	**E**	**E**	**H**
	4	**Major** Permanent loss of 5 < 10% of individuals of a species in the area. Decrease in recruitment over the Operational phase of the TGP. Permanent loss of 5 < 10% of suitable habitat/vegetation community.	**E**	**E**	**E**	**H**	**M**
	3	**Moderate** Death of a small number of individuals, alteration to population dynamics that is resolved during the Operational phase of the TGP, permanent loss of < 5% of suitable habitat.	**E**	**H**	**H**	**M**	**M**
	2	**Minor** Temporary alteration to behaviour, population dynamics, habitat connectivity.	**H**	**H**	**M**	**L**	**L**
	1	**Insignificant** TJV consider that there is no 'insignificant' impact to a threatened species precisely because they are threatened.	**H**	**M**	**L**	**L**	**L**

E: Extreme risk – immediate action and formal documentation required.

H: High risk – management attention and formal documentation required.

M: Medium risk – environmental management documents will specify responsibility and actions.

L: Low risk – manage by routine procedures/instructions.

8.1 CONCEPTUAL DISTURBANCE AREAS

Conceptual disturbance areas are defined as follows:

- Operational Area: Species occurring in areas shaded yellow (proposed infrastructure), comprising up to 2,570 hectares, as viewed in Figure 2, Figure 3 and Figure 9.
- Pinjin Infrastructure Corridor: Species occurring within 30 metres of the central alignment of the proposed corridor (i.e. - 15 metres either side of the central alignment).
- Tropicana - Transline Infrastructure Corridor: Species occurring within 30 metres of the central alignment of the proposed corridor (i.e. - 15 metres either side of the central alignment).
- Borefield and Pipeline: Species occurring within yellow shaded areas as viewed in Figure 7 and Figure 13. It should be noted that only 200 hectares of the shaded area (14,210 hectares) will be disturbed by the borefield, however to date, a precise area has not been defined. Estimates related to impacts in the borefield area are therefore likely to be an overestimate of actual expected impacts.

8.2 THREATENED FLORA

Of the 54 threatened flora species that have the potential to occur in the greater TGP region, 14 will be directly impacted by clearing for infrastructure development. Table 12 provides a summary of percentage impacts to flora species due to direct clearing of individuals or populations.

Due to large amounts of data gathered for TGP, the following process was undertaken in combining all data for threatened flora species:

- All duplicates were removed.
- Points within 100 metres of each other were merged and defined as one population and the sum of plant counts was taken for each point to provide the most accurate measure of plant numbers (all reference to populations are based on merged data).
- The total number of plants occurring within the conceptual layout was divided by the sum of all plants recorded in the greater region including records from:
  - Site specific surveys.
  - Florabase.
  - Surveys undertaken by Tropicana JV in Neale Junction, Queen Victoria Springs Nature Reserve and Plumridge Lakes Nature Reserve.
  - Surveys undertaken as part of exploration activities.

Actual plant numbers recorded for species of conservation significance in representative quadrats in the Borefield and Pipeline Corridor survey area were extrapolated to provide a relative estimate of species numbers over the entire Borefield and Pipeline survey area. These extrapolated numbers have been used in Table 12 to estimate impacts to Priority

species based on vegetation associations of these species. This method of impact assessment was not applied to other areas surveyed as reliable detailed vegetation association information was not available for all areas.

Plants counts for Queen Victoria Springs and Plumridge Lake Nature Reserves are also extrapolated based on a surveyed density (plants per square metre) that was applied to the actual estimated area of the population.

It is worth noting that these numbers may over represent the proportion of plants within the impact area relative to the area outside the impact footprint in some instances, as a more intense survey effort has been directed at these areas than some more remote portions of the survey area. It is likely if the areas surrounding these more remote records were also intensely searched, additional numbers of plants outside the impact footprint would be located.

Table 12: Summary of Threatened Flora Species Disturbance

Species	TGP Survey Data		Regional Data		Disturbance in Conceptual Footprint		% Impact (No. Plants in Conceptual Footprint/ Estimated Regional Count)
	No. of Populations	No. of Plants	No. of Populations / Records	No. of Plants	No. of Populations/ Records	No. of Plants	
Baeckea sp. Great Victoria Desert	125	815,294	54	460,250	17	5,995	0.47
Dicrastylis nicholasii	368	8,791,146	68	265,008	55	63,203	0.70
Grevillea secunda	17	82	111	20,249	5	27	0.13
Olearia arida	127	547,043	44	2,467	39	3,706	0.67
Acacia eremophila numerous nerved variant	21	731	44	2,978	12	372	10.03
Acacia eremophila var. *variabilis*	3	45	23	159	1	10	4.90
Dicrastylis cundeeleensis	81	8,744	50	1,671	29	4,845	46.52
Eucalyptus pimpiniana	11	554	18	757	2	125	9.53
Microcorys macredieana	70	45,576	113	65,012	7	427	0.39
Micromyrtus stenocalyx	103	2,118	37	160,070	5	29	0.02
Comesperma viscidulum	9	33	33	20,030	12	10	0.05
Daviesia purpurascens	39	23,390	97	626	2	569	2.37
Lepidobolus deserti	99	5,147	132	900,100	3	10	0.01
Caesia talinyka ms	61	668	12	6,338	2	31	0.44

Refer to Section 8.2.2.3 for discussion of records.

8.2.1 Federally Endangered and State Declared Rare Flora

There will be no direct impact from clearing of known populations of *Conospermum toddii*. A total of 15 populations were recorded within the Operational Area, eight populations adjacent to the Pinjin Infrastructure Corridor (300 metres from the proposed road alignment) and over 22 populations occur in Queen Victoria Springs and Plumridge Lakes Nature Reserves. All populations occur outside the conceptual footprint for the TGP.

The management strategies proposed in Section 7.2 will reduce the inherent risk of the identified impacts on *Conospermum toddii* as listed in Table 13.

Table 13: Inherent and Residual Risk of Impacts - *Conospermum toddii*

Impact	Inherent Risk	Residual Risk
Loss of individuals from disturbance.	Extreme	Low
Habitat loss and degradation from disturbance.	Extreme	Low
Fragmentation and reduced variability.	High	Low
Risk of fire on individuals and habitats.	High	Medium
Introduced plants competing and degrading DRF habitat.	Medium	Low
Introduced fauna degrading habitat and feeding on DRF.	High	Medium
Dust causing DRF deaths and altering DRF habitat.	Medium	Low
Habitat contamination.	Low	Low

No *Conospermum toddii* recorded in the TGP surveys will be cleared. Given the distance of known *Conospermum toddii* from infrastructure areas (>300 metres), it is considered highly unlikely that the conservation significance of this species will be altered by development of the TGP.

8.2.2 State Priority Species

The management strategies proposed in Section 7.3 will reduce the inherent risk of impacts on Priority species from high, medium and low to medium (introduced fauna) and low (all other impacts) as listed in Table 14. This does not include impacts of clearing which are different for each individual species. Individual species are discussed in the following sub-sections.

Table 14: Inherent and Residual Risk of Impacts - Priority Species

Impact	Inherent Risk	Residual Risk
Risk of fire on individuals and habitats.	High	Low
Introduced plants competing and degrading DRF habitat.	High	Low
Introduced fauna degrading habitat and predating on DRF.	High	Medium
Dust causing DRF deaths and altering DRF habitat.	Medium	Low
Habitat contamination.	Low	Low

8.2.2.1 Priority One Species

Two Priority 1 species, *Baeckea sp. Sandstone* and *Dampiera eriantha,* were recorded in the TGP Operational Area (but outside the conceptual footprint), with four and 23 populations of each species identified, respectively. The species are also known from five records (per species) on Florabase and five and 11 populations, respectively, recorded outside the defined TGP survey areas.

There will be no direct impact from clearing on the known populations of Priority 1 species. Given the predicted low to medium residual impacts from other activities following implementation of management measures, it is considered highly unlikely that development of the TGP will result in any negative alteration to the conservation status of Priority 1 species.

8.2.2.2 Priority Two Species

Of the seven Priority 2 species recorded in the TGP survey areas, four species, *Baeckea* sp. Great Victoria Desert, *Dicrastylis nicholasii, Grevillea secunda* and *Olearia arida* occur within the conceptual infrastructure footprint. *Malleostemon* sp. Officer Basin also occurs in the Operational Area, but is outside the conceptual infrastructure footprint and therefore not impacted.

Baeckea sp. Great Victoria Desert

Baeckea sp. Great Victoria Desert is broadly distributed and abundant in the Operational Area, TTIC, Pinjin Infrastructure Corridor and Borefield and Pipeline Corridor with over 800,000 individual plants estimated to occur in the survey areas. In addition to the plants recorded in TGP surveys, *Baeckea* sp. Great Victoria Desert also occurs in high numbers in Plumridge Lakes and Queen Victoria Springs Nature Reserves. It is estimated that development of the TGP will directly impact less than 1% of estimated *Baeckea* sp. Great Victoria Desert plant numbers.

Dicrastylis nicholasii

Dicrastylis nicholasii is broadly distributed and abundant in the Operational Area, TTIC Pinjin Infrastructure Corridor and Borefield and Pipeline Corridor with over 8,000,000 individual plants estimated to occur in the survey areas. In addition to the plants recorded in TGP surveys, *Dicrastylis nicholasii* also occurs in high numbers in Plumridge Lakes Nature Reserve. It is estimated that development of the TGP will directly impact less than 1% of estimated *Dicrastylis nicholasii* plant numbers.

Grevillea secunda

Grevillea secunda was recorded in the Operational Area, Pinjin Infrastructure Corridor and TTIC with over 20,000 individual plants estimated to occur in the TGP and nearby areas. The species is also known to occur in high numbers in Queen Victoria Springs Nature Reserve. It is estimated that development of the TGP will directly impact less than 1% of estimated *Grevillea secunda* plant numbers.

Oleria arida

Oleria arida was surveyed in the Operational Area, TTIC, Pinjin Infrastructure Corridor and Borefield and Pipeline Corridor with over 500,000 plants estimated to occur in the TGP survey areas. The species is also known to occur in Neale Junction Nature Reserve and in

Queen Victoria Springs Nature Reserve. It is estimated that development of the TGP will directly impact less than 1% of estimated *Oleria arida* plant numbers.

8.2.2.3 Priority 3 Species

Of the six Priority 3 species record in the TGP survey areas (*Acacia eremophila* numerous nerved variant, *Acacia eremophila* var. *variabilis*, *Dicrastylis cundeeleensis, Eucalyptus pimpiniana, Microcorys macredieana* and *Micromyrtus stenocalyx)* all occur in the conceptual footprint.

Acacia eremophila numerous nerved variant

Acacia eremophila numerous nerved variant was recorded in the Operational Area with over 700 individual plants recorded. The species is also thought to occur in high numbers in Plumridge Lakes Nature Reserve and is known from seven Florabase records ranging in description from patchy to frequent. It is estimated that development of the TGP will directly approximately 10% of known *Acacia eremophila* numerous nerved variant.

Acacia eremophila var. *variabilis*

Acacia eremophila var. *variabilis* was recorded in the Operational Area with approximately 45 individual plants recorded from three populations. In addition, 30 populations were recorded outside the TGP, with 645 plants recorded. It is estimated that development of the TGP will directly impact less than 5% of known *Acacia eremophila* var. *variabilis.*

Dicrastylis cundeeleensis

Dicrastylis cundeeleensis is broadly distributed and abundant in the Operational Area, TTIC Pinjin Infrastructure Corridor and Borefield and Pipeline Corridor with over 8,000 individual plants recorded. The species is also known to occur in Neale Junction Nature Reserve and Plumridge Lakes Nature Reserve. It is also known from 11 Florabase records ranging in frequency from uncommon to very common. Actual plant numbers are not listed on Florabase and as such, regional impact is calculated at 46.52% of the estimated plant numbers. This high percentage impact is partly due to:

- Two large populations (consisting of ~2,000 plants) occurring in the pit area.
- Lack of targeted searches outside the impact area.
- The species being recently listed (2008) as a Priority taxa, resulting in some surveys not targeting potential populations.

The species is broadly distributed in the area, having been recorded in four vegetation communities along the Pinjin Infrastructure Corridor and four vegetation communities in the Operational Area. It is not associated with a restricted landform or vegetation unit.

Eucalyptus pimpiniana

Eucalyptus pimpiniana was recorded in the Pinjin Infrastructure Corridor with over 500 individual plants recorded. The species is also known from 11 Florabase records with over 600 plants recorded. It is estimated that development of the TGP will directly impact less than 10% of estimated *Eucalyptus pimpiniana* plant numbers.

Microcorys macredieana

Microcorys macredieana is broadly distributed and abundant in the Operational Area, TTIC, Pinjin Infrastructure Corridor and Borefield and Pipeline Corridor with over 45,000

individual plants estimated to occur in the survey areas. The species is also known to occur in high numbers in Queen Victoria Springs and Plumridge Lake Nature Reserve and 12 populations have been recorded in Neale Junction Nature Reserve. It is estimated that development of the TGP will directly impact less than 1% of estimated *Microcorys macredieana* plant numbers.

Micromyrtus stenocalyx

Micromyrtus stenocalyx was recorded in the Operational Area and Pinjin Infrastructure Corridor, with over 2,000 individual plants recorded in the survey areas. The species is also known to occur in high numbers in Plumridge Lakes and Queen Victoria Springs Nature Reserves. It is estimated that development of the TGP will directly impact less than 1% of estimated *Micromyrtus stenocalyx* plant numbers.

8.2.2.4 Priority 4 Species

All three Priority 4 species (*Comesperma viscidulum, Daviesia purpurascens* and *Lepidobolus deserti)* recorded in the TGP surveys occur in the conceptual infrastructure footprint.

Comesperma viscidulum

Comesperma viscidulum was recorded in the Pinjin and TTIC, with approximately 30 individual plants recorded. The species was also recorded in other nearby areas (Independence Track) with over 20,000 individual estimated to occur. The species is also known from nine Florabase records with over 30 plants recorded. It is estimated that development of the TGP will directly impact less than 1% of estimated *Comesperma viscidulum* plant numbers.

Daviesia purpurascens

Daviesia purpurascens was recorded in abundance in the Operational Area, Pinjin Infrastructure Corridor and Borefield and Pipeline Corridor with over 23,000 individual plants estimated to occur in the survey areas. The species is also known from 51 Florabase records with over 300 individual plants recorded. It is estimated that development of the TGP will directly impact less than 3% of estimated *Daviesia purpurascens* plant numbers.

Lepidobolus deserti

Lepidobolus deserti was recorded in the Operational Area, TTIC, Pinjin Infrastructure Corridor and Borefield and Pipeline Corridor with over 7,000 individual plants estimated to occur in the survey area. The species is also known to occur in high numbers in Queen Victoria Springs Nature Reserve and is known from 19 Florabase records. It is estimated that development of the TGP will directly impact less than 1% of estimated *Lepidobolus deserti* plant numbers.

8.2.3 Priority Ecological Community

One Priority 3 PEC "Yellow Sandplain Community of the GVD" may potentially occur in the TTIC and Pinjin Infrastructure Corridor. This community contains diverse fauna, supporting a high number of conservation significant species, distinctive flora and is threatened by mining. The management strategies proposed for the TGP will reduce the inherent risk of the identified impacts as listed in Table 15.

Table 15: Inherent and Residual Risk of Impacts - PEC

Impact	Inherent Risk	Residual Risk
Habitat loss and degradation from disturbance.	Extreme	Medium
Fragmentation and reduced variability.	Extreme	Low
Degradation of PEC from fire.	High	Medium
Introduced plants degrading PEC.	High	Low
Introduced fauna degrading PEC.	High	Low
Dust altering PEC habitat.	Medium	Low
Habitat contamination.	Low	Low

It is difficult to quantify impacts on the potential PEC due to the lack of information available and poor definition of the gazetted area. Further regional work is required to assess the similarities between the gazetted PEC and potential PEC of the TGP area.

8.2.4 Vegetation Communities

Of the 18 major vegetation communities of conservation significance defined in the survey areas, it is anticipated that 11 will be impacted by proposed disturbance activities. These communities are listed in Table 16 for the Operational Area and Infrastructure Corridors, with percentage disturbance for each vegetation community calculated based on the extent of the community as surveyed for the TGP. Disturbances associated with the borefield are discussed below.

