AngloGold Ashanti Australia

Independence Group NL

Tropicana Gold Project

Environmental Scoping Document

March 2009

360 environmental

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Executive Summary

The Tropicana Joint Venture (TJV) is composed of AngloGold Ashanti Australia Limited and Independence Group NL. The TJV proposes to develop an open-cut gold mine, together with associated infrastructure including a project water supply and mine access road. The mine will extract and process gold bearing ore from the Tropicana and Havana deposits. The TJVs mining tenements are located on the western edge of the Great Victoria Desert, 330 km east-northeast of Kalgoorlie in Western Australia. The proposed mine and associated infrastructure are referred to collectively as the Tropicana Gold Project (TGP). 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, one is no longer considered suitable; and
- Mine Access Road and Infrastructure Corridors - Two options are under consideration.

The TGP has been referred to the Environmental Protection Authority of Western Australia and the Commonwealth Department of the Environment, Water, Heritage and the Arts for formal assessment. The level of assessment set under the *Environmental Protection Act 1986* for the project is a Public Environmental Review (PER) with an eight week public comment period. This document provides the scope of work to describe the proposed TGP, its perceived environmental risk factors and the studies proposed to enable the projects' formal assessment. A PER level of assessment is suitable to enable Commonwealth assessment under the *Environment Protection and Biodiversity Conservation Act 1999* via the Bilateral Agreement between the State and Commonwealth Governments.

The TJV, in consultation with various stakeholders and the TGPs Peer Review Panel, has adopted a risk-based approach to identifying potential environmental impacts. The five key environmental factors identified for the TGP are:

- Probable emissions (particularly greenhouse) and other potential discharges;
- Impact of improved infrastructure and access into a remote area;
- Probable loss of, or disturbance to, threatened species;
- Impact of clearing and ground disturbance; and
- Possible damage to ecosystem functionality (terrestrial and/ or subterranean).

The remoteness of the TGP and lack of detailed environmental survey for the area (and much of its surrounds) has necessitated an extensive series of environmental surveys, which commenced in 2006. These surveys have been designed to describe the regional environmental setting of the TGP and to investigate the potential impacts of the five key environmental factors identified above. The results of environmental surveys and further details of environmental risk management for the TGP will be provided in the PER document. The TJV anticipates that the PER documentation will be available to the public in May 2009.

Glossary of Terms and Abbreviations

AGAA – AngloGold Ashanti Australia
AHD – Australian Height Datum
BOM – Bureau of Meteorology
CIL – Carbon in Leach
CN_{WAD} – Cyanide Weak Acid Dissociable (measure of ecologically important cyanide)
DEC – Department of Environment and Conservation (Western Australia)
DEWHA – Department of Environment, Water, Heritage and Arts (Commonwealth)
EIA – Environmental Impact Assessment
EPA – Environment Protection Authority (Western Australia)
EP Act – *Environmental Protection Act 1986*
EPBC Act – *Environment Protection and Biodiversity Conservation Act 1999* (Commonweath)
ESD – Environmental Scoping Document
GVD – Great Victoria Desert
IGO – Independence Group NL
LNG – Liquid Natural Gas
MCC – Motor Control Centre
Mine Access Road – two routes are currently under consideration to provide an access road to the Operational Area (Cable Haul and Pinjin)
Operational Area – consists of the proposed open pits, ore/ gold processing infrastructure, aerodrome, village and other buildings necessary for the functioning of the TGP
PEC – Priority Ecological Community
PER – Public Environmental Review
Resource Area – the physical surface directly above the identified mineralisation at the Tropicana and Havana deposits
ROM – Run of Mine
SHD – Sandhill Dunnart
SMM – Southern Marsupial Mole
TGP – Tropicana Gold Project
TJV – Joint Venture (AGAA 70% and Manager; IGO 30%)
TSF – Tailings Storage Facility
Water Supply Area – two areas have been considered to identify a suitable and sustainable aquifer to supply the Operational Area (Minigwal Trough and Officer Basin Water Supply Areas). The Officer Basin Water Supply Area is no longer considered to be a viable option.
WC Act – *Wildlife Conservation Act 1950* (State)
WRL – Waste Rock Landform

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1. INTRODUCTION

1.1. BACKGROUND

360 Environmental Pty Ltd (360 Environmental) was commissioned by the Tropicana Joint Venture (TJV), between AngloGold Ashanti Australia Limited (AGAA; 70% and manager) and Independence Group NL (IGO; 30%), to prepare an Environmental Scoping Document (ESD) for mining activities and associated infrastructure for the proposed Tropicana Gold Project (TGP). The TGP is located approximately 330 km east-northeast of Kalgoorlie in Western Australia (Figure 1).

This ESD is for gold mining activities and associated infrastructure including:

- Operational Area – A proposed gold mine including the pit (or pits), waste landforms, stockpiles, tailings storage facility, processing plant, water storage dams, power station, internal roads, administration block/s, aerodrome, village and other supporting infrastructure;
- Water Supply Area – Two options have been considered, the Minigwal Trough and the Officer Basin Water Supply Areas (the Minigwal Trough is the preferred option). Note that the Officer Basin formation underlies both potential Water Supply Areas; and,
- Mine Access Road and Infrastructure Corridor – Two options are under consideration, the Pinjin and Cable Haul Options. The Pinjin Option is the preferred option for the Mine Access Road. A communications corridor is also likely to be required to connect the Operational Area to existing national and global communications infrastructure. The preferred communication technology is optic fibre which will require the installation of a buried cable and a maintenance track.

The TJV holds exploration and mining tenements that cover approximately 12,500 km² across a linear distance of 330 km on the western edge of the Great Victoria Desert (GVD) biogeographic region. The TJV commenced exploration drilling in the area in 2002. Gold mineralisation has been identified over a strike length of approximately four kilometers with two areas of significant mineralisation, termed the Tropicana and Havana deposits (the Resource Area), which form the basis of the proposed TGP. It is currently proposed that the TGP would operate for approximately 10 - 15 years to realize the potential of the resource and that full development of the TGP could result in the clearing of between 3,500 - 4,000 ha of vegetation, depending on the power source that is selected for the Operational Area. Baseline environmental studies for the TGP commenced in 2006 and are nearing completion.

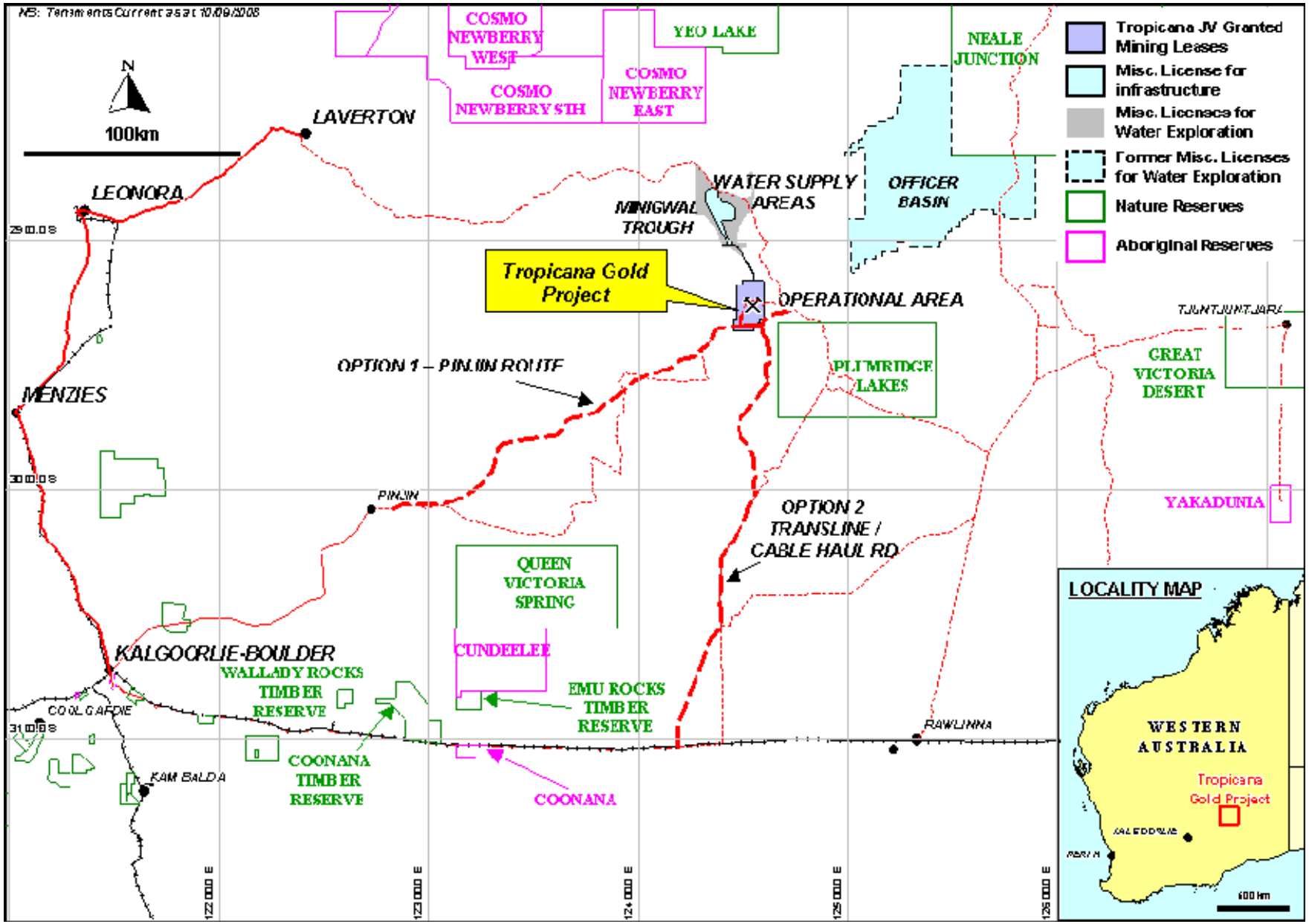

Figure 1: Tropicana Gold Project - Location of the proposed Operational Area, Mine Access Road Options and Water Supply Area Options

1.2. PURPOSE

This ESD describes the major aspects associated with the TGP, outlines current knowledge of the existing environment and identifies the steps that the TJV is undertaking to provide Western Australia's Environmental Protection Authority (EPA), the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) and other stakeholders with sufficient information to undertake a formal Environmental Impact Assessment (EIA).

A referral document was prepared in accordance with Section 38 of the *Environmental Protection Act 1986* (EP Act) and submitted to the EPA (30/05/08). The EPA determined that a formal EIA should be carried out via a Public Environmental Review (PER) level of assessment with an eight week public comment period. No appeals were received on the level of assessment.

Additionally, the TJV referred the TGP to DEWHA as a potential Controlled Action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; 09/06/08). DEWHA confirmed that the TGP does constitute a Controlled Action and that Commonwealth assessment of the TGP will occur via the Bilateral Agreement between Western Australia and the Commonwealth. It is anticipated that the final PER documentation will be submitted to the EPA in early 2009, with the assessment complete by early 2010.

This document has been prepared in accordance with Section 6.1 of the EPAs *Environmental Assessment (Part IV Division 1) Administrative Procedures 2002*, which outlines the requirements for an ESD where the level of assessment has been set at a PER. It also meets the requirements of the EPBC Act in providing Terms of Reference for Commonwealth environmental assessment.

The purpose of this document is to:

- Provide a description of the proposed TGP;
- Outline legislation and guidelines relevant to the TGP;
- Summarize knowledge of the regional setting of the TGP that existed prior to the TJVs activities in the area;
- Outline the TJVs stakeholder / partner engagement program.
- Outline the TGP-specific environmental risk assessment process;
- Present environmental factors considered relevant to the proposal and to describe options considered during the project design phase; and
- Present an outline of environmental studies that will be completed for the PER.

1.3. PROPONENT

AGAA is the 70% stakeholder in the TJV and the Manager of the TGP. AGAA is a wholly owned subsidiary of AngloGold Ashanti Limited, an international gold producer with 21 projects located on four continents. AGAA wholly owns and operates the Sunrise Dam Gold Mine and is a 33% owner of the Boddington Gold Mine (Newmont 67%). An expansion of the

Boddington Gold Mine is currently under construction; previous operations at Boddington ceased in 2001.

IGO is the 30% stakeholder in the TJV. IGO is an ASX listed, Perth-based nickel and gold exploration and mining company involved in several joint venture operations and is owner-operator of the Long Nickel Mine in Kambalda, WA.

The key contact for this proposal is Belinda Bastow, Environmental Manager – Exploration / Tropicana

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2. PROJECT OVERVIEW

2.1. SUMMARY DESCRIPTION OF PROPOSAL

The proposed TGP aims to establish an open-cut gold mine, processing plant and associated infrastructure located approximately 330 km east-northeast of Kalgoorlie and 230 km east of Laverton (Figure 1). The key statistics of the estimated resource and life of mine requirements are shown in Table 1.

Table 1: Estimated Project Statistics.

Project Component	Characteristics
Current Resource:	
• Resource tonnes	62.8 Mt
• Resource grade	2.01 g/t
• Estimated gold resource	4.05 Moz
Proposed utilization of resource:	
• Construction period	24 to 28 months, commencing 2010
• Mining rate (ore and waste)	Up to 65 Mtpa
• Stripping ratio	8:1
• Open pit void/s	400 ha
• Pit depth	350 m
• Overburden Volume	720 Mt
• Processing Rate	Up to 7 Mtpa
Life of Mine:	
• Project Life	~ 10 - 15 years
• Maximum Area of Disturbance	Approximately 4,000 ha
• Total Area of Rehabilitation	Maximum of approximately 3,600 ha (excluding the open pit void/s)

The TGP will result in the clearing of up to 3,500 - 4,000 ha, depending on the power source that is selected for the Operational area. A breakdown of the estimated disturbance area per

activity is shown in Table 2. The infrastructure of the proposed TGP will be located on the tenements listed in Table 3. A conceptual layout of the Operational Area is shown in Figure 2, including alternate options for the placement of infrastructure such as the village and tailings storage facility. Alternate placements are discussed further in Section 7. The main aspects of the mining operation are described in further detail below.

Table 2: Estimated Maximum Disturbance Area for Activities Associated with the Tropicana Gold Project.

Activity	Area (ha)
Waste Dump / Low Grade Stockpile / Run of Mine Pad	1,290
Mining Area	400
Tailing Storage Facility and Pipeline Corridor	365
Plant, Power Station, Workshop, Offices, Water Dams	200
Internal roads	100
Village & Sewage Ponds	15
Quarry & Borrow Pits	70
Aerodrome	50
Mine Access Road (& Public Bypass)	500
Power supply (Diesel, Solar Thermal or Gas pipeline)[1]	600
Production Bores / Water Supply Corridor	200
Communication Corridor	150
Disturbance Estimate - Total	3,940 ha

1: This clearing will only occur if these options are determined to be viable.

Table 3: Mining and Miscellaneous Licenses for the Proposed Tropicana Gold Project.

Infrastructure Corridor Options				
Option 1 - Pinjin Option[1]		L31/56	L31/57	L39/185
Option 2 - Cable Haul Option[2]				L39/186
Operational Area				
M39/978	M39/979	M39/980		M39/981
M39/982	M39/983	M39/984		M39/985
M39/986	M39/987	M39/988		M39/1010
M39/1011	M39/1012	M39/1013		M39/1014
M39/1015	M39/1016	M39/1017		M39/1018
M39/1019	M39/1020	M39/1021		M39/1028
M39/1029	M39/1030	M39/1048		M39/1049
M39/1050	M39/1051	M39/1052		L39/172
Water Supply Area				
Minigwal[3] Trough	L38/150	L38/113	L38/114	L39/178

1: The Pinjin Route is the preferred road route to the Operational Area.
2: The Cable Haul Option is an alternate access route but may be used as communications corridor.
3: Note that the Minigwal Trough and Officer Basin were identified in the EP Act and EPBC Act referral documents as potential water supply areas. The Officer Basin is no longer considered a viable option, due to increased pumping distances and clearing impacts in comparison to the Minigwal Trough.

The layout of the site and selection of the mining fleet, crushing and processing options have been designed to balance energy efficiencies (e.g., minimize transport distances between pit and crusher) and environmental sensitivities (e.g., location of Declared Rare Flora) whilst leaving opportunities for future expansions to the pit should they become economically viable (e.g., not putting the waste dumps right on the edge of the pit/s).

2.2. MINING METHODOLOGY

The mining method selected for use at the TGP is open pit mining with conventional drill and blast techniques and a typical mining fleet (trucks, shovels, excavators etc.). The mining fleet will include ancillary equipment (e.g., dozers, graders, service trucks and water trucks) necessary to construct and maintain the pit, haul roads, Run of Mine (ROM) pad, waste dump and the tailings storage facility (TSF). Ore extraction for the TGP will occur from a series of open pit voids, which may coalesce into a single large pit over the course of the TGPs operational phase. Vegetation and growth mediums (such as topsoil / sand) will be removed prior to mining activities progressively over the life of the mine.

Depending on economic conditions and the actual depth / volume of ore beneath the resources identified to date, there may be potential for underground mining to proceed in the future. Underground mining is outside the scope of the TGP as described in this ESD.

2.3. PROCESSING

The processing plant consists of two stage crushing, high pressure grinding roll (HPGR), communition circuit and carbon-in-leach (CIL) circuit. If practicable, direct dumping will be used to feed the primary crusher to minimize ore rehandling on the ROM pad. The processing plant has been designed to maximize process efficiencies and reduce energy consumption (e.g., HPGR inclusion in the circuit to maximize power consumption efficiencies). The proposed crushing and processing steps for gold production are summarized in Figure 3.

The selected TSF is likely to be located adjacent to the waste dumps (Figure 2). The TSF will be monitored for levels of Weak Acid Dissociable Cyanide (CN_{WAD}) to ensure that wildlife is protected. A cyanide management plan will be developed in consultation with relevant regulators and will meet the requirements of the International Cyanide Management Code (ICMC), of which AGAA is a signatory. The preferred management option is to actively control cyanide levels at the CIL circuit to maintain residual CN_{WAD} in tailings bleed water at an acceptable level (in accordance with the requirements of the ICMC). However, should monitoring in the first year of operation demonstrate that this is not possible, then an alternative method will be evaluated and implemented to meet the required standards. Alternatives include dilution, supernatant treatment or partial tailings treatment.

The TSF has been designed to contain a 1 in 100 year, 72-hour rainfall event (approximately 150 mm).

Figure 2: Current Preferred and Alternate Options Considered for the Operational Area Site Layout with Environmental Constraints.