Table 16: Estimated Disturbance to Conservation Significant Vegetation Communities

Number (as per Section 5.2)	Vegetation Unit	Total Area Surveyed (Hectares)	Area to be Disturbed (Hectares)	Approximate % Impact
Operational Area				
1	Mixed Eucalypt woodlands over mixed open shrubs and *Triodia basedowii.*	30,823	1,680	5.5
6	Minor Clay Pan: Scattered *Acacia nyssophylla/Grevillea sarissa* over open herbs and grasses.	174	2.51	1.4
2	Dunes: Scattered *E. gongylocarpa* over mixed shrubs and *Triodia desertorum* or *T. basedowii.*	6,009	9.11	0.15
Pinjin Infrastructure Corridor				
S9	Mixed low Shrubland with occasional emergent *Eucalyptus* species.	306	14	4.8
S5	Mixed low shrubs over grasses and occasional *Eucalyptus gongylocarpa*.	854	29	3.4
Tropicana - Transline Infrastructure Corridor				
1	Mixed *Eucalyptus* woodland over hummock grassland.	5,124	66	1.3

Number (as per Section 5.2)	Vegetation Unit	Total Area Surveyed (Hectares)	Area to be Disturbed (Hectares)	Approximate % Impact
2	*Callitris preissii* tall shrubland.	4,652	57	1.2
5	*Triodia rigidissima* hummock grasslands.	4,364	98	1.6

To summarise, disturbance to those conservation significant vegetation communities listed in Table 16 will range between:

- 0.15 to 5.5% in the Operational Area.
- 3.4 to 4.8% in the Pinjin Infrastructure Corridor.
- 1.2 to 1.6% in the Tropicana - Transline Infrastructure Corridor.

These figures represent an estimated disturbance to vegetation communities based on the extent of the community surveyed for the TGP. The communities are not restricted to the TGP area and therefore the percentage impacts are likely to decrease if compared to regional distribution of the communities.

Percentage disturbance for the borefield area has not been calculated as part of this report as the infrastructure footprint has not been defined. It is anticipated that the borefield and pipeline corridor will result in approximately 200hectares of native vegetation clearing.

Clearing of 200 hectares for the borefield area will mainly be located within three common vegetation communities (E2, E3 and T1 as defined in Botanica, 2009). Depending on the final location of infrastructure, it is possible that a small area of E1, A1 and A2 vegetation could be cleared. Tropicana JV have committed to minimising disturbance to community E1 and avoiding disturbance to communities E5 and E6 which are locally restricted to landforms of the broader project area. This management commitment is listed in Section 7.2.1 and Table 10.

8.3 THREATENED FAUNA

8.3.1 Federally Listed Species

8.3.1.1 Southern Marsupial Mole (Endangered and State Schedule 1)

Southern Marsupial Mole holes were surveyed in all areas of the TGP. In the Operational Area, 42 of 139 mole holes were located in areas of infrastructure development, with the age of holes ranging from fresh to old. In the Pinjin Infrastructure Corridor, three of ten Marsupial Mole holes were recorded within 50 metres of the proposed road alignment, classified as old to very old. One of 26 mole holes surveyed in the TTIC was within 50 metres of the alignment. This hole was classified as old. None of the twelve mole holes located within the Borefield and Pipeline Corridor were in areas of proposed infrastructure.

Estimations of total population sizes are difficult to ascertain, but recent studies indicate Southern Marsupial Moles may be more common and widespread than previously thought in the Great Victoria Desert (Benshemesh, 2008).

The main threats to the Southern Marsupial Mole resulting from the TGP have been identified as habitat loss and the loss of individuals resulting from disturbance activities. The infrastructure corridors will not intersect dune systems (preferred Marsupial Mole habitat) and as such, potential impacts on individuals and habitat are significantly reduced. The Operational Area will impact a discrete area of Southern Marsupial Mole habitat, and may also impact individuals using this area. Implementation of management measures as per Section 7.2 reduces the risk of impacts on the Southern Marsupial Mole as shown in Table 17.

Table 17: Inherent and Residual Risk of Impacts - Southern Marsupial Mole

Impact	Inherent Risk	Residual Risk
Loss of individuals from disturbance.	High	Medium
Habitat loss and degradation from disturbance.	High	Medium
Fragmentation and reduced variability.	Medium	Low
Loss of individuals from fire.	Medium	Low
Degradation of habitat from fire.	Medium	Low
Introduced plants degrading habitat.	Low	Low
Direct predation from introduced fauna.	High	Low
Introduced fauna degrading habitat.	Low	Low
Loss or injury to individuals from vehicle collision.	Low	Low
Habitat contamination.	Low	Low

Based on reduced risks of impacts, it is considered unlikely that development of the TGP will result in any negative alteration to the conservation status of the Southern Marsupial Mole.

8.3.1.2 Sandhill Dunnart (Endangered and State Schedule 1)

The Sandhill Dunnart was not recorded during any surveys commissioned for the TGP. Sandhill Dunnarts have been recorded approximately 50 kilometres south west of the Operational Area (G. Gaikhorst and C. Lambert, pers com, shown on Figure 14) and potentially suitable habitat occurs in the Operational Area and adjacent to the Pinjin and TTIC.

The main threats to the Sandhill Dunnart resulting from the TGP have been identified as habitat loss, loss of individuals, fragmentation and reduced viability (from disturbance activities) as well as degradation of habitat from fire and direct predation from introduced fauna.

Infrastructure will be designed to avoid potential Sandhill Dunnart habitat and as such, potential impacts on individuals (should they occur) and habitat are significantly reduced. Fire management strategies will include fire control mechanisms and identification of fire sensitive vegetation and habitat to ensure awareness of areas of potential significance to the Sandhill Dunnart.

Implementation of a feral animal control program which will include mechanisms for feral animal eradication, correct management of waste and water facilities and education of personnel may assist in reducing potential impacts posed by feral animals.

Implementation of management measures as per Section 7.2, reduces the risk of impacts on the Sandhill Dunnart (should it occur) and its potential habitat as shown in Table 18.

Table 18: Inherent and Residual Risk of Impacts - Sandhill Dunnart

Impact	Inherent Risk	Residual Risk
Loss of individuals from disturbance.	Extreme	Medium
Habitat loss and degradation from disturbance.	High	Medium
Fragmentation and reduced variability.	High	Medium
Loss of individuals from fire.	Medium	Medium
Degradation of habitat from fire.	High	Medium
Introduced plants degrading habitat.	Low	Low
Direct predation from introduced fauna.	High	Low
Introduced fauna degrading habitat.	Medium	Low
Competition for resources due to introduced fauna.	Medium	Low
Altered habitat due to dust.	Low	Low
Loss or injury to individuals from vehicle collision.	Low	Low
Injury and illness from waste and contamination.	Low	Low
Habitat contamination.	Low	Low

Based on reduced risks of impacts, it is considered unlikely that development of the TGP will result in any negative alteration to the conservation status of the Sandhill Dunnart.

8.3.1.3 Mulgara (Vulnerable and State Schedule 1)

Surveys of the TGP did not categorically identify the presence of the Brush-tailed Mulgara, although suitable habitat was identified. Records of burrows and scats within the survey areas suggest that Mulgara may occur within the TGP area.

The main threats to the Mulgara resulting from the TGP have been identified as habitat loss and loss of individuals (should they occur) from disturbance activities and direct predation from introduced fauna. As per the Sandhill Dunnart, the same management and mitigation measures apply, including avoidance of potentially suitable Mulgara habitat and implementation of feral animal control measures.

Implementation of management measures as per Section 7.2, reduces the risk of impacts on the Mulgara (should it occur) and its potential habitat as shown in Table 19.

Table 19: Inherent and Residual Risk of Impacts - Mulgara

Impact	Inherent Risk	Residual Risk
Loss of individuals from disturbance.	High	Medium
Habitat loss and degradation from disturbance.	High	Medium
Fragmentation and reduced variability.	Medium	Low
Loss of individuals from fire.	Medium	Low
Degradation of habitat from fire.	Medium	Low
Introduced plants degrading habitat.	Medium	Low
Direct predation from introduced fauna.	High	Low
Introduced fauna degrading habitat.	Medium	Low
Competition for resources due to introduced fauna.	Medium	Low
Altered habitat due to dust.	Low	Low
Loss or injury to individuals from vehicle collision.	Low	Low
Injury and illness from waste and contamination.	Low	Low
Habitat contamination.	Low	Low

Based on reduced risks of impacts, it is considered unlikely that development of the TGP will result in any negative alteration to the conservation status of the Mulgara.

8.3.1.4 Malleefowl (Vulnerable and State Schedule 1)

Twenty inactive Malleefowl mounds were identified in and surrounding the Operational Area, two in areas of proposed infrastructure. Eight inactive Malleefowl mounds were surveyed along the TTIC, and a fresh set of Malleefowl tracks were observed. One active and one inactive Malleefowl mound was observed along the Pinjin Infrastructure Corridor, along with one set of tracks, and an individual Malleefowl was observed once approximately 600 metres from the proposed centre alignment. One inactive mound was surveyed in the Water Borefield and Pipeline Corridor, outside of the area of impact. All Malleefowl mounds, tracks and birds sighted are presented in Figure 9 through to Figure 12. Birds Australia has no modern records for Malleefowl in the vicinity of TGP, however a Malleefowl was sighted south of Plumridge Lakes Nature Reserve in 2007.

The main threats to the Malleefowl resulting from the TGP have been identified as habitat loss (from clearing), loss of individuals (clearing and collision with vehicles), fragmentation and reduced viability (clearing), as well as degradation of habitat from fire and direct predation from introduced fauna. As per the Sandhill Dunnart, the same management and mitigation measures apply, including avoidance of potentially suitable Malleefowl habitat and implementation of feral animal control measures. Vegetation deemed suitable Malleefowl habitat will not be intersected by infrastructure corridors or other infrastructure, significantly reducing interaction with the Malleefowl and subsequently the risk of vehicle collision and degradation of habitat.

Implementation of management measures as per Section 7.2, reduces the risk of impacts on the Malleefowl and its habitat as shown in Table 20.

Table 20: Inherent and Residual Risk of Impacts - Malleefowl

Impact	Inherent Risk	Residual Risk
Loss of individuals from disturbance.	High	Medium
Habitat loss and degradation from disturbance.	High	Low
Fragmentation and reduced variability.	High	Medium
Loss of individuals from fire.	Medium	Medium
Degradation of habitat from fire.	High	Medium
Introduced plants degrading habitat.	Low	Low
Direct predation from introduced fauna.	High	Medium
Introduced fauna degrading habitat.	Medium	Low
Altered habitat due to dust.	Low	Low
Loss or injury to individuals from vehicle collision.	High	Low
Injury and illness from waste and contamination.	Low	Low
Habitat contamination.	Medium	Low

Based on reduced risks of impacts, it is considered unlikely that development of the TGP will result in any negative alteration to the conservation status of the Malleefowl.

8.3.2 State Listed Species

8.3.2.1 Australian Bustard (Priority 4)

Eight Australian Bustards were sighted in the Operational Area, as well as tracks on three occasions. One Australian Bustard and a nest with one egg was found more than 50 metres from the proposed Pinjin Infrastructure Corridor, and tracks were observed on six occasions. Tracks were observed once in the Water Borefield and Pipeline Corridor outside of the proposed infrastructure area.

The main threats to the Australian Bustard resulting from the TGP include loss of individuals, habitat degradation and fragmentation from disturbance activities. Loss of individuals from vehicle collision was also noted as a threat.

Implementation of management measures as per Section 7.2, reduces the risk of impacts on the Australian Bustard as shown in Table 21.

Table 21: Inherent and Residual Risk of Impacts - Australian Bustard

Impact	Inherent Risk	Residual Risk
Loss of individuals from disturbance.	High	Medium
Habitat loss and degradation from disturbance.	High	Medium
Fragmentation and reduced variability.	High	Low
Loss of individuals from fire.	Medium	Low
Degradation of habitat from fire.	Medium	Low
Introduced plants degrading habitat.	Low	Low

Impact	Inherent Risk	Residual Risk
Direct predation from introduced fauna.	Medium	Low
Introduced fauna degrading habitat.	Low	Low
Altered habitat due to dust.	Low	Low
Loss or injury to individuals from vehicle collision.	High	Low
Injury and illness from waste and contamination.	Low	Low
Habitat contamination.	Low	Low

8.3.2.2 Crested Bellbird (Priority 4)

The Crested Bellbird was recorded in the Pinjin Infrastructure Corridor. The main threat to the species is fragmentation from disturbance activities. Implementation of management measures as per Section 7.2, reduces the risk of impacts on the Crested Bellbird as shown in Table 22.

Table 22: Inherent and Residual Risk of Impacts - Crested Bellbird

Impact	Inherent Risk	Residual Risk
Loss of individuals from disturbance.	High	Low
Habitat loss and degradation from disturbance.	High	Low
Fragmentation and reduced variability.	High	Low
Loss of individuals from fire.	Medium	Low
Degradation of habitat from fire.	Medium	Low
Introduced plants degrading habitat.	Low	Low
Direct predation from introduced fauna.	Medium	Low
Introduced fauna degrading habitat.	Low	Low
Altered habitat due to dust.	Low	Low
Loss or injury to individuals from vehicle collision.	Medium	Low
Injury and illness from waste and contamination.	Low	Low
Habitat contamination.	Low	Low

As the Crested Bellbird has been recorded from Nature Reserves in the region and the southern subspecies (P4) has not been positively identified in surveys, residual impacts to this are considered Low.

Due to the extent of suitable habitat outside the study area, wide distribution and nomadic nature of both the Australian Bustard and Crested Bellbird, the impact of the TGP these species is likely to be negligible and it is considered highly unlikely that development of the TGP will result in any negative alteration to the conservation status of the Australian Bustard.

8.3.2.3 Peregrine Falcon (Other Specially Protected Species)

The Peregrine Falcon was surveyed on one occasion in the Operational Area. This species is widespread in Australia. Its habitat is widely represented outside of the TGP and no

breeding habitat was located within the Operational Area (*Ecologia*, 2009e). These factors combined with implementation of management and mitigation measures makes all predicted residual impacts on this species Low.

8.3.2.4 Woma Python (Other Specially Protected Species)

The Woma Python was opportunistically recoded on two occasions by TJV staff in the Operational Area and once in Neale Junction. The species occurs in the arid zones of Western Australia, favouring open myrtaceous heath on sandplains, and dunefields dominated by spinifex (*Triodia* spp.) The species may inhabit the sand dune vegetation unit of the Operational Area. This habitat is present within and outside the TGP and development of the TGP will only require a small proportion (less than 0.15%) of disturbance to this unit.

Favourable habitat for the Woma Python is well represented outside the TPG in Neale Junction, Victoria Springs and Plumrigdge Lakes Nature Reserves. These factors combined with implementation of management and mitigation measures makes all predicted residual impacts on this species Low. These factors combined with implementation of management and mitigation measures makes all predicted residual impacts on this species Low.

8.3.3 Migratory Species

8.3.3.1 Rainbow Bee-eater

The Rainbow Bee-eater was sighted on 58 occasions in surveys of the proposed infrastructure corridors and Operational Area. The Rainbow Bee-eater is common in WA, is able to travel large distances and has diverse habitat preferences. These factors combined with implementation of management and mitigation measures makes all predicted residual impacts on this species Low.

8.3.3.2 Fork-tailed Swift

Approximately 340 Fork-tailed Swifts were observed on four occasions in the Operational Area and Borefield and Water Pipeline area. In Western Australia, the Fork-tailed Swift is considered rare or scarce in the project area. They are nomadic in response to broad-scale weather pattern changes, attracted to thunderstorms where they can be seen in flocks of up to 2,000 birds. They rarely land, living almost exclusively in the air and feeding entirely on aerial insects, especially nuptial swarms of beetles, ants, termites and native bees (Johnstone and Storr 1998, Simpson and Day 2004).

Due to their preference for aerial habitat and uncommon distribution in the project area, impact assessment has identified all impacts to the Fork-tailed Swift as having a Low inherent and residual risk.

8.3.3.3 Wood Sandpiper

The Wood Sandpiper was observed on a lake near Pinjin after a significant rainfall event. This bird is a migratory visitor to Australia over summer. It is a nomadic bird, and considered an uncommon visitor to the southern region. Because of its nomadic lifestyle and low occurrence in the region, it is not likely to be impacted on a large scale, impact

assessment identified all impacts to the Wood Sandpiper as having a Low inherent and residual risk.