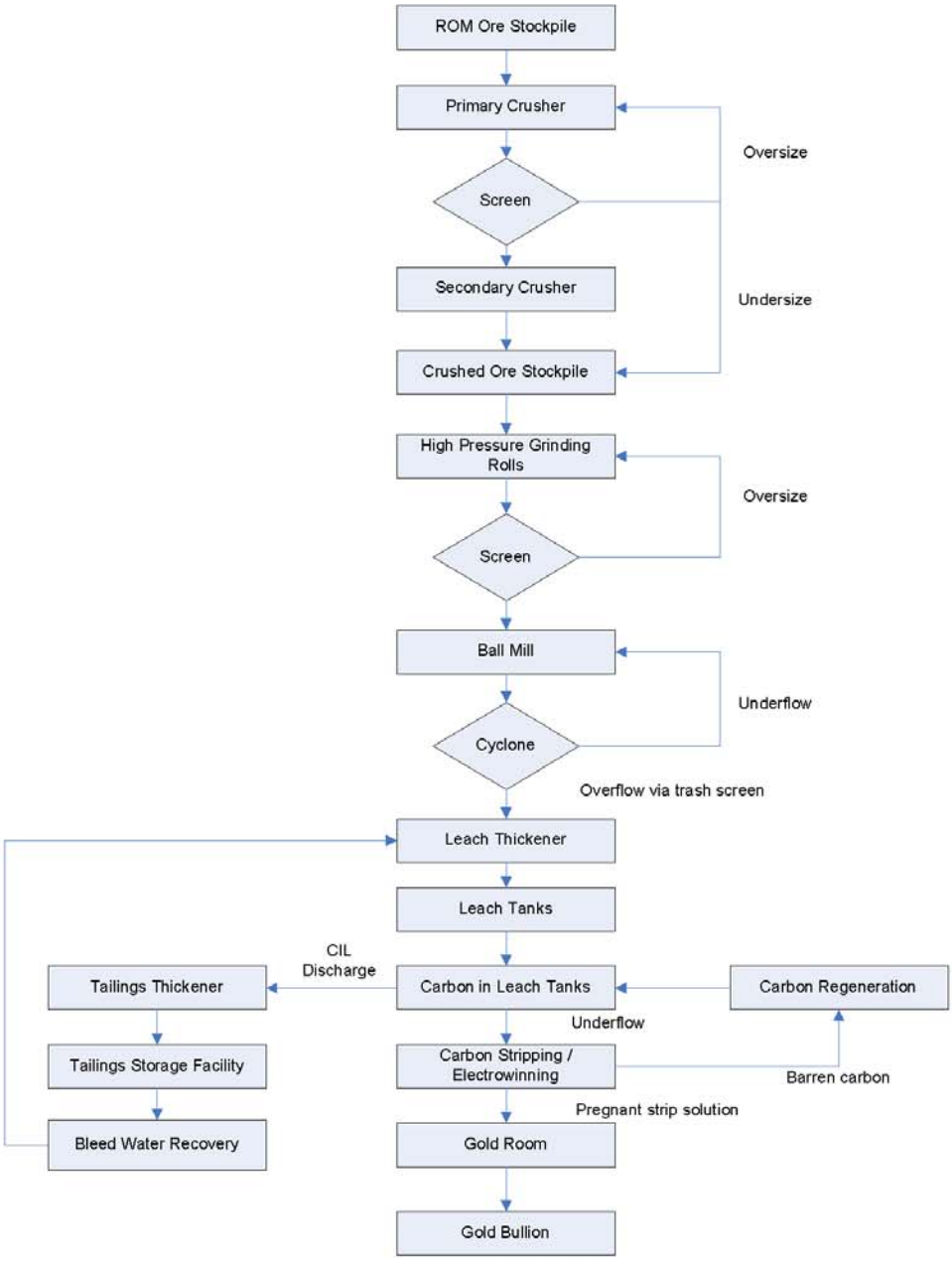

Figure 3: Processing Flow Chart - Extracted Ore to Gold Bullion.

2.4. POWER STATION AND FUEL SELECTION

An onsite power station with a power generation capacity of up to 50 MW will be required. Fuel sources being considered include solar thermal, diesel, natural gas or liquid natural gas (LNG) or a combination. Depending on the fuel source the TGP may require diesel fuel storage with a capacity of up to 4 ML, and / or an onsite LNG storage facility with a capacity of approximately 1400 m^3 and / or installation of up to 400 km of gas pipeline. If a diesel powered station is selected the storage facility could be shared with the bulk fuel storage facility required at the mine services area. The TJV is investigating the potential installation of a Solar Thermal Power Station at the Operational Area to supply a significant proportion of the project's base-load power requirements. This would cut emissions considerably in comparison to a traditional diesel plant. Stand-alone Solar Thermal Power Stations are relatively new technology and would require a back-up option, which may be powered by diesel. Even with the diesel back-up, a Thermal Solar Power Station would result in a significant reduction of the TGPs emissions. An alternative to onsite power generation is access to grid power via a power line from Kalgoorlie to TGP. This would require installation of approximately 400 km of power lines.

Liquidified petroleum gas will be used as the fuel source for the elution heaters, carbon regeneration kiln and furnace necessary for gold processing.

Evaluation of renewable energy options such as photovoltaic solar panels and wind energy will be considered for non-baseload requirements (e.g., pumps along the pipeline to the borefield) where practicable.

2.5. INTERNAL ROADS AND VILLAGE

Internal roads at the Operational Area will be linked to the Mine Access Road (section 2.9) and Public Bypass Road via a substantial gravel road. The Public Bypass Road will be located 10 km south of the Operational Area. The main road access to the Operational Area will be located on the western side of the pit/s, and direct traffic to the administration area (Figure 2). New gravel roads will be constructed to service the aerodrome, accommodation village, mining areas, borefields etc. Parking facilities will also be incorporated into the layout (such as at the administration area, village workshop etc.).

The village will be sited approximately 4 km northwest of the processing plant (Figure 2) with rooms for up to 700 persons during the operational phase of the TGP. It is envisaged that there will be approximately 300 personnel on site on a typical day during the operational phase. Additional accommodation may be required for construction peaks and for the overlap between the construction, commissioning and operational phases.

Environmental initiatives being considered for the village include:

- Grey water recycling to support a limited quantity of landscaping;
- All buildings being constructed to the Building Code of Australia standard 1B with a minimum five star energy efficiency rating; and
- Renewable energy will be included where practical.

Sewage from the plant ablutions administration buildings and accommodation village will be processed through a packaged sewage treatment plant. Reuse options for treated water will be investigated.

2.6. AERODROME

An aerodrome will be constructed to accommodate commercial aircraft up to the standard of a BAE-146 eighty seat jet aircraft. The current preferred site of the aerodrome will be north of the processing plant. However, due to the fact that exploration drilling is ongoing the site may change based on these results. The location of the aerodrome may also need to be relocated if the TJV proceeds with a Solar Thermal Power Station, as the aerodrome area is the most suitable location. If the currently proposed location is not suitable, either the existing gravel strip on the eastern side of the project will be upgraded or an alternative will be required. Associated buildings/ infrastructure including a check-in building with a covered outdoor area and fuel storage facility will be required at the aerodrome.

2.7. ANCILLARY BUILDINGS

A range of buildings will be constructed for administration, maintenance, storage and workforce amenities. The buildings will generally be transportables or steel framed and panel clad structures. Motor Control Centres (MCCs) will be steel, fire proof buildings complete with fire protection measures, pressurisation and air conditioning. Buildings will include:

- Ablutions buildings;
- Administration;
- Analytical laboratory;
- CIL area MCC room;
- Combined workshop/ warehouse;
- Crib rooms;
- Crusher control room;
- Crushing area MCC room;
- Gatehouse;
- HPGR area MCC;
- Milling area MCC room;
- Plant control room;
- Reagent storage facilities; and
- Screening area MCC room.

2.8. WATER REQUIREMENTS, SOURCE, STORAGE AND DEWATERING

At the time the TGP was referred to the EPA and DEWHA for formal assessment, the TJV was evaluating two potential water options (Figure 1). The Officer Basin Water Supply Area is no longer considered a viable option due to its increased distance from the Operational Area. Raw water for the Operational Area will be sourced from the Minigwal Trough located approximately 50 km northwest of the Operational Area (Figure 1). The Water Supply Area will consist of up to 40 production water bores generating up to 7 Mm^3/annum. Potential impacts of drawdown on surrounding vegetation and subterranean fauna (if present) will be discussed in the PER. The bores will pump to a centrally located storage facility at the Water Supply Area and will be pumped to the Operational Area (40-60 km, depending on the final borefield area configuration). It is likely that a lower saline and a hyper-saline pipeline network will be established within the same pipeline corridor to maximize the efficiency of

water use at the Operational Area. A series of water tanks will be installed at the Operational Area to receive the water from the borefield. This water will be used for processing, dust suppression and generating potable water via the site's Reverse Osmosis plant.

Various additional water storage facilities including the process water pond, recycled water pond and potable water storage tanks will also be required for general operational purposes and to deal with excess water resulting from rainfall and run-off.

Dewatering is likely to be required in the area of the proposed pit/s. Studies to date (to be further discussed in the PER) suggest that dewatering requirements will be minimal.

2.9. COMMUNICATION CORRIDOR, MINE ACCESS ROAD AND BYPASS

A Mine Access Road will be required to link the Operational Area to Kalgoorlie. Vehicle tracks from Kalgoorlie and Laverton that are currently used to access the TJV tenements pre-date the TJVs activities in the area and are 4WD only. These tracks are not of suitable quality to support the increased heavy vehicle transport demands required for a mining operation and are poorly located from an environmental management perspective. The existing tracks are adjacent to, and intersect with, known populations of Declared Rare Flora (DRF) and areas of known threatened species habitat. Sections of the existing track are partly located within the presumed boundary of the recently identified Priority Ecological Community (PEC). Widening of these tracks to allow safe passage for an increased level of traffic would result in the removal of known DRF populations and loss of other threatened species and habitat. Two Mine Access Road Options are under consideration (Figure 1): the Pinjin Option (approximately 400 km) and Cable Haul Option (approximately 500 km). Only one option will be developed as the main mine access. The construction of either option will require the upgrade of existing tracks / roads and the clearing of new areas. A Public Bypass Road will also be established to divert public traffic away from the Operational Area.

Management of traffic along the Mine Access Road will require ongoing consultation and cooperation between the TJV, local councils and other State regulators. At this stage, the road is scoped to be a private road (regardless of whether it is the Pinjin or Cable Haul option). The TJV recognize that preventing use of the road by the general public (e.g., tourists) and other mining / exploration companies is likely to be impossible. Appropriate signage and public education measures will be developed in an attempt to minimize unauthorized use of the road, and thereby minimize safety risks on the road and minimize increased use of the region by unauthorized persons.

It is likely that a communication corridor will be required to link the TGP to the existing national telecommunications network. If practical, the communication corridor will be positioned adjacent to the Mine Access Road. However, a separate communication corridor following a different route to the Mine Access Road may be required depending on the availability of a suitable connection point to existing telecommunications infrastructure. The communication corridor is likely to house a fiber optic cable, though other technologies are being considered. If the communication corridor is developed separately from the Mine Access Road a vehicle track will be required for installation and maintenance purposes.

This communication corridor would also provide an alternative light vehicle access road during inclement weather or fire.

Communication will be required between the Operational Area, Water Supply Area and Tailings Storage Facility for infrastructure monitoring, management and control purposes. An internal communication system will also be established using hand held and in-car radios.

3. APPLICABLE LEGISLATION AND GUIDELINES

The TJV, in planning and implementing the proposed mine, has / will adopt the principles of environmental protection detailed in section 4A of the EP Act and EPA Position Statement No. 7 *Principles of Environmental Protection*. Specifically these principles are:

- Precautionary principle;
- Principle of intergenerational equity;
- Principle of the conservation of biological diversity and ecological integrity;
- Principles relating to improved valuation, pricing and incentive mechanisms; and
- Principle of waste minimization.

Table 4 lists a selection of State and Commonwealth legislation and regulations and various guidelines and strategies relevant to the proposed TGP. Further discussion of these documents and others relevant to the TGP is available on the project's website (www.tropicanajv.com.au).

Table 4: Relevant Legislation, Guidances and Position Statements

EPA Documents
Environmental Protection Bulletin No.1 Environmental Offsets – Biodiversity
Guide to EIA Environmental Principles Factors and Objectives
Guide to Preparing an Environmental Scoping Document
Position Statement 2: Protection of Native Vegetation in Western Australia
Position Statement 3: General Requirements for Terrestrial Biological Surveys
Position Statement 5: Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia
Position Statement 6: Towards Sustainability
Position Statement 7: Principles of Environmental Protection
Position Statement 9: Environmental Offsets
Guidance Statement 6: Rehabilitation of Terrestrial Ecosystems
Guidance Statement 12: Guidance Statement For Minimising Greenhouse Gas Emissions
Guidance Statement 19: Guidance Statement for Environmental Offsets
Guidance Statement 41: Assessment of Aboriginal Heritage
Guidance Statement 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA
Guidance Statement 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in WA (draft)
Guidance Statement 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in WA
Guidance Statement 55: Implementing Best Practice in Proposals submitted to the EIA process
Guidance Statement 56: Terrestrial Fauna Surveys for EIA in WA
State Government Legislation
Aboriginal Heritage Act 1972
Bush Fires Act 1954
Contaminated Sites Act 2003
Dangerous Goods Safety Act 2004
Environmental Protection Act 1986
Land Administration Act 1997
Mining Act 1978
Mine Safety and Inspection Act 1994
Rights in Water and Irrigation Act 1914
Wildlife Conservation Act 1950
Commonwealth Government Legislation, Strategies and Guidelines
Environment Protection and Biodiversity Conservation Act 1999
Intergovernmental Agreement on the Environment 1992
National Strategy for Ecologically Sustainable Development 1992
National Strategy for the Conservation of Australia's Biological Diversity 1996
Native Title Act 1993
Draft Policy Statement: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999
International Agreements
China-Australia Migratory Bird Agreement 1986
Japan-Australia Migratory Bird Agreement 1974
Republic of Korea-Australia Migratory Bird Agreement 2006
Other Standards
Implementation Framework for Western Australia for the Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting.
HB 203:2006 Environmental Risk Management – Principles and Procedures
AS/NZS 4360:2004 Australian / New Zealand Standard: Risk Management

4. REGIONAL ENVIRONMENTAL SETTING FOR PROPOSAL

The Operational Area and the Minigwal Trough Water Supply Area are located in the southwest corner of the Great Victoria Desert (GVD). The Operational Area is located between Plumridge Lakes Nature Reserve (14 km to the southeast of the Operational Area) and Queen Victoria Spring Nature Reserve (over 100 km south-west of the Operational Area; Figure 1). The total area of the GVD is approximately 42 million hectares, of which approximately 21 million hectares are in WA. The Pinjin Option for the Mine Access Road spans the Murchison and GVD bioregions. The Cable Haul Option spans the Nullarbor and GVD.

The following sections discuss the regional environmental setting of the TGP, with a focus on the Operational Area as this will be the area of greatest potential impact.

4.1. PHYSICAL ENVIRONMENT

4.1.1. Climate

The most relevant current Bureau of Meteorology (BOM) monitoring sites for the Operational Area are Laverton Airport (approximately 230 km northeast) and Balgair (approximately 250 km southeast). The surrounding area has a semi-arid climate with daily temperature ranges of approximately 5 to 48 °C in summer and -5 to 35 °C during winter (Bureau of Meteorology 2008a & b). Rainfall generally comprises scattered showers during the winter months, and seasonal thunderstorms and cyclone related events during the summer months. Annual rainfall averages approximately 275 - 290 mm, with lowest rainfall in spring (Bureau of Meteorology 2008a & b). Summer rainfall is generally associated with cyclonic activity extending into the interior, and this may result in heavy rains between January and April (Laverton Airport received over 200 mm in February 2004). The lowest recorded annual rainfall received in the area was 118.6 mm at Laverton Airport (2005) and 140.7 mm at Balgair (1991) (Bureau of Meteorology 2008a & b).

As desert rainfall is often sporadic and localized, these average rainfall figures are indicative only as rainfall at the Operational Area may differ significantly from Balgiar and Laverton on a daily / annual basis. Daily temperatures can also vary significantly from Balgair and Laverton, however these monitoring sites do give an indication of conditions at the Operational Area. The TJV has installed weather-monitoring equipment, which will provide site-specific weather information for the area. Eventually, this will be upgraded to the standard required to enable BOM to generate weather forecasts for the Operational Area.

Similar to the GVD, the Nullarbor bioregion has a semi-arid climate with mild winters. Weather in summer in the Nullarbor can be extremely variable. Mean summer temperature ranges from 18.2 °C - 32.9 °C. Summer rainfall is unreliable. In winter, mean temperatures range from 4.4 °C - 13.8 °C. Winter low-pressure systems rarely provide significant rainfall in the inland areas of the Nullarbor. The annual mean rainfall is generally between 100 mm and 200 mm across the bioregion (Australian Natural Resources Atlas 2008a).

The Murchison bioregion has an arid climate with winter rainfall. The mean average annual rainfall is about 210 mm, ranging from 190 mm in the northeast to 240 mm in the southwest.

Rainfall is unreliable and most years can expect a dry spell of four to six months (Australian Natural Resources Atlas 2008b). Summers are hot and dry, with the average daytime temperature averaging 38 °C in January and can exceed 40 °C. Winters are mild with cool nights (Australian Natural Resources Atlas 2008b).

4.1.2. Topography and Surface Drainage

The GVD is a vast sandbelt consisting of sandplains and dunes, the majority of which run east-west and parallel to each other. There are local occurrences of playa lakes, associated lee-sided mounds (lunettes) and rocky prominences (Australian Natural Resources Atlas 2008c). The local landscape at the Operational Area consists predominantly of sand, with sand dunes forming east-west ridges as they do in the majority of the rest of the GVD. The Resource Area lies on a low ridge inside a broad valley between a local dunefield (known to the TJV as Salty Dog) and a local high-point (known as Hat Trick Hill).

Surface drainage is a very minor feature in the majority of the GVD (Australian Natural Resources Atlas 2008c). Two broad, low-relief drainage lines occur on either side of the Resource Area (Western Australian Geological Survey 1978). These drainage lines flow in a north-easterly direction, with outflow into an unnamed salt lake /clay pan approximately 9 km north of the Resource Area.