8.3.3.4 Common Greenshank

The Common Greenshank was observed on a lake southwest of Pinjin after a significant rainfall event. This bird prefers coastal regions, but will move inland if the appropriate conditions exist. Due to its uncommon occurrence in the region and preference for coastal regions, impact assessment identified all impacts to the Common Greenshank as having a Low inherent and residual risk.

8.3.4 Conservation Significant Fauna Species Not Observed

Other species that were identified in desktop surveys, but not located in the field are assessed in the following categories:

- **Species considered extinct in the survey area**: the Chuditch, Numbat, Bilby, Boodie, Greater Stick-nest Rat and Thick-billed Grass-wren are all considered to be at Low risk of being impacted by the Tropicana project, due to the likelihood they are extinct in the area.
- **Species for which habitat exists in the survey areas, they might have been surveyed nearby, but none were surveyed**: including the Central Long-eared Bat, Great Desert Skink, Southern Desert Lerista (Recorded at QVSNR), Major Mitchell's Cockatoo, Princess Parrot, Night Parrot and Naretha Blue Bonnet. These are also considered to have a Low risk of being impacted by the TGP with correct management such as minimising clearing of vegetation with hollows.
- **Migratory species**: include the Cattle Egret, Great Egret/White Egret and Oriental Plover/Dotterel are unlikely to frequent the TGP, and rarely land making the risk of impact to these species Low.
- **Wide-ranging species**: like the Grey Falcon are unlikely to be impacted due to their wide ranges and extensive habitats, making their risk of being impacted Low.
- **Smaller birds with small ranges**: are the Slender-billed Thornbill and Striated Grasswren. Although their small ranges make them susceptible, suitable habitat is well represented in the region, and the Grasswren has been surveyed from Nature Reserves, resulting in a Low risk rating for impacts from the TGP.

8.4 RESIDUAL IMPACT ASSESSMENT SUMMARY

The residual impact after mitigation measures have been implemented for each conservation significant species surveyed at Tropicana is shown in Table 23. The full risk matrix is provided in Appendix 2.

The residual impacts shown in Table 23 range between Low and Medium, with the majority of impacts classified as Low. The highest residual impacts are related to land disturbance, fire impacts and introduced fauna impacts on conservation significant species. Even with the management measures implemented as outlined in Section 7.2.1, land disturbance is required to complete the operations, and occasionally impacts on conservation significant species cannot be avoided. Fire is already present in the landscape, and may reduce in its

extent, severity and impact with the implementation of fire management measures. Introduced fauna are also already present in the area and may decrease in their impacts with the implementation of feral fauna management.

Table 23: Residual Impact Assessment for Tropicana Conservation Significant Species

Conservation Significant Species	**Residual Risk**														
	Disturbance			**Fire**		**Introduced Flora**		**Introduced Fauna**			**Vehicle Collision**	**DUST**		**Waste And Contamination**	
	Loss of Individuals	Loss of Habitat and Habitat Degradation	Fragmentation reduced genetic variability	Loss of Individuals	Habitat Loss and degradation	Competition	Habitat Degradation	Habitat Degradation	Direct Predation	Competition	Loss or injury of Individuals	Plant Deaths	Altered Habitat	Injury and Illness to Individuals	Groundwater, Surface water and Habitat Contamination
Southern Marsupial Mole	M	L	L	L	L	n/a	L	L	L	n/a	L	n/a	n/a	L	L
Sandhill Dunnart	M	M	M	M	M	n/a	L	L	L	L	L	n/a	L	L	L
Mulgara	M	M	L	L	L	n/a	L	L	L	L	L	n/a	L	L	L
Malleefowl	M	L	M	M	M	n/a	L	L	M	n/a	M	n/a	L	L	L
Australian Bustard	M	M	L	L	L	n/a	L	L	M	n/a	M	n/a	L	L	L
Peregrine Falcon	L	L	L	L	L	n/a	L	L	L	n/a	L	n/a	L	L	L
Woma Python	L	L	L	L	L	n/a	L	L	L	n/a	L	n/a	L	L	L
Fork-tailed Swift	L	L	L	L	L	n/a	L	L	L	n/a	L	n/a	L	L	L
Rainbow Bee-eater	L	L	L	L	L	n/a	L	L	L	n/a	L	n/a	L	L	L
Wood Sandpiper	L	L	L	L	L	n/a	L	L	L	n/a	L	n/a	L	L	L
Common Green shank	L	L	L	L	L	n/a	L	L	L	n/a	L	n/a	L	L	L
Crested Bellbird	L	L	L	L	L	n/a	L	L	L	n/a	L	n/a	L	L	L
PEC	n/a	M	L	n/a	M	n/a	L	L	L	n/a	n/a	L	L	L	L

Conservation Significant Species	**Residual Risk**														
	Disturbance			**Fire**		**Introduced Flora**		**Introduced Fauna**			**Vehicle Collision**	**DUST**		**Waste And Contamination**	
	Loss of Individuals	Loss of Habitat and Habitat Degradation	Fragmentation reduced genetic variability	Loss of Individuals	Habitat Loss and degradation	Competition	Habitat Degradation	Habitat Degradation	Direct Predation	Competition	Loss or injury of Individuals	Plant Deaths	Altered Habitat	Injury and Illness to Individuals	Groundwater, Surface water and Habitat Contamination
Declared Rare Flora	Priority Flora are assessed for impacts associated with disturbance in Table 13			M	M	L	L	M	M	n/a	n/a	L	L	n/a	L
Priority Flora Species				L	L	L	L	M	M	n/a	n/a	L	L	n/a	L

9. LIMITATIONS OF SURVEYS AND RECOMMENDATIONS

The flora and fauna surveys completed for conservation significant species associated with the TGP outlined limitations in their surveys based on the following categories.

9.1 HISTORICAL DATA

- A lack of historical surveys in the areas means little data exists for the region, making it difficult to predict species' presence, or compare findings. Further systematic surveys would be required to reveal all the fauna and flora present.
- The paucity of information on the Southern Marsupial Mole makes it difficult to predict habitats, link moles to holes, or determine the age of the holes surveyed.
- Surveys of Southern Marsupial Mole holes cannot definitively link the moles to the holes, although no alternative hole creators have been proposed.

9.2 SEASONALITY

- The lack of annual or biennial flora species recorded as a function of the dry season.
- Fauna surveys undertaken in the winter season reduce the likelihood of sampling reptiles.
- Surveys conducted in the hottest parts of the year mean ground burrowing animals may burrow further down making detection more difficult.
- Surveys for Southern Marsupial Moles conducted by Ecologia and URS were hindered by light rainfall during the survey period which may have obscured mole holes, although many mole holes were still identified.

9.3 RECENT FIRE ACTIVITY

- Recent fires in the access corridor made plant identification in some sections unfeasible. Areas of yellow dunes which have been recently burnt may provide suitable habitat for *Conospermum toddii* and more identifications may have been made if areas were not burnt. This species may return to burnt dunes after rains.
- Recent fires reduced fauna habitat, and hence fauna sightings and captures in some sections.
- Recent fires affected soil penetrometer results used for detection of Southern Marsupial Mole habitat and holes.
- Recent fires effect on habitat resulted in decreased viewings of fauna in Level 1 surveys, except for birds of prey.
- Recent fires destroyed suitable habitat for habitat specific species such as the Sandhill Dunnart.

9.4 OTHER LIMITATIONS

- The more general Level 1 fauna surveys were reliant on secondary evidence of species.
- Scats found in fauna surveys could not be identified to a species level.

9.5 FURTHER WORK

- Mattiske recommend further flora survey work be undertaken following higher seasonal rainfall events such as post cyclonic rain to survey for annual or biennial species at the TGP.
- Mattiske recommend further surveys after rains for *Conospermum toddii* on burnt yellow dunes, and avoiding disturbance of yellow dunes until such time as absence of conservation significant species can be determined.
- URS recommend targeted surveys for Mulgara prior to disturbance.

10. CONCLUSION

Tropicana JV commissioned a number of botanical and zoological consultants to undertake surveys for conservation significant flora and fauna species and habitat on the proposed TGP Operational Area, Pinjin and Tropicana - Transline Infrastructure Corridors, Public Bypass Road and Borefield and Pipeline Corridor.

Consultants were contracted to perform Level 1 and Level 2 surveys. Species of significance with a high likelihood of occurring in the TGP area were specifically targeted in comprehensive Level 2 surveys. Several consultants were used to increase the robustness of the process, reducing bias and error.

Searches of the Western Australian and Federal government's threatened species databases conducted by botanical consultants identified 54 conservation significant flora species with the potential to occur in the TGP area. Surveys of the TGP areas identified 20 conservation significant flora species occurring within the defined survey areas comprising one Federally Endangered and DRF species (*Conospermum toddii),* 18 State Priority species and one State species of interest. Impacts on conservation significant species that occur in the proposed impact area include:

- No DRF (*Conospermum toddii)* will be impacted.
- No Priority 1 species will be impacted as mitigation measures will prevent impact on these species.
- Four species listed as Priority 2 will be impacted by the proposed infrastructure. Estimated percentage impact in terms of overall plant numbers are 0.47% of *Baeckea* sp Great Victoria Desert, 0.7% of *Dicrastylis nicholasii*, 0.13% of *Grevillea secunda* and 0.67% of *Olearia arida*.
- Six Priority 3 species will be impacted. Estimated percentage impact in terms of overall plant numbers are 10.03% of *Acacia eremophila* numerous nerved variant, 4.9% of *Acacia eremophila* var. *variabilis, 46.52%* of *Dicrastylis cundeeleensis*, 9.53% of *Eucalyptus pimpiniana, 0.39%* of *Microcorys macredieana* and 0.02% of *Micromyrtus stenocalyx*.
- Three Priority 4 species will be impacted. Estimated percentage impact in terms of overall plant numbers are 0.05% of *Comosperma viscidulum*, 2.37% of *Daviesia purpurascens*, and 0.01 %of *Lepidobolus deserti*.
- One species of interest *Caesia* talinkya ms will have 0.44% of its known plant numbers impacted.

It is considered unlikely that the TGP will have a significant negative impact on the status of any Priority flora species in the region for the following reasons:

- The majority of Priority flora populations recorded are outside the proposed areas of disturbance.
- Many Priority flora species located in the TGP area are represented in local Nature Reserves.
- No identified flora species are anticipated to change conservation status to a higher category in the near future.

- It is possible that some species identified in these surveys may be de-listed due to improved knowledge gained through the surveys, the high number of specimens identified and increases in their known distribution.

Searches of the Western Australian and Federal government's threatened species databases conducted by fauna consultants identified 32 species with the potential to exist in the area. Surveys of the Operational Area, Infrastructure Corridors, Public Bypass and Water Borefield and Pipeline Corridor confirmed the historical and current presence of 11 conservation significant fauna species (Greater Stick-nest Rat, Southern Marsupial Mole, Woma Python, Malleefowl, Peregrine Falcon, Australian Bustard, Rainbow Bee-eater, Crested Bellbird, Wood Sandpiper, Common Greenshank and Fork-tailed Swift).

It is considered unlikely the TGP will have a significant negative impact on these species for the following reasons:

- The Greater Stick-nest Rat is considered extinct in the region.
- The Peregrine Falcon, Woma Python, Australian Bustard, Rainbow Bee-eater, Crested Bellbird, Wood Sandpiper, Common Greenshank and Fork-tailed Swift are relatively common and mobile species with preferred habitats well represented outside the TGP.
- Habitat for Marsupial Moles (yellow sand dunes), will be avoided where possible, and impact to these areas will be minimised.
- Mulga Woodland habitat for Malleefowl, and Malleefowl mounds will be avoided where possible.
- Although the Sandhill Dunnart and Mulgara were not observed, several areas of potential habitat were identified. These areas will also be avoided where possible.

The Priority 3 PEC Yellow Sandplains Community of the Great Victoria Desert potentially crosses the TTIC and the Pinjin Infrastructure Corridor, but was not identified in the Borefield and Pipeline Corridor or Operational Area. Impacts to the PEC will be reduced through avoidance of known locations of the PEC where possible. As this PEC supports high numbers of conservation significant flora and fauna in the region, this approach will also reduce impacts to species that utilise dune habitats.

The risks to conservation significant species identified through the flora, fauna and habitat surveys have been minimised through the measures outlined in Section 7.2.

The residual risks to conservation significant flora and fauna species are seen as generally minimal.

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APPENDICES

APPENDIX 1:
CONSERVATION SIGNIFICANT FLORA AND FAUNA DESCRIPTIONS

SIGNIFICANT FLORA

***Conospermum toddii* (Declared Rare Flora)**

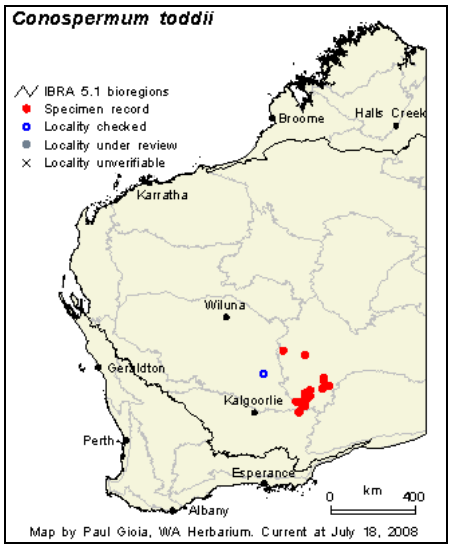
Conospermum toddii (Victoria Desert Smokebush) is a spreading shrub 100 - 200 centimetres in height, generally growing to less than two metres tall. It produces white or yellow flowers from July to October and has long, fine, thread-like leaves that are bent upwards in a soft curve (Plate 1). It flowers between July and October with small, white to yellow flowers, especially following a favourable rainfall. Its typical habitat is on crests of yellow sand dunes, but it can also be found in the interdunal swales and low lying areas between dunes. In recently burnt areas the smokebush regenerates from seed, and small seedlings may be present in a variety of habitats (DEC, 2008a).

Plate 1: *Conospermum toddii*

(Source: Florabase)

Florabase has 29 records of *Conospermum toddii*, collected between 1967 and 2008. Two of these records are from surveys conducted for the TGP, the other 27 were independent collections. Populations recorded by the TGP surveys were described as healthy, with 60 plants. Population sizes recorded by independent surveys varied between greater than 25 and 100 mature plants and 1688 seedlings, or occasional and abundant. The distribution of *Conospermum toddii* as shown on Florabase is shown on Figure 1.

Figure 1: Distribution of *Conospermum toddii*



(Source: Florabase, 2008)

***Caesia rigidifolia* (Priority 1)**
Caesia rigidifolia is a rhizomatous, tufted perennial herb, which grows to 45 centimetres high. It has green and white flowers. Flowering occurs in October (DEC, 2008).

This species is currently under taxonomic review (ecologia, 2008b). Species which were once classified *Caesia rigidifolia* may now be changed. Two species sampled in these surveys were initially considered *Caesia rigidifolia*, will now be considered as *Caesia* sp. Great Victoria Desert and *Caesia talinyka* ms and are described below.

Two records exist on Florabase for this species, the first from PLNR in 2007 and another from an unknown location in 2000.

No distribution map of *Caesia rigidifolia* is available.

***Caesia* sp. Great Victoria Desert (Conservation Significance to be determined)**
Caesia sp. Great Victoria Desert is a sedge-like rhizomatous, tufted perennial herb (Plate 2). It forms a thick, dark green grass–like clump up to 50 centimetres high and about 70 centimetres in diameter. It has folded, viscid (sticky) leaves. It is much like *C. rigidifolia* (Priority 1) except that the plants are larger and the leaves are folded.

The name *Caesia* sp. Great Victoria Desert is currently not recognised on FloraBase, but it is recognised by the WA Herbarium as being a current name. The name recognized on FloraBase is *Caesia rigidifolia*. *Caesia rigidifolia* (a Priority 1 species) is currently under taxonomic review and may become a new species altogether.

Plate 2: *Caesia* sp. Great Victoria Desert

(Source: Ecologia)

***Caesia talinyka* (Conservation Significance to be determined)**
Caesia talinyka ms was initially recorded in 2005 from one collection within the Tropicana Project Area on a sand dune with *Eucalyptus* spp. over low mixed shrubs, and on a large number of sand dunes surveyed in the southern section of the Project Area.

Although this specimen was initially identified as *Caesia rigidifolia* (P1), after comparing it to the original 1875 type specimen of *Caesia rigidifolia*, the initial identification as *Caesia rigidifolia* was shown to be incorrect. The taxon collected by Ecologia is now known as *Caesia talinyka* ms and is scheduled to be published in *Nuytsia* by C. Tauss. It is likely to be listed as a Priority taxon subsequent to publication. This taxon appears most closely related to *Caesia viscida* (known from Cape Arid).

No information on the distribution of this species is available.

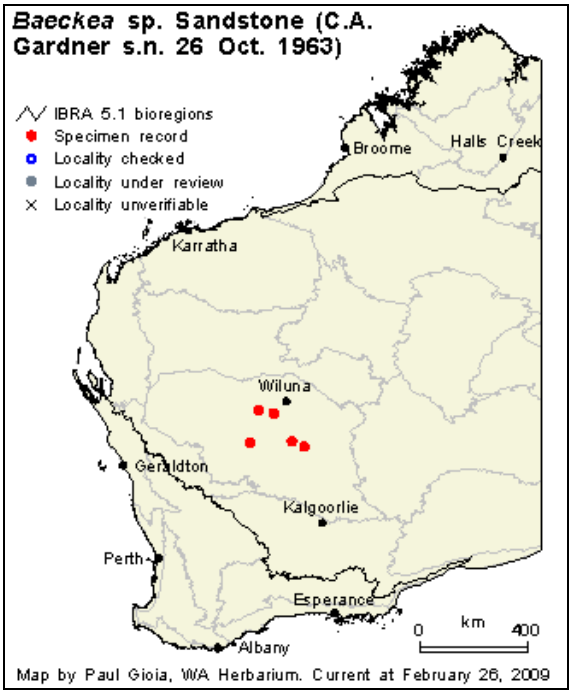
***Baeckea sp. Sandstone* (Priority 1)**
Baeckea sp. Sandstone is an upright low shrub, growing to one metre in height. It has white flowers which bloom in October. Records of the species on Florabase are from flat orange to red sand.

Plate 3: *Baeckea sp. Sandstone*

(Source: Ecologia)

Florabase has five records for the species. It was collected twice in 1963, recorded as occasional in 1994, located again in 1996 and recorded as locally common in 2004. A distribution map of the species is provided as Figure 2. The TGP survey findings are in addition to these Florabase records.

Figure 2: Distribution of *Baeckea sp. Sandstone*



(Source: Florabase, 2008)

***Dampiera eriantha* (Priority 1)**

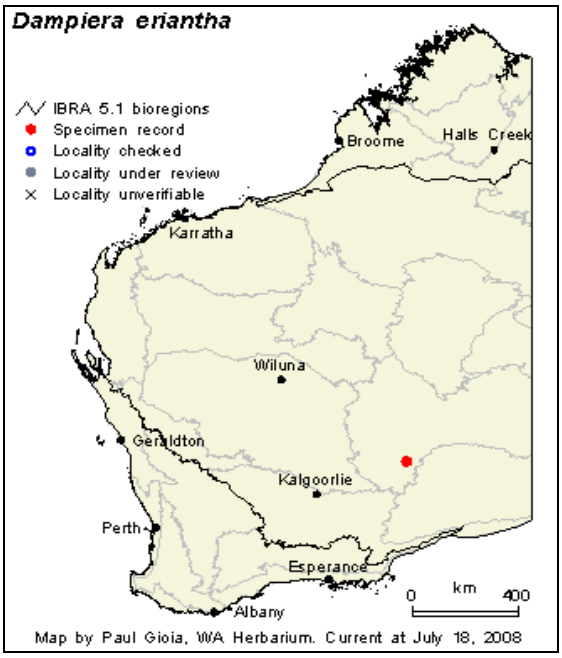
Dampiera eriantha is an erect perennial to 60 centimetres, hairless other than on the flowering structures. The leaves do not have stalks and are linear to oblong with curled margins. The flowers are borne in auxiliary clusters with pale grey flowers.

Plate 4: *Dampiera eriantha*

(Source: Ecologia)

Five records are available on Florabase for *Dampiera eriantha*, three records from 1891, a few plants in 2007 and ten plants in 2008. Collections for the TGP are in addition to these collections. The distribution of *Dampiera eriantha* is shown in Figure 3.

Figure 3: Distribution of *Dampiera eriantha*



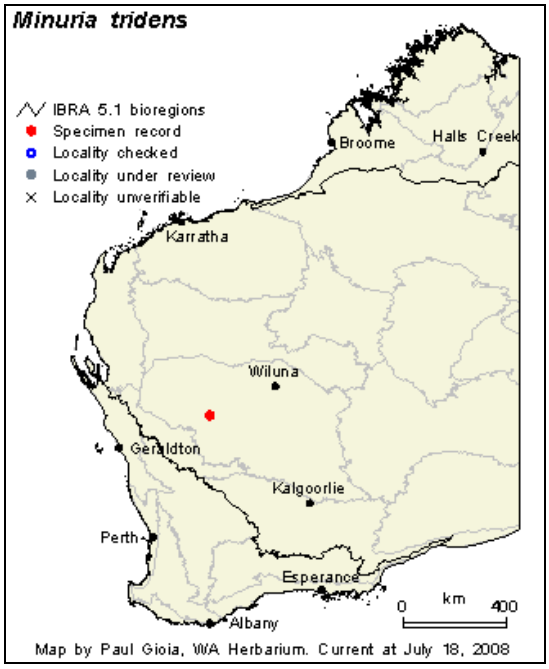
(Source: Florabase, 2008)

***Minuria tridens* (Priority 1)**

Minuria tridens is a small upright shrub to 35 centimetres with daisy flowers of white or pale lavender. Flowering occurs in September.

Only one other record is available on Florabase, it was found to be common on a roadside near Cue in 1986. Its known distribution in Western Australia is shown in Figure 4. It is otherwise known only from arid areas of the Northern Territory.

Figure 4: Distribution of *Minuria tridens*



(Source: Florabase, 2008)

***Baeckea* sp. Great Victoria Desert (Priority 2)**

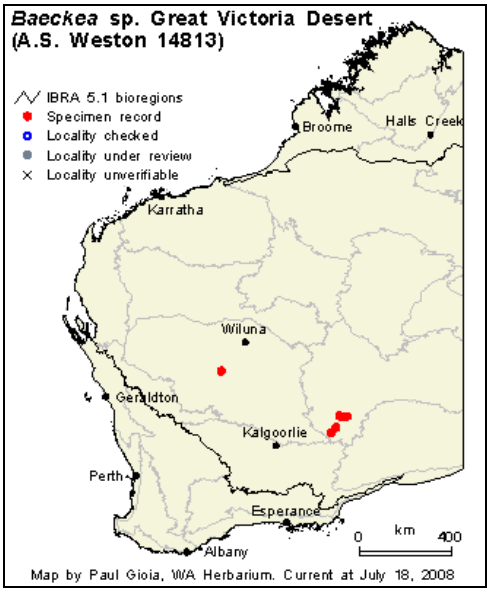
Baeckea sp. Great Victoria Desert is described as a low spreading to upright shrub to one metre. Its stems tend to be sparse with a limited number of small branches present with small leaves occurring in groups along the sides of the stem (Plate 5). The small pink to white flowers are seen between April and June. It can be found on undulating plains and gentle slopes on red sand and yellow sandy loam (DEC, 2008a).

Plate 5: *Baeckea* sp. Great Victoria Desert

(Source: Ecologia)

Florabase has seven records of this species, the first from 1985, sampled as occasional in 1990, common in 2004, over 250 plants in 2006 and most recently collected in 2008. During the survey it was found on slopes and swales in all areas surveyed. Its distribution is shown in Figure 5.

Figure 5: Distribution of *Baeckea* sp. Great Victoria Desert



(Source: Florabase, 2008)

***Dicrastylis nicholasii* (Priority 2)**

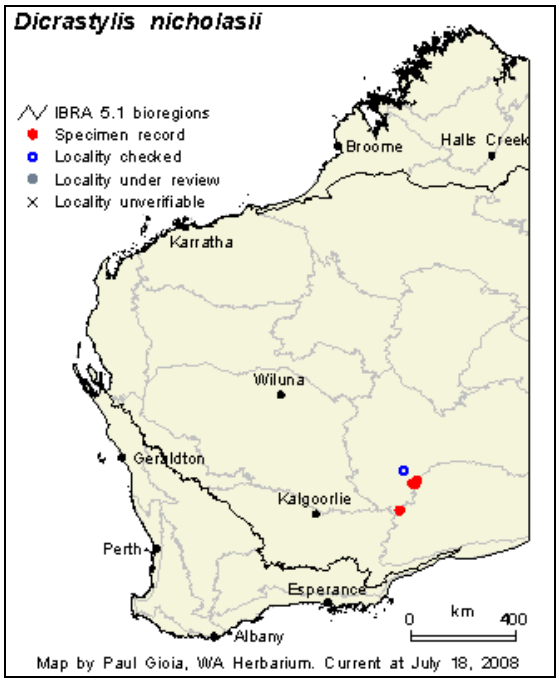
Dicrastylis nicholasii is an erect, woolly shrub which grows to 60 centimetres tall. Its blue flowers occur in groups at the end of branching stems from January and April, but it may flower at other times of the year in response to good rainfall (Plate 6). Its habitat is recorded as red sandy loams (DEC, 2008a).

Plate 6: *Dicrastylis nicholasii*

(Source: Ecologia, 2008)

Florabase has eight records of this species, collected between 1999 and 2006. Populations were recorded as occasional, or two plants being present. Its distribution is shown in Figure 6. Flora surveys for the TGP identified *D. nicholasii* in every area of survey, with the Tropicana population estimated at greater than 5000 plants.

Figure 6: Distribution of *Dicrastylis nicholasii*



(Source: Florabase, 2008)

***Grevillea secunda* (Priority 2)**

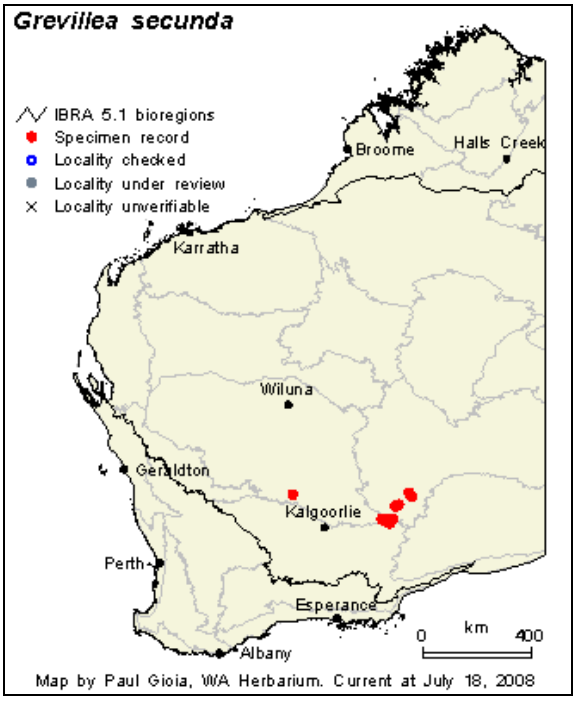
Grevillea secunda is a low spreading shrub, 30 to 80 centimetres tall (Plate 7). It produces red flowers from September to October and has been recorded on yellow or red sands on sand dunes and sandplains amongst medium or low trees (DEC, 2008a).

Plate 7: *Grevillea secunda*

(Source: Ecologia, 2008)

Florabase has 16 records for this species, collected between 1956 and 2006 in abundances ranging from one to 50 plants. Flora surveys for the TGP recorded *G. secunda* in the Operational Area and Access Roads. Its known distribution is shown in Figure 7.

Figure 7: Distribution of *Grevillea secunda*



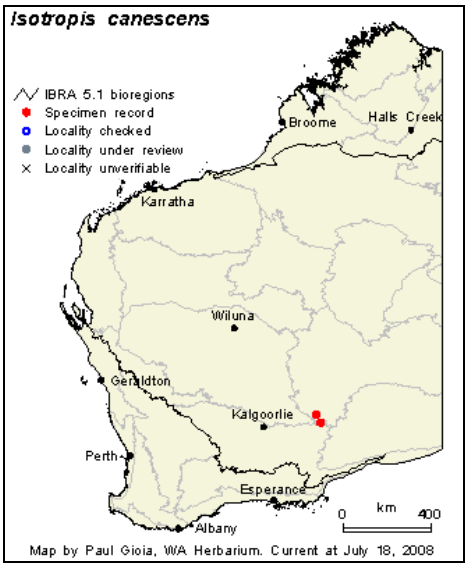
(Source: Florabase, 2008)

***Isotropis* ?*canescens* (Priority 2)**

Isotropis ?*canescens* is a prostrate perennial herb that grows to 30 centimetres. The flowers are yellow or red and are produced in August. This species is found to grow on sandplains of yellow clayey sand. No photograph is available for this species.

Florabase has four records for this species, collected between 1989 and 2004 in abundances varying between occasional and abundant. Its distribution is shown in Figure 8. The TGP surveyed this species once in the TTIC.

Figure 8: Distribution of *Isotropis canescens*



(Source: Florabase, 2008)

***Malleostemon* sp. Officer Basin (Priority 2)**

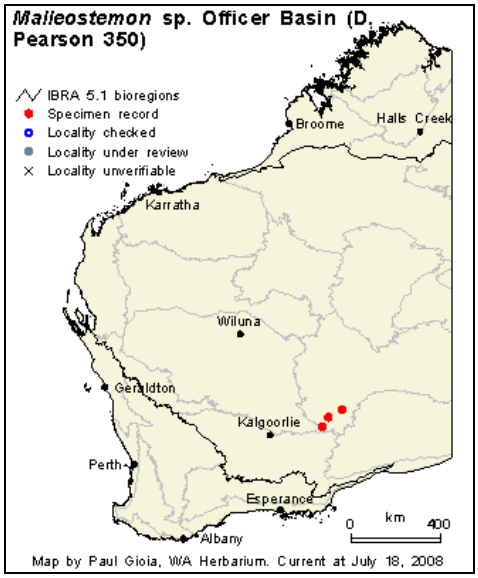
Malleostemon sp. Officer Basin is a shrub species that grows to one metre in height in open vegetation, but possibly up to three metres in tall shrubland. This species has small and almost round leaves that are close to the stem and arranged in overlapping rows (Plate 8). The stems have an open to sparse arrangement. The flowers are white and typically appear in December (DEC, 2008a). This species is found on the crests and upper slopes of sand dunes.

Plate 8: *Malleostemon* sp. Officer Basin

(Source: Ecologia, 2008)

Florabase has four records of this species. Two plants were surveyed in 2006, a population with occasional abundance in 1992, and twice with frequent abundance in 1987. Surveys for the TGP surveyed over 400 plants in the Operational Area and TTIC. Its distribution is shown in Figure 9.

Figure 9: Distribution of *Malleostemon* sp. Officer Basin



(Source: Florabase, 2008)

***Olearia arida* (Priority 2)**

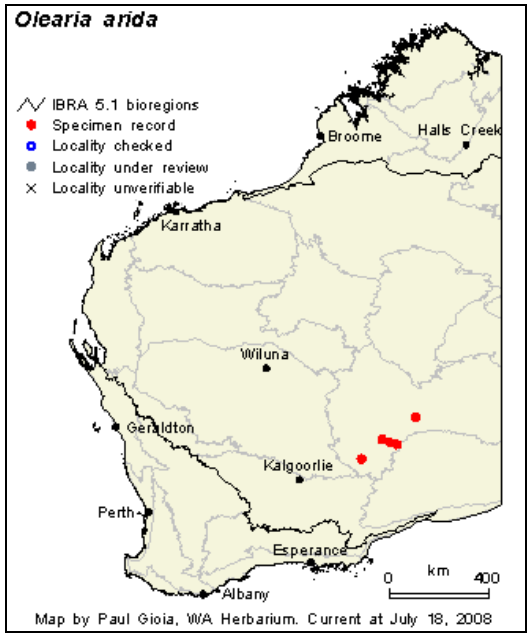
Olearia arida is an erect low shrub to 40 centimetres tall that produces a single white daisy head about two centimetres in diameter at the end of each stem from July to September (Plate 9). It has been recorded as occurring on red or yellow sands on undulating low rises (DEC, 2008a).