The landscape of the Murchison bioregion comprises low hills, mesas of duricrust separated by flat colluvium and alluvial plains (Australian Natural Resources Atlas 2008b). The eastern Murchison region is characterized by extensive areas of elevated red desert sandplains with minimal dune development. Broad plains of red-brown soils and breakaway complexes, as well as red sandplains, are typical of the eastern portion of the Murchison IBRA region (Cowan 2001).

The Nullarbor Plain is a tertiary limestone plain with subdued, arid karst features. It is a vast and remarkably flat treeless plain wholly contained within the much larger Bunda Plateau and has shallow calcareous soils, thinly mantling massive limestone in many places (McKenzie et al. 2002). Note that the TGP does not anticipate interacting with the karstic elements of the Nullarbor (the only proposed infrastructure of the TGP in the Nullarbor is the Cable Haul Road option and / or a communications corridor). No karst or limestone landforms will be disturbed by the TGP.

4.1.3. Geology and Soils

The TGP and wider tenement portfolio lie on the “Fraser Range” to the west of a major tectonic suture between the Yilgarn Craton and the Proterozoic Albany-Fraser Province. Host rock dating by the TJV indicates that mineralized basement rocks in the tenements are late Archean age and may form part of the tectonically reworked edge of the Yilgarn Craton.

The Fraser Range is flanked by the Officer Basin sediments of Mesoproterozoic to Neoproterozoic age. Permian aged weakly consolidated sandstones and glacial sediments have a significant regional extent throughout the area and unconformably overly the Officer Basin, Proterozoic and Archaean basement. Several marine incursions of Miocene to

Eocene age are recognized with wave cut platforms evident on regional digital terrain models. Shallow marine and littorial or beach facies sediments associated with these incursions are recognized to the south of the Resource Area.

The area has undergone Tertiary lateritic weathering to depths of 40 to 50 m. Recent aeolian sands (reworked beach facies sediments) and colluvium overlie the variably incised lateritic profile. Soil mapping of WA has been carried out by Tille (2006), who describes the area surrounding the Operational Area as being located in the Southern Great Victoria Desert Zone of the Sandy Desert Region.

4.1.4. Hydrogeology

Little detailed hydrogeological data were available for the proposed disturbance areas prior to the TJVs activities. The Officer Basin (underlying much of the proposed disturbance area) comprises an inter-cratonic downwarp structure that extends 15,000 km from the south-eastern flank of the Pilbara Craton to the central west of South Australia, covering an area of over 350,000 km^2. The structure contains up to 12,000 m of Proterozoic and Palaeozoic sedimentary and volcanic rocks containing a sequence of sedimentary aquifers up to 400 m thick overlain by superficial sediments (Allen 1997). The main aquifers are the Permian Paterson Formation and the Devonian Lennis Sandstone (Allen 1997). The groundwater level in the Officer Basin ranges from 20 to 30 m below palaeodrainages, to as much as 100 m below the hills (Allen 1997). The salinity distribution was not well known prior to the TJVs activities - some bores obtain fresh water, whereas elsewhere groundwater is brackish or saline (Allen 1997).

Observed water table elevations in the Operational Area appear to follow the surface topography and range from approximately 326 m AHD southwest of the Resource Area to about 315 m AHD to the northeast of the Resource Area. These water table elevations indicate a regional flow gradient to the northeast, arising from recharge on ridges identified as topographical highs to the south of the Resource Area.

Detailed hydrogeological surveys have been commissioned by the TJV, particularly for the Minigwal Trough Water Supply Area and the Operational Area; these will be detailed in the PER.

4.2. ECOLOGICAL ENVIRONMENT

4.2.1. Flora and Vegetation

The proposed TGP and the majority of the TJVs other exploration tenements are situated in the Helms Botanical District near the border of the GVD and the Nullarbor Plain bioregions, within the Eremaean Botanical Province. The GVD is an active sand-ridge desert of deep Quaternary aeolian sands with a tree steppe of Marble Gum (*Eucalyptus gongylocarpa*), Mulga (*Acacia aneura*) and Ooldea Mallee (*E. youngiana*) over hummock grassland, dominated by Hard Spinifex (*Triodia basedowii*) (Barton and Cowan 2001a & b). Species diversity in the GVD varies enormously from relatively low diversity sand plain communities dominated by Marble Gum over Hard Spinifex, to sand-dune / swale areas with a higher

diversity including Marble Gum, Mulga woodlands, mallee-form eucalypts, Native Pine (*Callitris*), and a variety of chenopods, grasses and shrubs (Shepard 1995).

Similarly, vegetation in the northern portion of the Nullarbor are primarily a tree steppe of Marble Gum, Mulga and Ooldea mallee over hummock grassland dominated by *Triodia basedowii* on the aeolian sands. *Acacia* dominates the colluvial soils with *Eremophila* and *Santalum* halophytes confined to edges of salt lakes and saline drainage systems (Barton & Cowan 2001). Low woodlands of Western Myall (*Acacia papyrocarpa*) over Bluebush (*Maireana sedifolia)* are present in the central and southern areas of the northern band (Barton & Cowan 2001).

The vegetation in the eastern Murchison bioregion is closely associated with the geology, soils and climate (Australian Natural Resources Atlas 2008b). Vegetation in the Murchison is dominated by *Acacia* woodlands, areas of outcropping rock with skeletal soils support *Acacia* low woodlands. Hummock grassland grows predominately on the saltbush shrubland on calcareous soils and samphire (*Halosarcia*) low shrubland on the saline alluvium areas (Australian Natural Resources Atlas 2008b). In the east of the bioregion, the red sand plains support mallee-mulga parkland over hummock grassland (Australian Natural Resources Atlas 2008b).

Flora species of conservation interest that potentially occur in and around the disturbance areas of the TGP are listed in Table 5. This list is accurate at the time of writing, however further survey and taxonomic work may alter the list in the future. Further details will be provided in the PER.

Table 5: Flora of Conservation Interest.

Species	Protected Under:		
	EPBC Act 1999	WC Act 1950	DEC Priority
Acacia eremophila numerous nerved variant			P2
Baeckea sp. Great Victoria Desert			P2
Caesia rigidifolia			P1
Comesperma viscidulum			P4
Conospermum toddii	Endangered	DRF	
Dampiera eriantha			P1
Daviesia purpurascens			P4
Dicrastylis cundeeleensis			P3
Dicrastylis nicholasii			P2
Diocirea ternata			P3
Eucalyptus articulata	Endangered	DRF	
Eucalyptus pimpiniana			P3
Eremophila perglandulosa			P1
Grevillea secunda			P2
Isotropis canescens			P2
Lepidobolus deserti			P4
Malleostemon sp. Officer Basin			P2
Microcorys macredieana			P3
Micromyrtus stenocalyx			P3
Micromyrtus serrulata			P3
Physopsis chrysotricha			P2
Olearia arida			P2
Thryptomene eremaea			P2
Thysanotus baueri			P1

No ecological communities that are listed as Threatened at the State or Commonwealth level are known to occur within the proposed disturbance area of the project. A 'yellow sandplain community' has been identified by Pearson (1994) and is considered to support a diverse mammalian and reptile fauna, as well as distinctive plant communities (Barton & Cowan 2002a & b). This community is present in the Queen Victoria Spring Nature Reserve and is likely to extend into exploration tenements held by the TJV to the south of the proposed project. The community has recently been listed as a PEC by DEC. At this point in time, no data is available defining its likely boundaries and location. It is possible that both of the proposed mine access roads pass through portions of this community.

4.2.2. Terrestrial Vertebrate Fauna

Prior to the TJVs activities, no region wide fauna surveys had been undertaken in the WA GVD nor had any major work been undertaken over the proposed disturbance areas. Some fauna surveys have been carried out in the surrounding areas and Nature Reserves and the following vertebrate species have been recorded in the general area (Crouch 2002; Shepard 1995):

- Budgerigar (*Melopsittacus undulatus*);
- Singing Honeyeater (*Lichenostomus virescens*);
- Wongai Ningaui (*Ningaui ridei*);
- Spinifex Hopping Mouse (*Notomys alexis*);
- Knob-tailed gecko (*Nephrurus levis*);
- Thorny Devil (*Molloch horridus*); and
- Desert Death Adder (*Acanthopis pyrrhus*).

Table 6 lists vertebrate fauna protected under State or Commonwealth legislation, or otherwise considered to be of conservation interest that may occur in the disturbance areas of the TGP. This list is accurate at the time of writing, however further survey and taxonomic work may alter the list in the future (e.g., the taxonomy of *Dasycercus* is currently tenuous). Further details will be provided in the PER.

Table 6: Vertebrate Fauna of Conservation Interest.