Plate 9: *Olearia arida*

(Source: Ecologia, 2008)

Florabase has seven records of this species dating from 1974 to 2006. Its abundance in these collections ranges from ten plants to frequent. Its known distribution is shown in Figure 10. In surveys for the TGP it was present in all survey areas, with at least 87 populations identified.

Figure 10: Distribution of *Olearia arida*



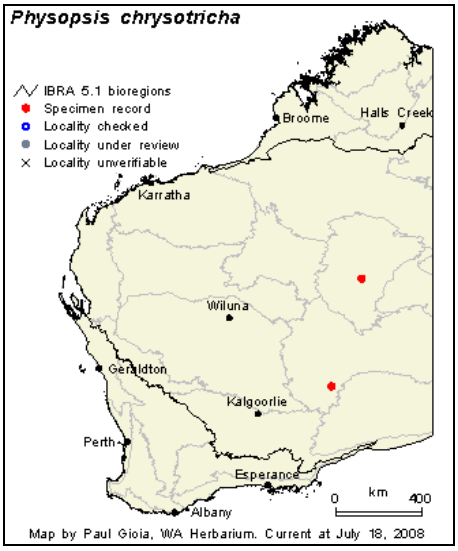
(Source: Florabase, 2008)

***Physopsis chrysotricha* (Priority 2)**

Physopsis chrysotricha is a shrub that produces yellow to white flowers in yellow wool during September. No photograph is available for this species.

Florabase only has two records of this species, collected in 1891 and 2003, with its frequency described as very rare. Its known distribution is shown in Figure 11. It was surveyed three times in the TTIC.

Figure 11: Distribution of *Physopsis chrysotricha*



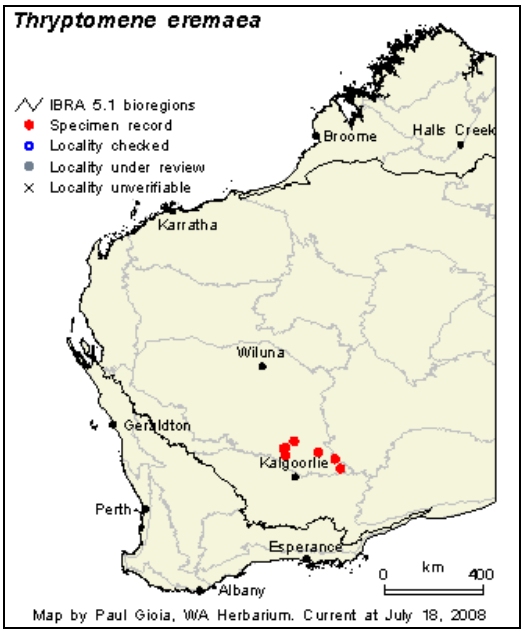
(Source: Florabase, 2008)

***Thryptomene eremaea* (Priority 2)**

Thryptomene eremaea is an erect, open shrub growing to between 50 and 150 centimetres tall. It produces pink or white flowers from July to September. It has been recorded as occurring on red or yellow sand on sandplains (DEC, 2008a).

Thryptomene eremaea has eight records on Florabase between 1916 and 2008. Population sizes vary between occasional, frequent and common. Its distribution is shown in Figure 12. It was surveyed three times for the TGP in the proposed Pinjin Access Corridor.

Figure 12: Distribution of *Thryptomene eremaea*



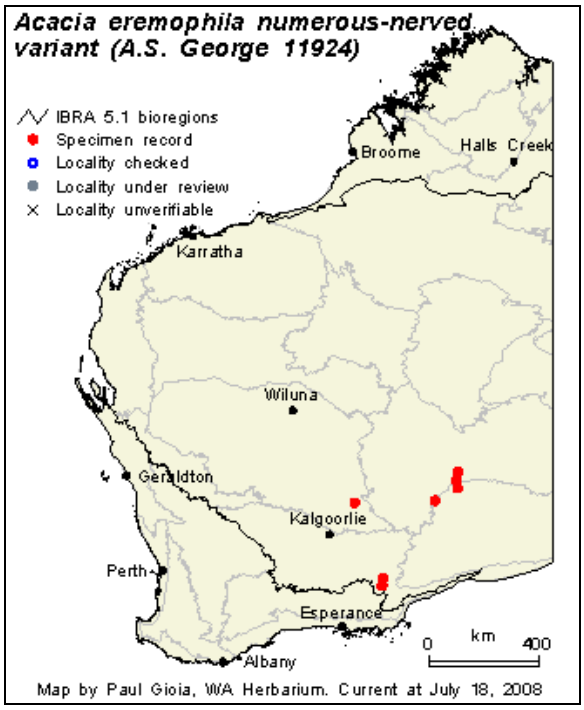
(Source: Florabase, 2008)

***Acacia eremophila* numerous-nerved variant (Priority 3)**

Acacia eremophila numerous-nerved variant is a dense shrub with a rounded crown from one to two metres high. The phyllodes are pale green to bronze green, erect, with brown, slightly hooked tips. The flower heads are mid-golden, with flowering occurring during September. It grows in sandy soil and on flats (DEC, 2008a).

Acacia eremophila numerous-nerved variant has seven collections on Florabase, from 1974 to 1984. Its frequency varies from frequent to patchy, and its known distribution is shown on Figure 13. During flora surveys for the TGP it was surveyed in the Operational Area and Pipeline Corridor.

Figure 13: Distribution of *Acacia eremophila* Numerous-nerved Variant

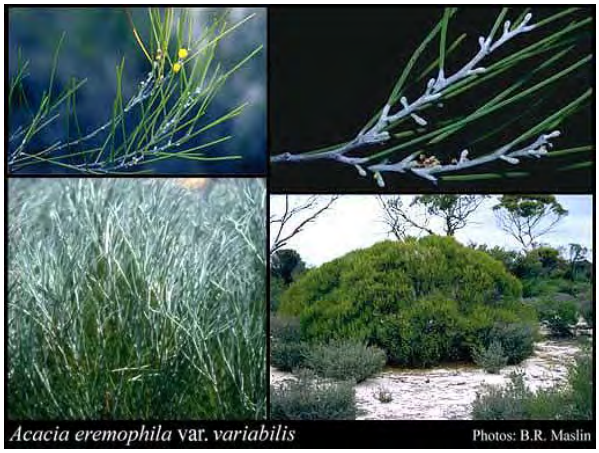


(Source: Florabase, 2008)

***Acacia eremophila* var. *variabilis* (Priority 3)**

Acacia eremophila var. *variabilis* is an upright, rounded shrub up to two metres high and two metres wide. The phyllodes are erect, semi-rigid with the branchlets, pulvinus and peduncles (flower stalk) conspicuously white tomentulose. The flowerheads are golden yellow and cylindrical (DEC, 2008a).

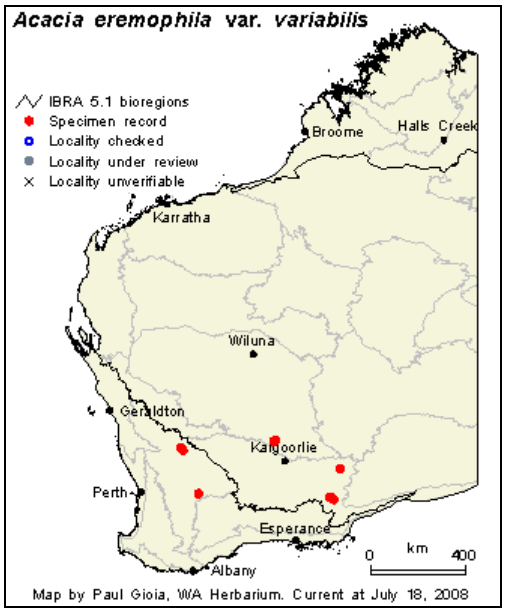
Plate 10: *Acacia eremophila* var. *variabilis*



(Source: Florabase, 2008)

Florabase has 16 records of this species recorded between 1916 and 1998, listed as a few plants and variable frequency. Its known distribution is shown in Figure 14. It was surveyed three times from the Operational Area during flora surveys for the TGP.

Figure 14: Distribution of *Acacia eremophila* var. *variabilis*



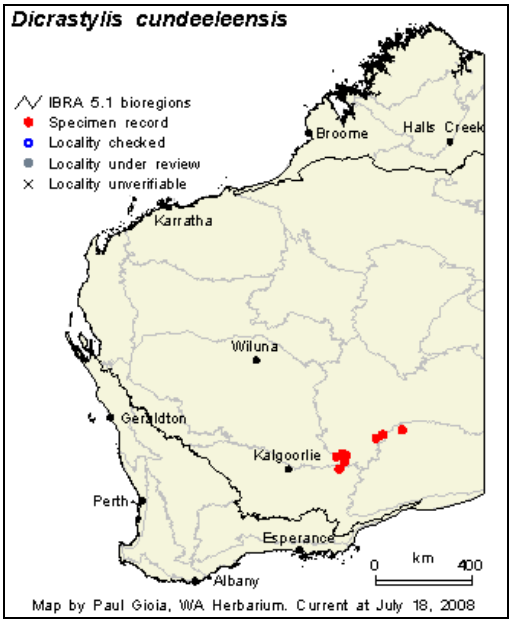
(Source: Florabase, 2008)

***Dicrastylis cundeeleensis* (Priority 3)**

Dicrastylis cundeeleensis has been described as a woolly shrub 20 to 50 centimetres tall that flowers white during April and October to December. It has been recorded as occurring on yellow, red or reddish-yellow sand on sandplains (DEC, 2008a).

Florabase has 11 records of this species, it has been surveyed from 1969 through to 2008, with a frequency ranging between uncommon and very common. Its known distribution is shown in Figure 15. More than 1000 plants were surveyed in the Pinjin Access Route and TTIC and Borefield and Pipeline Area during surveys of for the TGP.

Figure 15: Distribution map of *Dicrastylis cundeeleensis*



(Source: Florabase, 2008)

***Eucalyptus pimpiniana* (Priority 3)**

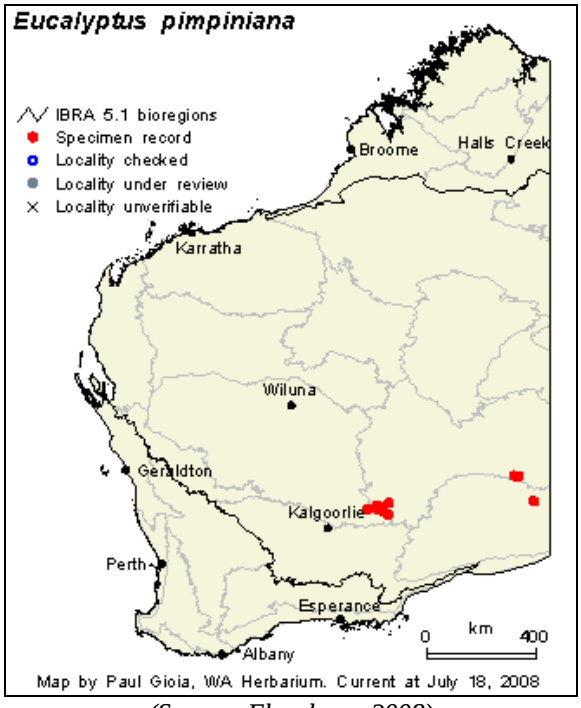
Eucalyptus pimpiniana is described as a straggly, shrubby mallee which grows between 70 and 200 centimetres tall (Plate 11). It has white flowers, which bloom from May to October, and smooth bark. It is recorded as occurring on red sand, on sand dunes and plains (DEC, 2008a).

Plate 11: *Eucalyptus pimpiniana*

(Source: Florabase, 2008)

Eucalyptus pimpiniana has 11 records in Florabase, being surveyed between 1984 and 2008, with populations of between limited distribution and up to 500 plants being recorded. Its known distribution is shown in Figure 16.

Figure 16: Distribution of *Eucalyptus pimpiniana*



(Source: Florabase, 2008)

***Microcorys macredieana* (Priority 3)**

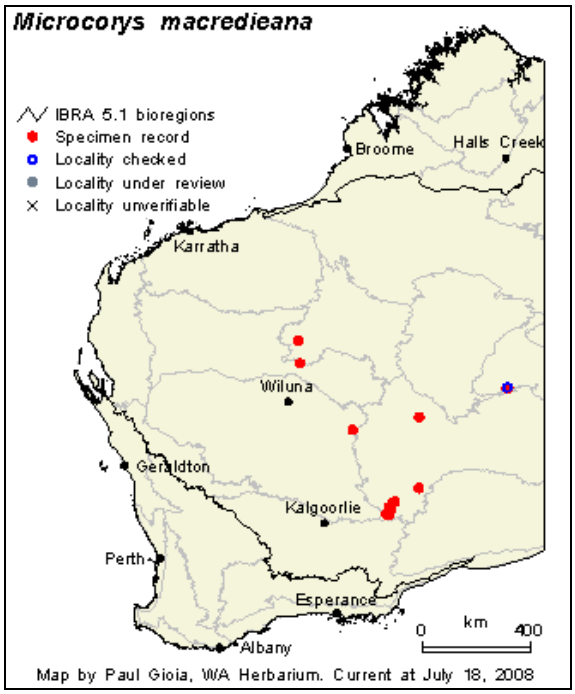
Microcorys macredieana is a wispy, broom-like low shrub from the mint family which grows to between 20 and 150 centimetres tall (Plate 12). It flowers with unevenly shaped white flowers. It occurs on yellow sand on dunes and sandplains and is often found growing in small groups (DEC, 2008a).

Plate 12: *Microcorys macredieana*

(Source: Ecologia)

Florabase has 24 records of this species, from 1987 through to 2008. Population sizes range from common, abundant and frequent to populations of single plants. Its known distribution is shown in Figure 17. Flora surveys of the TGP identified this species in every area surveyed, with over 270 plants in total.

Figure 17: Distribution of *Microcorys macredieana*



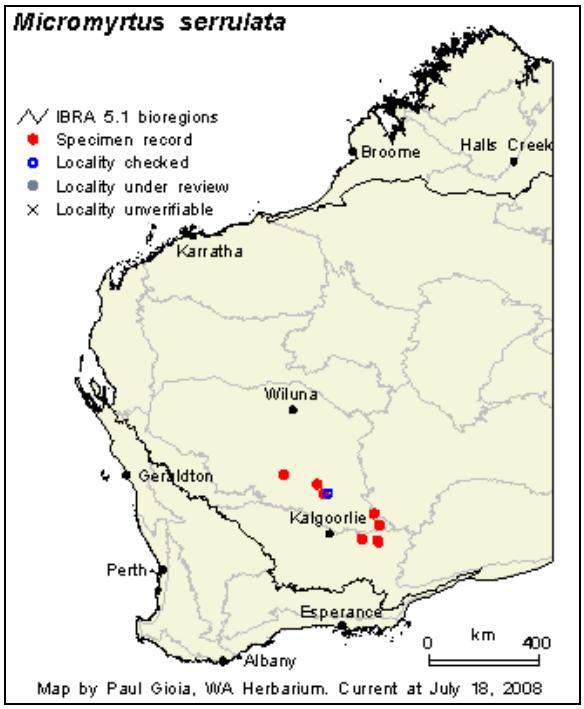
(Source: Florabase, 2008)

***Micromyrtus serrulata* (Priority 3)**

Micromyrtus serrulata is described as an erect or somewhat spreading shrub which grows to between 40 and 150 centimetres tall. It produces white flowers from June to November. Its habitat has been recorded as brownish sandy and clayey soils over granite (DEC, 2008a).

Florabase has 14 records of this species, ranging from 1963 to 2006. *Micromyrtus serrulata* is described as being rare to frequent and even locally dominant. Its known distribution is shown in Figure 18.

Figure 18: Distribution of *Micromyrtus serrulata*



(Source: Florabase, 2008)

***Micromyrtus stenocalyx* (Priority 3)**

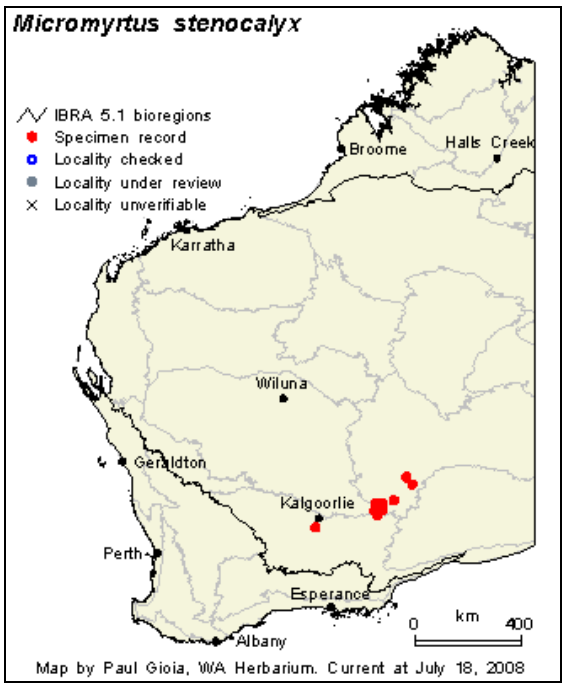
Micromyrtus stenocalyx is a straggly, widely spreading shrub that grows to between 30 and 150 centimetres tall. It produces white flowers in April and from July to December (Plate 13). It is recorded as occurring on yellow or (rarely) red soils on sand dunes and undulating sandplains (DEC, 2008a).

Florabase has 17 records for this species, between 1963 and 2006. Population sizes were described as occasional, with figures of 20 and 50 plants provided. Its known distribution is shown in Figure 19. Over 1400 plants were surveyed in the TGP, from the Operational Area, Pinjin Access Road and TTIC.

Plate 13: *Micromyrtus stenocalyx*

(Source: Ecologia, 2008)

Figure 19: Distribution of *Micromyrtus stenocalyx*



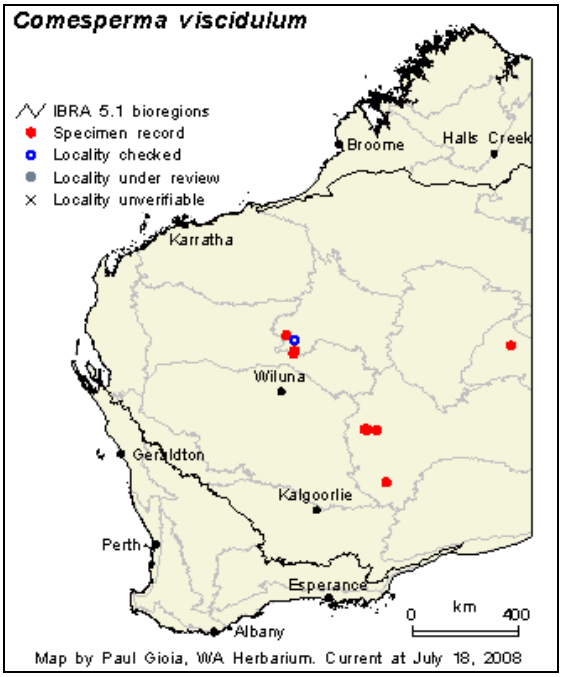
(Source: Florabase, 2008)

***Comesperma viscidulum* (Priority 4)**

This species is a shrub to 70 centimetres tall with cream and purple flowers. It occurs on red or yellow sands on sand dunes and undulating sandplains (DEC, 2008a).

There are nine records for this species on Florabase, ranging from 1998 to 2007, with abundance mostly described as common. Its known distribution is shown in Figure 20. During flora surveys for the TGP it was surveyed in the TTIC and Pinjin Access Route.

Figure 20: Distribution of *Comesperma viscidulum*



(Source: Florabase, 2008)

***Daviesia purpurascens* (Priority 4)**

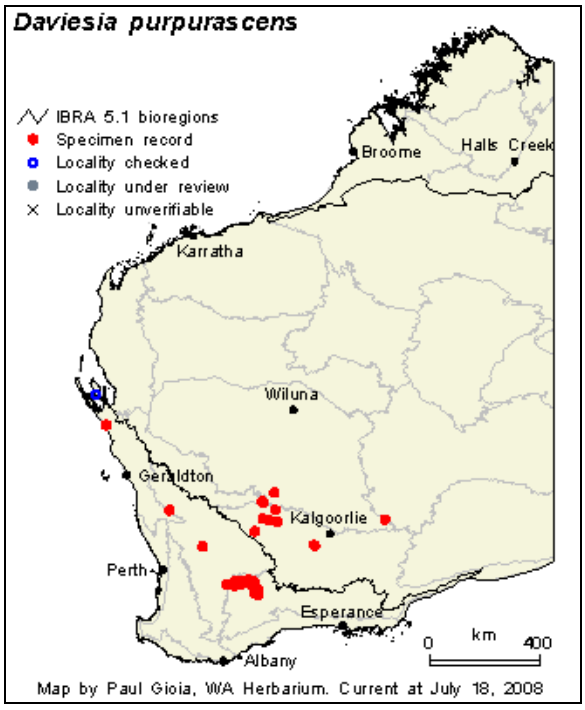
Daviesia purpurascens is an erect shrub to one metre tall that flowers yellow, red and brown during October (Plate 14). It has been recorded as occurring on sandy or loamy soils over laterite on flats and ridges (DEC, 2008a).

Plate 14: *Daviesia purpurascens*

(Source: Florabase, 2008)

Florabase has 51 records for this species, from 1891 to 2008. Abundances range from isolated plants to frequent and common. Its known distribution is shown in Figure 21. It was surveyed in all areas of the TGP with 42 populations totalling over 200 plants.

Figure 21: Distribution of *Daviesia purpurascens*



(Source: Florabase, 2008)

***Lepidobolus deserti* (Priority 4)**

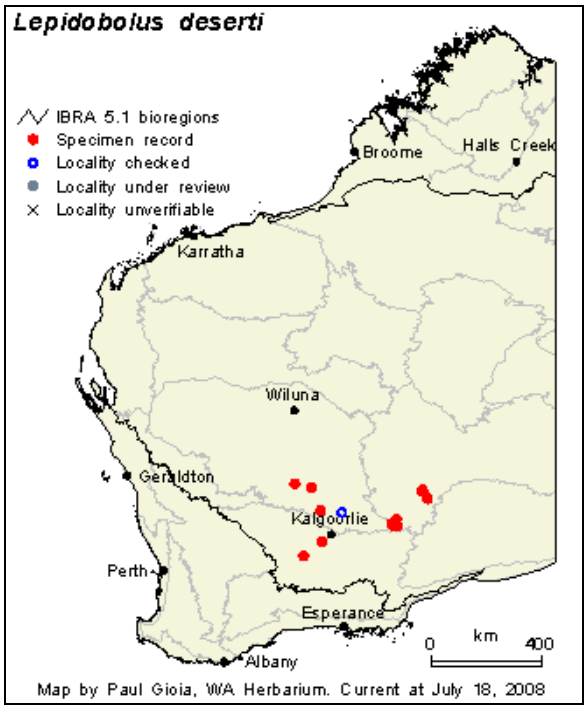
Lepidobolus deserti is a rhizomatous, caespitose, perennial, sedge-like herb which grows between 15 and 45 centimetres tall (Plate 15). It has been recorded as occurring on yellow or orange sand on sand dunes in association with mallee, shrubs and spinifex (DEC, 2008a).

Plate 15: *Lepidobolus deserti*

(Source: Ecologia)

Florabase has 19 records for this species, being surveyed between 1953 and 2007. Abundances ranged from occasional to frequent, with eight to 100 plants quoted in some collections. Its known distribution is shown in Figure 22. In surveys of the TGP it was found in every area surveyed, with an estimated total population of greater than 5000 plants.

Figure 22: Distribution of *Lepidobolus deserti*



(Source: Florabase, 2008)

SIGNIFICANT FAUNA

Southern Marsupial Mole (*Notoryctes typhlops*) - Endangered

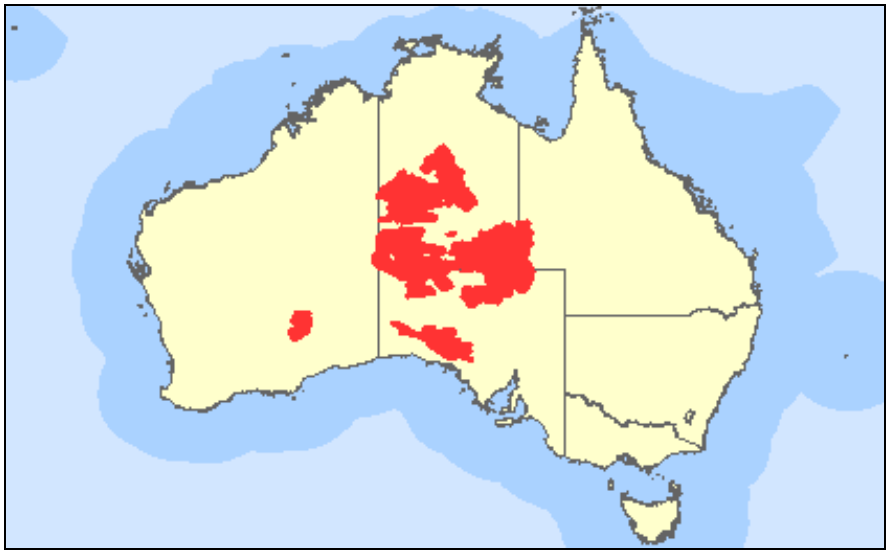
The Southern Marsupial Mole (*Notoryctes typhlops*) is one of Australia's least known mammals as it only rarely ventures to the surface, preferring to remain underground. Best available data indicates that the Southern Marsupial Mole occurs in South Australia, Northern Territory and Western Australia. An accurate assessment of the conservation status of the Southern Marsupial Mole is difficult due to the paucity of information and taxonomic uncertainties (Benshemensh, 2004).

Plate 16: *Notoryctes typhlops*

(Source: NT Government, 2006)

The Southern Marsupial Mole is mostly recorded in sandy dunes with various Acacias and Spinifex. This habitat is widespread and typical of the sandy deserts. They may also occur in sandy plains and sandy river flats where aeolian dunes occur (Benshemensh, 2004). The present day distribution is shown in Figure 23. Total population size is difficult to estimate.

Figure 23: Present Distribution of the Southern Marsupial Mole (DEWHA, 2008)



(Source: DEWHA, 2008)

Sandhill Dunnart (*Sminthopsis psammophila*) - Endangered

The Sandhill Dunnart (*Sminthopsis psammophila*) is a small marsupial that inhabits the arid zone (Plate 17). It is classified as Endangered under the *EPBC Act* and is on Schedule 1 of the *WC Act*. As one of the largest of the *Sminthopsis* genus, ranging from 30 to 55 grams, they are primarily insectivorous and are known from under 100 specimens since being described in 1894. They are generally found amongst sandy dunes of deep yellow, occasionally orange, sands with a healthy coverage of Spinifex hummocks (Churchill, 2001b).

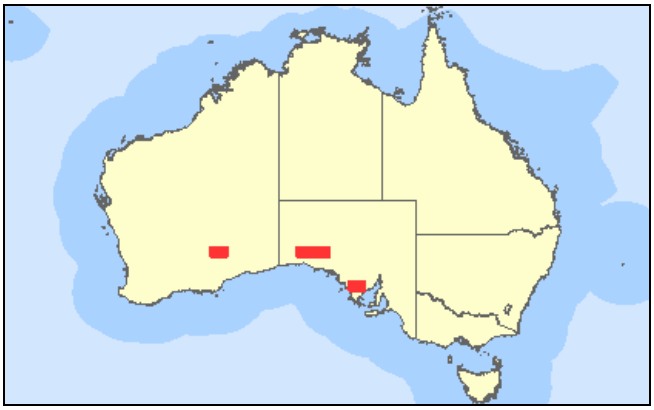
Plate 17: *Sminthopsis psammophila*

(Source: Gaikhorst & Lambert, 2008)

Sandhill Dunnarts have been recorded in the Northern Territory, South Australia and Western Australia, but have not been observed in the Northern Territory since its initial discovery. The species was thought to be extinct until 1969, when five animals were discovered in South Australia. It was also discovered in Western Australia in 1985 when 10 animals were captured at two sites near Queen Victoria Springs. Since then, animals have only been caught in South Australia and Western Australia.

The species is now only known from a small location in the Great Victoria Desert region of Western Australia and two areas in South Australia (Figure 24). In Western Australia Sandhill Dunnarts have been captured in Queen Victoria Springs, (Pearson and Robinson, 1990) and near Mulga Rock in the Great Victoria Desert (Hart and Kitchener, 1986).

Figure 24: Present Distribution of the Sandhill Dunnart (DEWHA, 2008)



(Source: DEWHA, 2008)

The major threats to the Sandhill Dunnart are the increased frequency and extent of wildfires as Spinifex of between eight and 38 years is a critical habitat requirement. Fire also fragments populations and makes recolonisation of suitable areas difficult (Gaikhorst & Lambert, 2008). Like many native fauna in the arid zone of Australia, population size and distribution fluctuate according to availability of resources. The present population size of the Sandhill Dunnart is unknown. Sandhill Dunnarts may migrate into the Project Area following suitable climatic conditions.

Mulgara - Vulnerable, Schedule 1

The Mulgara, listed as Vulnerable under the *EPBC Act* and Schedule 1 under the *WC Act*, is a small marsupial which varies between 125 and 170 millimetres in length. They are light sandy colour on top with grey underneath, and have reddish hairs on their tails, becoming black towards the end, with a fattened tail base. They inhabit sandy regions, living in burrow complexes dug into flat areas between sand dunes. They are not strictly nocturnal and feed on insects, arthropods and small vertebrates. They breed between May and June and have up to eight young between July and December. They are relatively long lived, with captive studies indicating over six years. In the wild, trapping results have indicated their numbers fluctuate significantly from year to year (Woolly, 1995).

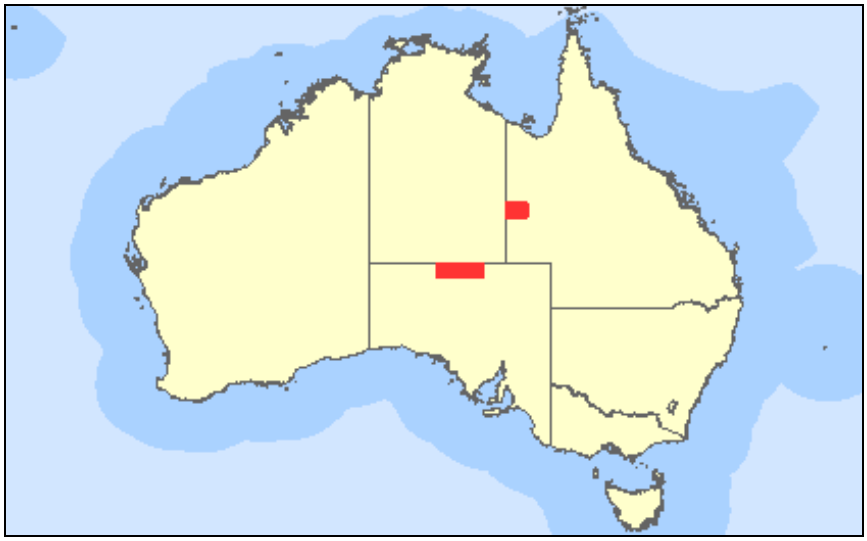
Plate 18: *Dasycercus Cristicauda*

(Source: Faunabase, 2008)

Habitats known to support Mulgara generally have a spinifex cover of between 10 to 60 percent with a preference for species such as *Triodia basedowii*, which forms neat clumps which enable the Mulgara to move freely around them (Ecologia, 2007c).