Species		Status under:			
Common Name	**Scientific Name**	**EPBC Act 1999**	**WC Act 1950**	**DEC Priority**	**IUCN**
Southern Marsupial Mole (SMM)	*Notoryctes typhlops*	Endangered	Schedule 1		Endangered
Sandhill Dunnart (SHD)	*Sminthopsis psammophila*	Endangered	Schedule 1		Endangered
Princess Parrot, Alexandra's Parrot	*Polytelis alexandrae*	Vulnerable	Schedule 1		Near Threatened
Slender-billed Thornbill (western)	*Acanthiza iredalei iredalei*	Vulnerable	Schedule 1		
Malleefowl	*Leipoa ocellata*	Vulnerable	Schedule 1		Vulnerable
Mulgara	*Dasycercus cristicauda*	Vulnerable	Schedule 1		Vulnerable
Great Desert Skink, Tjakura, Warrarna, Mulyamiji	*Egernia kintorei*	Vulnerable	Schedule 1		Vulnerable
Woma Python	*Aspidites ramsayi*		Schedule 4		Endangered
Naretha Blue Bonnet	*Northiella haematogaster*		Schedule 4		
Australian Bustard	*Ardeotis australis*			P4	Near Threatened
Grey Falcon	*Falco hypoleucos*			P4	Near Threatened
Peregrine Falcon	*Falco peregrinus*		Schedule 4		LeastConcern
Rainbow Bee-eater	*Merops ornatus*	Migratory			
Great Egret, White Egret	*Ardea alba*	Migratory			
Cattle Egret	*Ardea ibis*	Migratory			
Oriental Plover, Oriental Dotterel	*Charadrius veredus*	Migratory			
Fork-tailed Swift	*Apus pacificus*	Migratory			

4.2.3. Terrestrial Invertebrate Fauna

Some invertebrates, known broadly as Short Range Endemic (SRE) species, are particularly sensitive to habitat alteration and are an increasingly important consideration as part of the EIA process. SREs have been broadly defined as species with a natural range of less than 10,000 km^2 (Harvey 2002), and many species have a natural range that is considerably less, sometimes from a single locality (New and Sands 2002). Many SRE species rely on moist conditions and are very selective of particular microhabitats, often favouring south-facing slopes, fallen logs and deep litter (Harvey 2002). The susceptibility of SREs to changes in the availability of their preferred microhabitat (either through disturbance or removal) and their general inability to disperse to a more favourable microhabitat means that a disturbance within the range of an SRE can result in a significant impact.

It is important to note that invertebrates are historically understudied and in many cases lack formal taxonomic descriptions. Currently recognized terrestrial SRE invertebrate groups in WA include (but are not limited to):

- Centipedes (Chilopoda);
- Isopods (Isopoda);
- Land Snails (Mollusca);
- Millipedes (Diplopoda);
- Scorpions (*Urodacus*); and
- Trap-door spiders (Mygalomorphae).

No SRE surveys are known to have been conducted in the region prior to the TJVs activities in the area.

4.2.4. Subterranean Fauna

Western Australian stygofauna and troglofauna exhibit high levels of endemism and many of these species appear to have restricted ranges, making them particularly important in the EIA process (EPA 2003). There is a significant lack of information on stygofauna and troglofauna for the GVD, and prior to the TJVs activities there were no known data for the area surrounding the project. As far as the TJV is aware, work commissioned for the TGP is the first subterranean fauna survey in the GVD.

4.3. CONSERVATION RESERVES

Approximately 14% of the GVD is protected by national parks and formal reserves (Australian Natural Resources Atlas 2008c). The existing reserve system includes the Queen Victoria Spring Nature Reserve (27,000 ha), the Plumridge Lakes Nature Reserve (31,000 ha) and the Neale Junction Nature Reserve (72,000 ha), located between 14 km and over 100 km from the project and its supporting infrastructure (Figure 1).

4.4. INDIGENOUS HERITAGE

In broad terms, the TGPs project area is at the boundary of the lands that may have been used by the Wongatha and Spinifex peoples. A limited number of formal studies have been undertaken within the region which has resulted in a limited amount of documented knowledge of indigenous occupation in the project area. A native title claim was made by the Wongatha people for an area that spans and includes the Operational Area of the TGP but that claim was dismissed by Federal Court in February 2007.

Indigenous heritage sites are important in that they link Indigenous cultural tradition to place, land and people over time. Indigenous sites can be classified into two basic but overlapping categories:

- Archaeological sites – places where material remains such as campsites or artefacts associated with past Aboriginal land use; and

- Ethnographic / Anthropological sites – places of spiritual importance such as ceremonial sites or mythological (Dreaming) sites.

Indigenous sites have been located at many locations across WA, however they are most common near geographical features including lakes, rivers, swamps, the coast and hills (Department of Indigenous Affairs 2008). There is a general absence of recorded archaeological and ethnographic sites surrounding the project, which is almost certainly a reflection on the lack of survey effort prior to the TJVs activities in the area. However, some features of the environment (including a lack of permanent water) do suggest that historical indigenous activity in the area was likely to be sporadic, termed 'rain chasing' by Gould (1968, 1977a, 1977b). This involved people pursuing localized rainfall events, allowing them to move or disperse across their lands taking advantage of ephemeral water sources. Archaeologically, this settlement / mobility pattern can be reflected in numerous small artefact scatters with poor assemblages dispersed across the landscape, together with a few large, diverse and complex artefact scatters at reliable water sources. For example, in 1875 William Ernest Powell Giles found numerous Aboriginal artefacts and sighted people at Queen Victoria Spring, which is known to periodically fill with water after significant rainfall (Shepard 1995).

Prior to the TJVs activities in the area, the nearest archaeological survey to the Operational Area was conducted in 1983 over a large area of sand dune field, approximately 130 km to the southwest (O'Connor 1983). Five campsites and artefact scatters were discovered. They were generally situated beside claypans, which would provide ephemeral water sources and also sources of plant and animal foods. The site assemblages were small to moderately sized, with a variety of stone material suggesting the occupants ranged over a wide area.

4.5. Early Settler Heritage and Culture

Due to the isolation of the project (in terms of distance from major centers of the past and present) and the lack of permanent water there are likely to be relatively few sites of historical importance in regard to early settler heritage and culture. During early European history in Australia (predominantly in the 1800s), several expeditions have crossed the GVD and surrounding areas for exploratory purposes. These have included:

- Economically driven expeditions (e.g., to identify stock routes);
- Scientific exploration; and
- Pioneering / adventure.

There have been several expeditions into the western section of the GVD including Giles and Elder Expedition, some leaving blazes on trees (e.g., at Queen Victoria Spring; Shepard 1995). More recent exploration has been carried out by Len Beadell who marked out his trail with signposts, which are of significant historical value (Shepard 1995). There is no evidence of these expeditions crossing the TGPs Operational Area.

4.6. EXISTING LAND USE AND SOCIAL ENVIRONMENT

The majority of the GVD is vacant crown land with some conservation reserves and Aboriginal lands. The bioregion includes land holdings of the Arangu Pitjantjatjara and part of the Maralinga Tjarutja lands in the eastern parts of the GVD (South Australia). Pastoral development in the bioregion is confined to a few peripheral areas in the south and east where water and feed are available in some years. Most of the bioregion is unsuited to grazing as water is limited and fodder plants are sparsely distributed (Australian Natural Resources Atlas 2008c).

The TGPs nearest neighbours are over 200 km away at the station of Kandanah to the south. There are several Aboriginal communities currently located within approximately 500 km of the Operational area: Coonana, Cundeelee, Tjuntjuntjara, Wongatha, Mount Margaret and Cosmo Newberry. The Coonana and Tjuntjuntjara are the closest communities to the project (approximately 200 and 350 km from the Operational Area respectively). The Tjuntjunjarra community is a member of a larger group known as the 'Spinifex People' that were removed from their lands in WA and SA during the 1950s and 1960s. Many of the people that now live in the Tjuntjunjarra community previously lived at Government missions at Cundelee and Coonana. The population has been estimated to be around 150 people. The Wongatha community's population is estimated to be 240. The Wongatha people have previously filed a Native Title claim (WC99/1) over approximately 160,000 km^2 of WA, including a significant proportion of the TGP area. The Federal Court dismissed the claim in February 2007.

Evidence exists of past sandalwood harvesting in the wider region. This is believed to have last occurred in the 1950s and 1960s, involving Wongatha people as harvesters.

5. COMMUNITY PARTNERS AND STAKEHOLDER CONSULTATION PROGRAM

The TJV recognizes that proactive communication with community, neighbours, landholders, government departments (in a regulatory and advisory capacity) and other stakeholders such as the Conservation Council of WA, Wilderness Society and Wildflower Society are crucial to the success of the TGP and to ensure the project meets expectations. To this end, the TJV has embarked on an extensive communication and consultation program across the breadth of potential stakeholders from landholders along the potential mine access roads to State and Commonwealth government regulators. These consultations and information sessions have ranged from mail-outs to formal presentations at small meetings with select attendees.

The following governmental and community stakeholders have been consulted during the TGPs development phase, and will continue to be consulted as the approvals process progresses.

- Central Desert Native Title Services;
- City of Kalgoorlie Boulder;
- Conservation Council of Western Australia;

- Coonana Aboriginal Community;
- Department of Environment and Conservation (EPA Services Unit, Environment Management Branch, Science Division, Kalgoorlie Branch);
- Department of Health;
- Department of Industry and Resources (Major Projects, Environment Division [Perth and Kalgoorlie], Aboriginal Economic Development Group, Mineral Titles);
- Department of Indigenous Affairs;
- Department of Planning and Infrastructure;
- Department of Water;
- Commonwealth Department of the Environment, Water, Heritage and the Arts;
- Friends of Great Victoria Desert Park;
- Goldfields Esperance Development Commission;
- Goldfields Land and Sea Council;
- Goldfields Naturalist Group;
- Malleefowl Preservation Group;
- North East Independent Body;
- Shires of Menzies and Laverton;
- Tjuntjuntjarra Aboriginal Community;
- Pastoralists;
- Wilderness Society; and
- Wildflower Society.

A report on stakeholder consultations and outcomes will be included in the PER documentation.