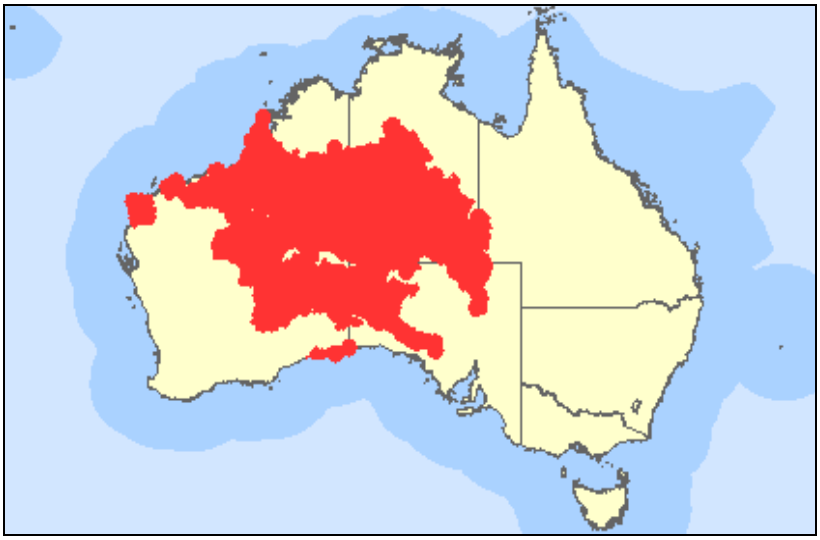
The Mulgara genus was recently split into two species, *Dasycercus. cristicauda* (Crest-tailed Mulgara, Plate 18) and *D. hillieri*, which was subsequently replaced by *D. blythi* (Brush-tailed Mulgara or Ampurta). Because most previous records did not distinguish among the two species of Mulgara now recognised, there is ambiguity about the distribution of both species although *D. cristicauda* is now presumed extinct in Western Australia. *D. blythi* (*D. hillieri)* is listed as Priority 4 (*WC Act 1950*) and its estimated distribution is shown in Figure 25. *D. cristicauda* is listed as Vulnerable (*EPBC Act, 1999)* and Priority 1 (*WCAct, 1950*) and its estimated distribution is shown in Figure 26.

Figure 25: Present Distribution of *D. hillieri (D. blythi)*



(Source: DEWHA, 2008)

Figure 26: Present Distribution of *D. Cristicauda* (DEWHA, 2008)



(Source: DEWHA, 2008)

Malleefowl (*Leipoa ocellata*) - Vulnerable, Schedule 1

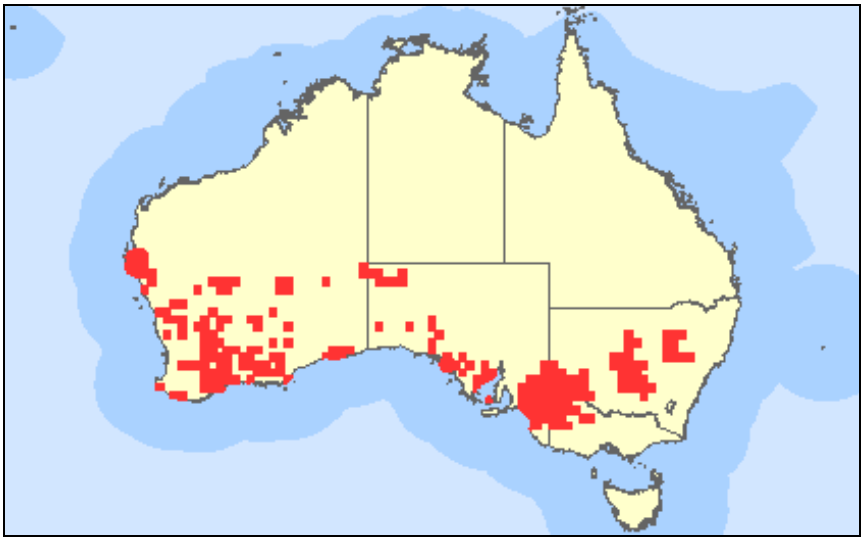
The Malleefowl (*Leipoa ocellata*) belongs to the family Megapodiidae, or mound builders, and is unique among birds as it uses external sources of heat to incubate its eggs. Adult and chick Malleefowl are shown in Plate 19. Listed as Vulnerable under the *EPBC Act* and on Schedule 1 of the *WC Act 1950*, the Malleefowl is found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. A sandy substrate and abundance of leaf litter are required for nest building and breeding. Densities of the birds are generally greatest in areas of higher rainfall and on more fertile soils where habitats tend to be thicker and there is an abundance of food plants (DEC, 2008b).

Plate 19: Malleefowl

(Source: Faunabase, 2008)

Much of the best Malleefowl habitat has been cleared or modified by grazing of sheep, cattle, rabbits and goats. Fire also has a devastating effect and breeding in burnt areas is usually reduced for at least 30 years. Predation by foxes is another threat to Malleefowl and may be a major cause of decline (Benshemesh, 2000). The present day distribution of Malleefowl is provided in Figure 27. The total population size is estimated at 100,000 breeding birds in 100 populations (estimate of low reliability) with populations known to be declining (Garnet & Crowley, 2000).

Figure 27: Malleefowl Present Distribution Map (courtesy of DEWHA)



(Source: DEWHA, 2008)

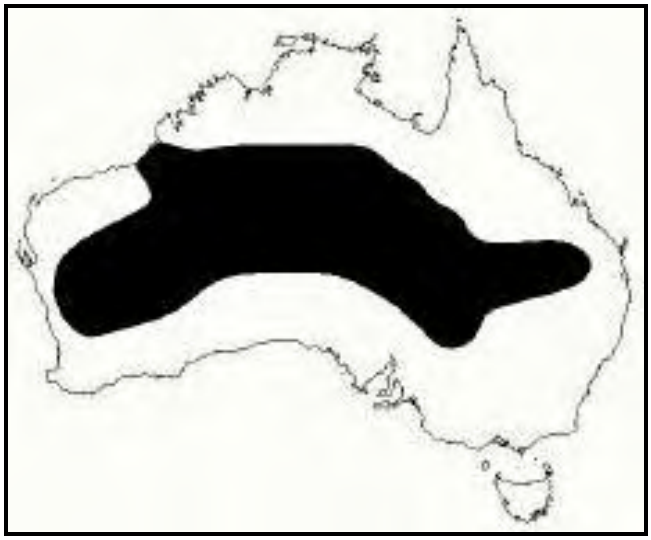
Woma Python - Endangered, Schedule 4 (Other specially protected fauna)
A medium sized python of up to 2.7 metres, the Woma Python has a narrow head compared to other pythons. It is usually banded as show in Plate 20.

Plate 20: Woma Python (*Aspidites ramsayi*)

(Source: DEC, n.d.)

Although it is widely distributed through the arid zones of Western Australia, there are few records in the south of its range from recent years. Threats are listed as clearing and fox predation. It is listed as Endangered by the IUCN and Schedule 4 by DEC.

Figure 28: Distribution of the Woma Python



(Source: DEC, n.d.)

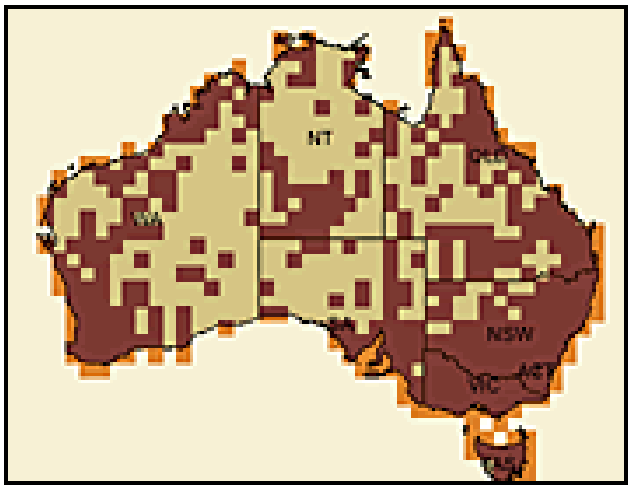
Peregrine Falcon (*Falco peregrinus*) - Other specially protected fauna

The Peregrine Falcon (*Falco peregrinus)* (Plate 21) utilises a variety of habitats from woodlands to open grasslands and coastal cliffs, but is seen less frequently in deserts. It has a widespread distribution, as shown on Figure 29. Its diet comprises birds, rabbits, bats and reptiles. The Peregrine Falcon is threatened by habitat loss and was impacted by DDT in the 1960's and 1970's (EPBC, 2009). It is listed by the DEC as 'Other specially protected fauna.'

Plate 21: Peregrine Falcon (*Falco peregrinus*)

(Source: Backyard Birds, 2009)

Figure 29: Present Distribution of the Peregrine Falcon

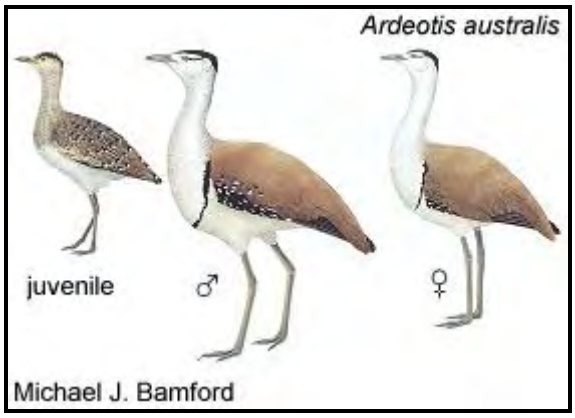


(Source: Backyard Birds, 2009)

Australian Bustard (*Ardeotis australis*) – Priority 4

The Australian Bustard (*Ardeotis australis*) is a large ground dwelling bird which grows to between 75 and 150 centimetres (Plate 22). It has a stately erect posture, with a long neck, legs, and a heavy body (Slater et al, 1986).

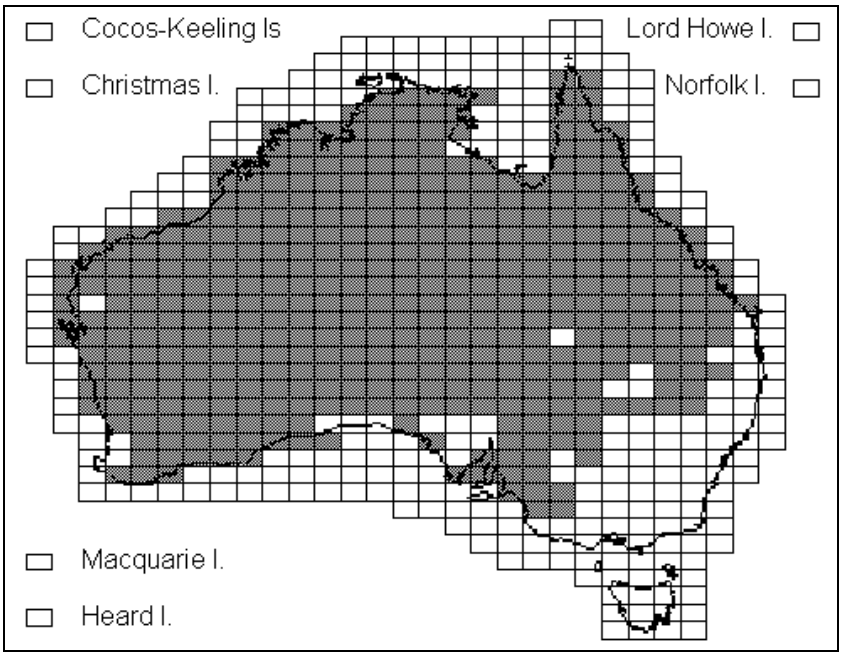
Plate 22: Australian Bustard (*Ardeotis australis*)



(Source: Faunabase, 2008)

It occurs in open plain grasslands, light scrubland and woodlands of inland Australia (Pizzey 1991). Its main threats are loss of habitat through clearing and cultivation, predation, shooting, poisoning and competition from stock. It has a broad distribution covering much of Australia, as show in Figure 30. Population size is estimated at less than 100,000 birds and decreasing (Garnett & Crowley, 2000).

Figure 30: Present Distribution of the Australian Bustard

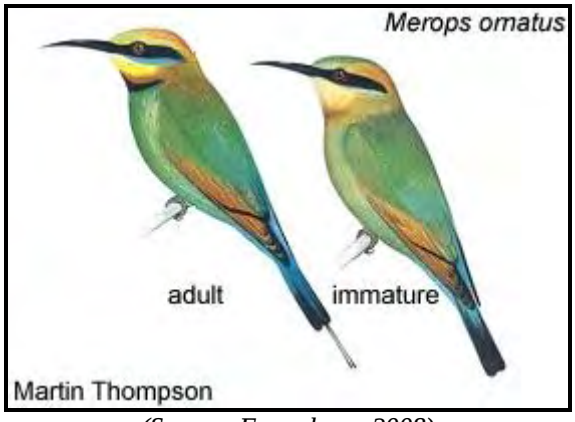


(Source: Garnett & Crowley, 2000)

Rainbow Bee-eater (*Merops ornatus*) - Migratory

The Rainbow Bee-eater (*Merops ornatus*) is a colourful blue, green and orange bee-eater with extended shafts through its central tail feathers (Plate 23). It is a small bird, growing to 23 centimetres. The Rainbow Bee-eater is well distributed throughout Western Australia, living almost anywhere suitable for hawking insects and is not protected under state legislation. Within Western Australia, it occurs in the better watered parts of the State, between the Kimberley and south-west, preferring lightly wooded, preferably sandy country near water (Johnstone and Storr, 1998).

Plate 23: Rainbow Bee-eater (*Merops ornatus*)

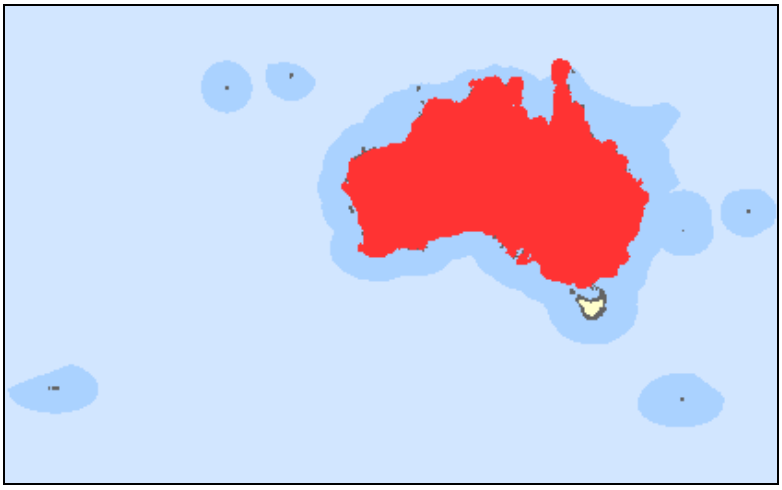


(Source: Faunabase, 2008)

This species is listed as migratory under the *EPBC Act*. It migrates between Australia and Japan, and is common from September to April in woodland and timbered plains throughout Australia. It breeds in New Guinea and Australia, requiring a long tunnel in a sand bank to nest (Slater et al., 1986).

It has a distribution covering all States within mainland Australia as shown in Figure 31. Population size is estimated to be reasonably large based on reporting rates for the species, with Birds Australia receiving over 300,000 records since 1998 (DEWHA, 2008).

Figure 31: Present Distribution of the Rainbow Bee-eater



(Source: DEWHA, 2008)

Wood Sandpiper (*Tringa glareola*) - Marine, Migratory, CAMBA, JAMBA, ROKAMBA
The Wood Sandpiper is a grey-brown bird with spots and notching on its wing feathers and a whitish underside (Pizzey & Knight, 1980). Its habitat is described as shallow fresh waters, with likely areas being muddy margins of wetlands, tidal mangroves, salt marshes, margins of mudflats and sewage ponds.

Plate 24: Wood Sandpiper (*Tringa glareola*)

(Source: Australian Museum, 2009)

This species is listed as migratory under the *EPBC Act*, and listed under CAMBA, JAMBA, ROKAMBA. It breeds in Eurasia to Siberia, visiting Australia as a summer migrant from September to April, and is described as uncommon in Southern Australia (Pizzey & Knight, 1980).

Figure 32: Known Distribution of the Wood Sandpiper

(Source: Birds Australia, 2009)

Common Greenshank (*Tringa nebularia*) - Marine, Migratory, CAMBA, JAMBA, ROKAMBA

The Common Greenshank is a large warder with a nervous disposition. Its plumage is grey to dark brown with white notched black feathers. Its preferred habitat is coastal regions, but will move inland where suitable conditions exist; suitable habitat includes mudflats, estuaries, wetlands, claypans, sewage ponds (Pizzey & Knight, 1980).

Plate 25: Common Greenshank (*Tringa nebularia*)

(Source: K Vang and W Dabrowka [Bird Explorers], 2009)

This species is listed as migratory under the *EPBC Act*, and listed under CAMBA, JAMBA, ROKAMBA. Its breeding range extends from Scotland to Siberia, migrating to Australia for the summer, extending from September to April (Pizzey & Knight, 1980).