6. TJV RISK BASED APPROACH TO TGP

The TJV has been active in the GVD since 2002. As exploration activities have increased in breadth (extending exploration activities into new areas) and intensity (progressing from widely spaced regional exploration activities to closely spaced resource definition drilling) the TJV has progressively increased survey effort for environmental values across the area and consulted with key stakeholders to ensure that potential impacts were identified and managed. As potential impacts have been identified, such as alteration to habitat of threatened species, targeted surveys for those species have been commissioned to determine how exploration activities can be managed to minimize risk, including identifying and avoiding the preferred habitat of conservation significant species.

In the absence of detailed information on the biophysical environment of the region and the proposed disturbance areas, the TJV has commissioned a variety of broad based and detailed surveys (discussed in section 9 and Appendices 1 - 4); further surveys are planned (Appendix 5). The findings of these surveys will be provided in the PER and have assisted

the TJV in determining an appropriate layout for the Operational Area and the most appropriate location for the service corridors. The environmental management strategy of the TJV follows the EPAs mitigation hierarchy of Avoidance – Minimisation – Rectification – Reduction - Offset (as a last resort only, to result in no net environmental harm, preferably, a net environmental benefit).

The TJV has demonstrated its precautionary approach to the management of environmental risk during its exploration activities in three main ways:

- Avoidance of critical habitat;
- Deferring potential high risk activities until adequate data is available to confidently determine the level of risk; and
- If available data does not enable the TJV to be satisfied that the potential risk is insignificant or manageable then TJV representatives have engaged with the relevant decision making authority for advice (e.g., DEC, DEWHA).

A formalized and detailed risk assessment process for the proposed TGP was initiated as the TJV progressed from exploration into pre-feasibility analysis, prior to commencing the formal environmental assessment process. The risk assessment process is ongoing, and has been based on principles and methodology outlined in *HB 203:2006 – Environmental Risk Management – Principles and Processes* and *AS/NZS 4360:2004 – Risk Management.* The primary aim has been to identify potential environmental consequences to all activities and to assign an appropriate response to reduce environmental risk.

As the risk assessment process is ongoing, the following information is preliminary only, and further surveys and investigations may alter the outcomes discussed in the PER document. The consequences, likelihoods and risks considered in the risk assessment process are defined in Tables 7 and 8. These tables are likely to be refined as risk assessment progresses. For example, specific consequence tables may be developed for different environmental aspects (e.g., threatened species versus emissions).

Table 7: Preliminary Consequence Table for the Tropicana Gold Project

Consequence	Example
1. Insignificant	• Very small number of individuals in a local population of non-conservation significant species or communities affected (estimate up to 1% of local population) • No affect on critical assets (e.g., a conservation significant species, aquifer) • Discharge or emission resulting in no significant/ detectable increase in normal background levels of a substance/ material used in operations outside of containment/ usage area • No health, amenity or nuisance effect on humans
2. Minor	• Small number of individuals of a local population of non-conservation significant species or communities affected (estimate up to 5% of local population) • No affect on critical assets • Discharge or emission resulting in an increase in normal background levels of a substance/ material used in operations outside of containment/ usage area (up to 25% of environmental limit) • Nuisance/ amenity effect to humans
3. Moderate	• Significant loss of a species or community at the local level • Limited impact on a critical asset • Discharge or emission resulting in a greater increase in normal background levels of a substance/ material used in operations outside of containment/ usage area (but less than the environmental limit) • Chronic or acute health or amenity effect on a small proportion of exposed humans (estimate up to 5% of exposed population)
4. Major	• Local extinction of a species or community • Significant impact to a critical asset • Discharge or emission in excess of environmental limit • Chronic or acute health or amenity effect on a larger proportion of exposed humans
5. Catastrophic	• Loss of a species or community from the region • Damage to a critical asset at a regional level • Loss of ecosystem function across the surrounding area • Human fatality

Table 8: Preliminary Risk Table for the Tropicana Gold Project

			Likelihood				
			A	B	C	D	E
			Almost certain (occurs in all circumstances/ planned event)	Likely (50% chance of occurrence)	Possible (5% chance of occurrence)	Unlikely (unusual or unexpected occurrence)	Rare (only occurs in exceptional circumstances)
Consequence	5	Catastrophic	E	E	E	E	H
	4	Major	E	E	E	H	M
	3	Moderate	E	H	H	M	M
	2	Minor	H	H	M	L	L
	1	Insignificant	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

The formal risk assessment was carried out by experienced AGAA staff with key roles in the development of the TGP with support from environmental consultants. Throughout the development of the TGP, the TJV has consulted widely (section 5) and has sort specific input from DEC, DEWHA, the Museum of Western Australia, the TGP Peer Review Panel (section 12) and environmental consultants in addition to commissioning extensive environmental surveys (Appendix 1). The five key environmental factors (some overlapping) that have been identified to date for the TGP are (risk-rated High to Extreme):

- Probable emissions (particularly greenhouse) and other potential discharges;
- Impact of improved infrastructure and access into a remote area;
- Probable loss of, or disturbance to, threatened species;
- Impact of clearing and ground disturbance; and
- Possible damage to ecosystem functionality including terrestrial systems, groundwater and groundwater dependent ecosystems.

Potential impacts that can be managed by standard or best practice techniques, or through an avoidance strategy include (risk-rated Low to Medium):

- Disturbance to Indigenous / Early settler heritage;
- Inappropriate waste disposal (industrial, general, hazardous waste etc.);
- Introduction and / or spread of weeds / feral animals;

- Unsustainable abstraction of water; and
- Discharge to land (e.g., cyanide contaminated tails).

Table 9 (page 33) provides a summary of the risk assessment process to date.

As several of the key impacts listed in Table 9 are related, and several impacts have the potential to affect the same environmental aspect, it follows that some cumulative impacts may result from the development of the TGP. These impacts may affect:

- Threatened / Specially Protected / Priority Fauna including the Sandhill Dunnart which could be impacted by loss of habitat from clearing impacts and increased incidence of fire;
- Vegetation complexes may be impacted directly by clearing and indirectly by impacts to groundwater; and
- Ecosystem functionality may be disrupted by the introduction of feral taxa (flora or fauna) and increased incidence of fire.

The management of cumulative impacts will be detailed in the PER.

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Table 9: Environmental Aspect Considerations

Environmental Aspect	Specific Factor	Potential Negative Outcomes	Likelihood	Consequence	Inherent risk	Comments/ Assumptions	Management Response	Likelihood	Consequence	Residual risk	Comments/ Assumptions
Emissions to air/land/water	Greenhouse gas emissions	Increased emissions	A	3	E	The TGP will require a substantial power source for operations. Greenhouse emissions may not have an immediate localized affect, but may contribute to climate change.	• Consider low emission technology options • Maximize efficiencies • Consider offset	B	3	H	Assumes low emissions technology/ power supply is available and viable. To some extent this is outside of the control of the TJV. The TGP is assessing several options for power supply and aiming to use a low emissions power source if practicable.
		Waste of resources (e.g., poor efficiency leads to unnecessary consumption of fuel)	C	3	H			D	3	M	
		Loss of opportunity to implement renewable options	C	3	H			D	3	M	
	General emissions/ discharge	Contamination of land or water	C	4	E	The TGP will require environmentally hazardous substances including hydrocarbons and cyanide to be utilized, transported and stored in order to extract and develop the gold resource.	• Appropriately manage environmentally hazardous substances (e.g., hydrocarbons and cyanide)	D	3	M	Assumes management actions are appropriate and that they are implemented as intended.
		Occupational Health and Safety	C	4	E			E	4	M	
		Visual amenity	C	2	M			E	2	L	
	Disposal of general waste	Contamination of land or water	C	3	H	The TGP will result in the generation of waste, some of which will have the potential to cause contamination.	• Appropriately manage waste (e.g., putrescible waste, industrial waste, recyclables)	E	3	M	Consequences remain the same, however likelihood is reduced with appropriate management.
		Generation of a contaminated site	C	3	E			E	3	M	
		Occupational Health and Safety	C	3	H			E	3	M	
	Dust	Occupational Health and Safety	A	3	E	The generation of dust is unavoidable, particularly during the construction phase of the TGP.	• Appropriately manage dust • Use appropriate water source to control dust where necessary (consider salinity, sustainability)	D	2	L	Assumes sufficient water of appropriate quality is available for dust suppression. Salinisation impacts (if they eventuate) will be restricted to narrow tracts of land (e.g., along sides of roads).
		Visual amenity	B	2	H			D	2	L	
		Loss of dust sensitive vegetation	B	3	H			C	2	M	
		Salinisation of land through dust control practices	B	3	H			C	2	M	
Improved infrastructure and increased access to the region	Increased incidence of fire	Loss / damage to habitat	B	5	E	Fire ignition may be caused by diverse activities intentional actions (e.g., fire-bugs), accidental activities (e.g., camp-fires getting out of control) or littering (e.g., glass bottles. The impact of fire on vegetation is known to be varied depending on the species impacted, fire interval and fire intensity.	• Discourage / educate unauthorized road users utilizing the Mine Access Road • Restrict vehicle movement by staff with private vehicles on site to minimize impact to nearby Nature Reserves and wider region • Consider not allowing JV staff or contractor employee vehicle onsite • Consider educational initiatives throughout the region to promote environmentally friendly behavior by visitors (e.g., signage) • Undertake specific environmental surveys to describe region and identify high value environmental assets (e.g., conservation significant species) that may be at risk or require mitigation/ offset	C	3	H	Preventing private individuals (i.e. non-TGP staff) from using the Mine Access Road will be difficult despite un-authorized road usage being illegal as the road will be private. Education of the general public may result in improved visitor behavior (e.g., litter disposal and hygiene practices).
		Loss / damage of infrastructure (waste of resources)	C	4	E			C	3	H	
		Occupational Health and Safety	C	5	E			E	5	H	
	Introduction/ spread of feral species	Competition with native flora	B	4	E	The GVD has relatively few weed species, the introduction of any would be a significant degradation environmental values. In addition, many of the conservation significant species in the GVD are small to medium and are therefore susceptible to predation by introduced predators.		C	3	H	
		Loss of threatened fauna (increased predation)	C	4	E			C	3	H	
	Increased use of regional Nature Reserves	Degradation of environmental values including (but not limited to): • Introduction / spread of feral taxa	B	4	E	The Queen Victoria Spring and Plumridge Lakes Nature Reserve are likely to have increased visitation following construction of the Mine Access Road (regardless of which option is developed). Therefore negative impacts to the Reserves may be expected.		C	4	E	
		• increased erosion from off-track driving	B	3	H			C	3	H	
		• increased incidence of fire	C	4	E			C	4	E	
	Inappropriate disposal of waste	Visual Amenity	B	2	H	The TJV has expected the worst case scenario – that visitors to the region will have little regard for the implications of litter and therefore take little care in its disposal. This may not be and overly pessimistic expectation.		C	2	M	
		Pollution	B	3	H			D	3	M	
		Habituation of fauna	C	2	M			C	2	M	
		Death of fauna (e.g., reptile – aluminium can interaction)	C	2	M			C	2	M	
		Fire (e.g., glass bottles or cigarette butts acting as ignition sources)	B	4	E			C	3	H	