Figure 33: Known Distribution of the Common Greenshank

(Source: Birds Australia, 2009)

Crested Bellbird (*Oreoica gutturalis*) - Least Concern

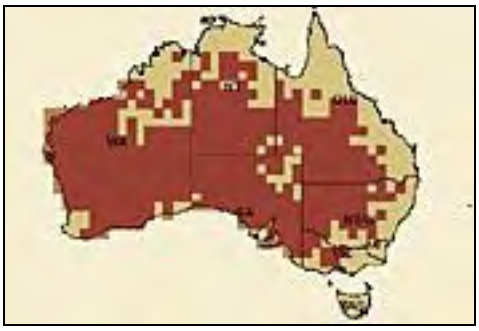
The Crested Bellbird is a small, brown bird. The males have a white forehead and throat, and the females do not have any white, and are browner with a yellow eye. Their habitat is described as arid scrublands, including mulga, acacias and saltbush and Eucalypt woodlands. It is described as sedentary and locally nomadic (Pizzey & Knight, 1980).

Plate 26: Crested Bellbird

(Source: Australian Museum, 2009)

The southern subspecies (*Oreoica gutturalis gutturalis*) is listed by the DEC as Priority 4, and the EPBC Act as Near Threatened, as it has declined from over 50 percent of its former range.

Figure 34: Known Distribution of the Crested Bellbird



(Source: Birds Australia, 2009)

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APPENDIX 2:
RISK ASSESSMENT MATRICES

Impact:	**DISTURBANCE**						
Definition:	Clearing of land for road construction and mining operations; the alteration of natural drainage systems; noise and vibration from machinery/operations.						
Conservation Significant Species	INHERANT RISK			Management and Mitigation	RESIDUAL RISK		
	Loss of Individuals	Loss of Habitat and Habitat Degradation	Fragmentation, reduced genetic distribution		Loss of Individuals	Loss of Habitat and Habitat Degradation	Fragmentation, reduced genetic variability
Southern Marsupial Mole	B3 - H	B3 - H	D3 - M	• Design roads and other infrastructure to minimise disturbance to known significant habitats, including potential PEC. • Disturbance to native vegetation will be minimised where possible and all areas requiring clearing will be clearly delineated. • Remnant patches of long unburnt vegetation deemed important as habitat for Sandhill Dunnart and Mulgara will be avoided where possible. • Critical habitats like dune systems suitable for Sandhill Dunnart, Marsupial Mole and Mulgara will be avoided. • Known locations of Malleefowl nests/mounds and mulga habitat will be avoided. • Known locations of Bustard nests will be avoided. • Adequate site storm water management and drainage along roads will be implemented. • Site inductions will include information about conservation significant flora, vegetation, fauna and habitat to ensure staff are aware of the potential impacts associated with activities on these species.	E3 - M	E2 - L	E2 - L
Sandhill Dunnart	D5 - E	D4 - H	D4 - H		E4 - M	E3 - M	E3 - M
Mulgara	C3 - H	C3 - H	D3 - M		D3 - M	C2 - M	D2 - L
Malleefowl	D4- H	C3 - H	D4 - H		D3 - M	D2 - L	D3 - M
Australian Bustard	B3 - H	B2 - H	B2 - H		C2 - M	C2 - M	E2 - L
Peregrine Falcon	E2 - L	E2 - L	E2 - L		E2 - L	E2 - L	E2 - L
Woma Python	E2 - L	E2 - L	E2 - L		E2 - L	E2 - L	E2 - L
Fork-tailed Swift	E2 - L	E2 - L	E2 - L		E2 - L	E2 - L	E2 - L
Rainbow Bee-eater	E2 - L	E2 - L	E2 - L		E2 - L	E2 - L	E2 - L
Wood Sandpiper	E2 - L	E2 - L	E2 - L		E2 - L	E2 - L	E2 - L
Common Greenshank	E2 - L	E2 - L	E2 - L		E2 - L	E2 - L	E2 - L
Crested Bellbird	B3 - H	B2 - H	B2 - H		E2 - L	E2 - L	E2 - L
Priority Ecological Community	N/A	B4 - E	B4 - E		N/A	C2 - M	D2 - L

Note: Priority Flora are assessed for impacts associated with disturbance in the main body of this report.

Impact:	**FIRE (anthropogenic)**				
Definition:	Activities associated with TGP may result in an increased likelihood of accidental fire.				
Conservation Significant Species	INHERANT RISK		Management and Mitigation	RESIDUAL RISK	
	Loss of Individuals	Habitat Loss and Degradation		Loss of Individuals	Habitat Loss and Degradation
Southern Marsupial Mole	D3 - M	D3 - M	• A fire management plan will be developed to minimise the risk of fire resulting from TGP activities. This plan will address: – Fire control with a specific focus on containing the spread of fires that may occur in the Operational Area. – Emergency response protocol. – Identification of fire sensitive vegetation and protection of these units. Fire sensitive vegetation will be clearly identified on all emergency response maps to prevent inadvertent impacts during fire emergency. – Regional fire control. • Work presenting a fire risk will not be conducted on days deemed to have a high fire risk (e.g. - high winds, high temperatures). • Clearing and construction activities will take place during periods of low fire risk (i.e. - April to September).	E2 - L	E2 - L
Sandhill Dunnart	D3 - M	D4 - H		E3 - M	E3 - M
Mulgara	D3 - M	D3 - M		D2 - L	D2 - L
Malleefowl	D3 -M	C3 - H		E3 - M	D3 - M
Australian Bustard	D3 - M	C2 - M		D2 - L	D2 - L
Peregrine Falcon	E2 - L	E2 - L		E2 - L	E2 - L
Woma Python	E2 - L	E2 - L		E2 - L	E2 - L
Fork-tailed Swift	E2 - L	E2 - L		E2 - L	E2 - L
Rainbow Bee-eater	E2 - L	E2 - L		E2 - L	E2 - L
Wood Sandpiper	E2 - L	E2 - L		E2 - L	E2 - L
Common Greenshank	E2 - L	E2 - L		E2 - L	E2 - L
Crested Bellbird	D3 - M	C2 - M		E2 - L	E2 - L
Priority Ecological Community	N/A	B3 - H		N/A	D3 - M
Conospernum toddii Status	C3 - H	C3 - H		E3 -M	E3- M
Priority Flora Species Status	C3 - H	C3 - H		D2 - L	D2 - L

Impact:	**INTRODUCED PLANTS**				
Definition:	The introduction of machinery, commencement of earthworks and general disturbance in the area, increased traffic flows, and increased population in the area all have the potential to introduce weeds into the area.				
Conservation Significant Species	INHERANT RISK		Management and Mitigation	RESIDUAL RISK	
	Competition	Habitat Degradation		Competition	Habitat Degradation, including altered fire regimes
Southern Marsupial Mole	N/A	E2 - L	• Strict vehicle hygiene practices will be adopted, with all machinery, vehicles and plant to be free of soil and vegetative matter upon arrival on site. • Work in known week infested areas will be undertaken separately to work in pristine areas. This relates mainly to work in the Pinjin area. Any vehicles moving between the Pinjin area and other areas during clearing and construction will be thoroughly cleaned of soil and vegetation matter. • The existing TGP weed management plan will be implemented during the design, operation and closure/rehabilitation phases. • Clearing and construction activities will be undertaken during dryer periods. • Any fill used for construction purposes will be taken from a known clean source. • Staff will be educated on weed management practices, particularly vehicle hygiene procedures.	N/A	E2 - L
Sandhill Dunnart	N/A	D2 - L		N/A	E2 - L
Mulgara	N/A	C2 - M		N/A	D2 - L
Malleefowl	N/A	D2 - L		N/A	E2 - L
Australian Bustard	N/A	D2 - L		N/A	E2 - L
Peregrine Falcon	N/A	D2 - L		N/A	E2 - L
Woma Python	N/A	D2 - L		N/A	E2 - L
Fork-tailed Swift	N/A	D2 - L		N/A	E2 - L
Rainbow Bee-eater	N/A	D2 - L		N/A	E2 - L
Wood Sandpiper	N/A	D2 - L		N/A	E2 - L
Common Greenshank	N/A	D2 - L		N/A	D2 - L
Crested Bellbird	N/A	D2 - L		N/A	D2 - L
Priority Ecological Community	N/A	D3 - M		N/A	E2 - L
Conospernum toddii	D3 - M	D3 - M		E2 - L	E2 - L
Priority Flora Species	C3 - H	C3 - H		D2 - L	D2 - L

Impact:	**INTRODUCED FAUNA**						
Definition:	Feral animals encouraged onto the site by human activity have the potential to impact threatened species.						
Conservation Significant Species	INHERANT RISK			Management and Mitigation	RESIDUAL RISK		
	Habitat Degradation	Direct Predation	Competition		Habitat Degradation	Direct Predation	Competition
Southern Marsupial Mole	E2 - L	B3 - H	NA	• No pets allowed on site. • Domestic waste management to be implemented. • Management of water storage facilities. • Introduced fauna control programme to be developed to protect known individuals and populations of threatened species in the area. • A 'Pro-baiting' scheme may be devised after consultation with the DEC. • Assist in eradication programs with statutory authorities to remove foxes, cats, rabbits and dogs.	E2 - L	D2 - L	NA
Sandhill Dunnart	C2 - M	C3 - H	D2 - M		D2 - L	D2 - L	D2 - L
Mulgara	C2 - M	C3 - H	D2 - M		D2 - L	D2 - L	D2 - L
Malleefowl	D2 - M	D4 - H	NA		D2 - L	C2 - M	N/A
Australian Bustard	E2 - L	C2 - M	NA		E2 - L	D2 - L	N/A
Peregrine Falcon	E2 - L	C2 - M	NA		E2 - L	D2 -L	N/A
Woma Python	E2 - L	C2 - M	NA		E2 - L	D2 -L	N/A
Fork-tailed Swift	E2 - L	E2 - L	NA		E2 - L	E2 - L	N/A
Rainbow Bee-eater	E2 - L	C2 - M	NA		E2 - L	D2 - L	N/A
Wood Sandpiper	E2 - L	C2 - M	NA		E2 - L	D2 - L	N/A
Common Greenshank	E2 - L	C2 - M	NA		E2 - L	D2 - L	NA
Crested Bellbird	E2 - L	C2 - M	NA		E2 - L	D2 - L	NA
Priority Ecological Community	C3 - H	N/A	N/A		D2 - L	D2 - L	N/A
Conospernum toddii	C3 - H	C3 - H	N/A		D3 - M	D3 - M	N/A
Priority Flora Species	C3 - H	C3 - H	N/A		D3 - M	D3 - M	N/A

Impact:	**DUST**				
Definition:	Increased dust will be generated through earthworks for the road and mine, and through general mining operations.				
Conservation Significant Species	INHERANT RISK		Management and Mitigation	RESIDUAL RISK	
	Plant Deaths	Altered Habitat		Plant Deaths	Altered Habitat
Southern Marsupial Mole	N/A	N/A	• Infrastructure will be designed and located to avoid all known locations of *Conospermum toddii* to minimise impacts of dust generation from disturbed areas. • Internal site roads will be treated for dust suppression at a rate that reduces and minimises dust generation. • Appropriate speed limits will be enforced in known or potential threatened species habitat areas to minimise dust generation from vehicle movement. • Total disturbance at any one time will be minimised to reduce areas potentially producing windblown dust. • Land clearing and growth medium stripping will be undertaken under appropriate weather conditions to limit growth medium loss (i.e. - low winds).	N/A	N/A
Sandhill Dunnart	N/A	D2 - L		N/A	E2 - L
Mulgara	N/A	D2 - L		N/A	E2 - L
Malleefowl	N/A	D2 - L		N/A	E2 - L
Australian Bustard	N/A	D2 - L		N/A	E2 - L
Peregrine Falcon	N/A	D2 - L		N/A	E2 - L
Woma Python	N/A	D2 - L		N/A	E2 - L
Fork-tailed Swift	N/A	D2 - L		N/A	E2 - L
Rainbow Bee-eater	N/A	E2 - L		N/A	E2 - L
Wood Sandpiper	N/A	E2 - L		N/A	E2 - L
Common Greenshank	N/A	E2 - L		N/A	E2 - L
Crested Bellbird	N/A	E2 - L		N/A	E2 - L
Priority Ecological Community	C2 - M	C2 - M		D2 - L	D2 - L
Conospernum toddii	C2 - M	C2 - M		D2 - L	D2 - L
Priority Flora Species	C2 - M	C2 - M		D2 - L	D2 - L

Impact:	**VEHICLES**		
Definition:	The implementation of a mining operation and access road will increase traffic flows in the area.		
Conservation Significant Species	INHERANT RISK Loss or injury of Individuals	Management and Mitigation	RESIDUAL RISK Loss or injury of individuals
Southern Marsupial Mole*	D2 - L	• Infrastructure Corridors (including access roads) will be designed to avoid cutting through critical habitats to reduce potential vehicle interaction with protected fauna. • The number and length of roads constructed will be minimised, their location will avoid bisecting critical habitats, thereby reducing fauna crossings and potential collision with vehicles. • Appropriate speed limits will be enforced on all roads in the TGP area. • Appropriate signage will be erected warning drivers of potential fauna in the area. • Any fauna killed by vehicle collision will be reported to site environmental personnel to be recorded. Specimens may need forwarding to the WA Museum. • Care will be taken when undertaking drilling activities near potential Marsupial Mole habitats. • Borrow pits will be located a suitable distance from the road to limit potential interaction between animals and vehicles. • Adequate site storm water management and drainage along roads will be implemented to minimise ponding of water near roads, thereby minimising attraction of species to roadways.	E2 - L
Sandhill Dunnart†	D2 - L		E2 - L
Mulgara	D2 - L		E2 - L
Malleefowl	B3 - H		C2 - M
Australian Bustard	B2 - H		C2 - M
Peregrine Falcon	D2 - L		E2 - L
Fork-tailed Swift	D2 - L		E2 - L
Woma Python	C2 - M		E2 - L
Rainbow Bee-eater	D2 - L		E2 - L
Wood Sandpiper	D2 - L		E2 - L
Common Greenshank	D2 - L		E2 - L
Crested Bellbird	C2 - M		E2 - L
Priority Ecological Community	N/A		N/A
Conospernum toddii	N/A	• Not applicable.	N/A
Priority Flora Species	N/A		N/A

Impact:	**WASTE AND CONTAMINATION**				
Definition:	The creation of a camp on the site will increase amounts of alien material, including organic material and potentially hazardous material, which will be disposed of in a domestic waste dump.				
Threatened Species	INHERANT RISK		Management and Mitigation	RESIDUAL RISK	
	Injury and Illness to Individuals	Groundwater, Surface water and Habitat Contamination		Injury and Illness to Individuals	Groundwater, Surface water and Habitat Contamination
Southern Marsupial Mole*	D2 - L	D2 - L	• Implementation of strict domestic waste management practices, including disposal of domestic waste in a licensed facility to prevent seed invasion from food waste products, contamination and attraction of feral and native fauna species. • Managing domestic waste sites according to relevant landfill regulations and best practice guidelines. • Regular inspection of waste facilities for trapped fauna. • Restricting access to water storage areas either by installing suitable barriers. • Maintaining cyanide levels below that which may kill fauna (Tropicana JV are signatories to the International Cyanide Management Code).	D2 - L	D2 - L
Sandhill Dunnart	D2 - L	D2 - L		D2 - L	D2 - L
Mulgara	D2 - L	D2 - L		D2 - L	D2 - L
Malleefowl	D2 - L	D3 - M		E2 - L	D2 - L
Australian Bustard	D2 - L	D2 - L		D2 - L	D2 - L
Peregrine Falcon	D2 - L	D2 - L		D2 - L	D2 - L
Woma Python	D2 - L	D2 - L		D2 - L	D2 - L
Fork-tailed Swift	D2 - L	D2 - L		D2 - L	D2 - L
Rainbow Bee-eater	E2 -L	E2 - L		E2 -L	E2 - L
Priority Ecological Community	D2 - L	D2 - L		D2 - L	D2 - L
Wood Sandpiper	D2 - L	D2 - L		D2 - L	D2 - L
Common Greenshank	D2 - L	D2 - L		D2 - L	D2 - L
Crested Bellbird	D2 - L	D2 - L		D2 - L	D2 - L
Conospernum toddii	N/A	D2 - L		N/A	D2 - L
Priority Flora Species	N/A	D2 - L		N/A	D2 - L