Table 9 (continued): Environmental Aspect Considerations

Environmental Aspect	Specific Factor	Potential Negative Outcomes	Likelihood	Consequence	Inherent risk	Comments	Management Response	Likelihood	Consequence	Residual risk	Comments/ Assumptions
Clearing and ground disturbance	Heritage sites (European and Indigenous)	Disturbance/ damage to sites	C	4	E	Prior to the TJVs activities there was little survey effort to identify heritage sites in the proposed impact areas of the TGP. In the absence of information a precautionary approach was adopted and extensive surveys were commissioned to investigate risk.	• The layout of the Operational Area and other infrastructure has been designed to avoid areas of significance • A Cultural Heritage Management Plan will form part of the PER	E	4	M	Extensive ethnographic and archaeological desktop and field surveys for sites of Indigenous significance have been undertaken across all proposed disturbance areas (roads, water supply areas, Operational Area). There are few sites and none will be impacted by the TGP. A desktop assessment of potential European heritage was undertaken for the Pinjin area which is the most likely disturbance area to have significance for European heritage. No known site of significance will be impacted by the TGP.
	Terrestrial vegetation and flora	Loss of threatened species / ecosystems	B	4	E	Prior to the TJVs activities there was little detailed information on the flora, vegetation and fauna of the area. The available information was insufficient to make informed and appropriate management.	• Undertake site specific environmental surveys to identify critical assets/ environmental values (including conservation significant species, critical habitat and ecosystems) in the disturbance areas and surrounding area - mitigate accordingly • Minimize negative impacts (e.g., removal of threatened species or alteration to their habitat, compaction of substrate, contamination of substrate, introduction of feral competitors) • Consider offset	E	4	M	Extensive field surveys have been undertaken for the Operational Area and the surrounding region. Locations of conservation significant species (Priority, Threatened and DRF) have been identified and infrastructure at the Operational Area has been located to minimize impacts. No Threatened or Priority ecological communities have been identified in the area. Both Mine Access Road options have been surveyed for flora, vegetation and fauna values and the road options have been designed to avoid preferred habitat where practicable (e.g., avoiding cutting dunes which are preferred habitat for several species). Fauna values have been surveyed at the Minigwal Trough and proposed pipeline; an assessment of the flora and vegetation at the Minigwal Trough and proposed water carrying pipeline is in progress. These surveys will inform the placement of water infrastructure to minimize negative impacts. Where necessary, targeted surveys for conservation significant species have been commissioned to better understand their biology to inform management decisions (e.g., *Conospermum toddii*, Southern Marsupial Mole).
		Damage to critical habitat	C	4	E			D	3	M	
		Interruption to lifecycle (e.g., loss of pollinators)	C	4	E			E	3	M	
		Disruption to ecosystem function	C	4	E			D	3	M	
		Increased sedimentation / erosion from altered surface water flow-sheet	C	3	H			D	2	L	
	Terrestrial fauna	Loss of threatened species	C	3	H			E	4	M	
		Damage to critical habitat	C	4	E			D	4	H	
		Interruption of normal activity patterns (e.g., migration and dispersal)	D	4	H			E	3	M	
		Disruption to ecosystem function	C	3	H			D	3	M	
Loss/ disturbance of Threatened Species (due to non-clearing activities/ events including changed fire regimes, introduced species etc.)	Terrestrial vegetation and flora	Loss of threatened species/ ecosystems	C	4	E	As above.	• As above, plus: o Design to minimize water pooling and changes to sheet flow o Provide appropriate egress and monitoring for trenches	D	3	M	
		Damage to critical habitat	C	3	H			D	3	M	
		Interruption to lifecycle (e.g., loss of pollinators)	C	4	E			E	3	M	
		Disruption to ecosystem function	C	4	E			E	3	M	
	Terrestrial fauna	Loss of threatened species	C	4	E			D	4	H	
		Damage to critical habitat	C	4	E			D	3	M	
		Interruption of normal activity patterns (e.g., migration and dispersal)	D	4	H			E	3	M	
		Disruption to ecosystem function	C	3	H			D	3	M	

Table 9 (continued): Environmental Aspect Considerations

Environmental Aspect	Specific Factor	Potential Negative Outcomes	Likelihood	Consequence	Inherent risk	Comments	Management Response	Likelihood	Consequence	Residual risk	Comments/ Assumptions
Damage to ecosystem functionality	Terrestrial ecosystems	Disruption to ecosystem function	C	4	E	As above.	• Undertake environmental surveys to identify critical assets/ environmental values (including conservation significant species and ecosystems) in the disturbance areas and surrounding area	D	3	M	As above.
		Loss of threatened species	C	4	E			E	4	M	
		Damage to critical habitat of Threatened, Specially Protected or Priority Taxa	C	3	H			D	4	H	
		Introduction or spread of weeds/ feral animals (by TGP personnel/ contractors)	C	4	E			D	3	L	
	Groundwater and hydrology	Damage to vegetation at the Operational Area or Minigwal Trough water supply area due to inappropriate groundwater abstraction regimes	C	4	E	Prior to the TJVs activities there was little detailed information on the hydrology, hydrogeology or ecosystem reliance on groundwater for the Operational Area or Minigwal Water Supply Area. The available information was insufficient to make informed and appropriate management.	• Undertake surveys to identify vegetation complexes that may be sensitive to changes in hydrology/ hydrogeology • Plan activities to avoid unsustainable abstraction from aquifers	E	4	M	Surveys and desktop assessments for flora and vegetation have been undertaken for the Operational Area and Minigwal Trough water supply area. To date, no ecosystem of subterranean fauna species has been identified that will be negatively impacted by the proposed borefield at the Minigwal Trough or dewatering program at the Operational Area.
		Abstraction of groundwater at the Operational Area or Minigwal Trough water supply area causes damage to populations of subterranean fauna	C	4	E	As above.	• Undertake surveys and desktop assessments to identify subterranean fauna • Plan activities to avoid unsustainable abstraction from aquifers	E	4	M	Surveys and desktop assessments for subterranean fauna have been undertaken for the Operational Area and the Minigwal Trough water supply area. To date, no subterranean fauna species has been identified that will be negatively impacted by the proposed borefield at the Minigwal Trough or dewatering program at the Operational Area.
		Abstraction of water from the target aquifer at the Minigwal Trough has negative impacts on a linked aquifer, leading to vegetation impacts	C	4	E	Prior to the TJVs activities there was little detailed information on the hydrogeology and aquifer linkages at the Minigwal Trough water supply area. The available information was insufficient to make informed and appropriate management.	• Undertake surveys and analysis to determine linkages between superficial and deep aquifers	E	4	M	Assessment of the hydrogeology of the Minigwal Trough water supply area has indicated that the target aquifer is separated from a higher, superficial aquifer by an aquitard, limiting impacts on the superficial aquifer.
		Aquifer is damaged due to unsustainable abstraction	B	4	E	Prior to the TJVs activities there was insufficient detailed information on the recharge rates and extent of the target aquifer at the Minigwal Trough for the TJV to make informed and appropriate management.	• Design borefield layout and extraction rate for sustainable use of the aquifer	E	4	M	Assessment of the target aquifer at the Minigwal Trough has demonstrated that an appropriate abstraction regime can be designed to avoid unsustainable abstraction.
		Discharge of water from pit dewatering causes damage to substrate, surface water and/ or groundwater	B	3	H	Prior to the TJVs activities there was no detailed information on the groundwater quality in the proposed pit area.	• Undertake groundwater sampling to determine composition • Recycle water through the processing plant	E	2	L	Groundwater sampling has indicated that mine dewater will be saline. Water generated from pit dewatering will be directed to the processing plant for use.

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7. BASIS FOR JUSTIFYING PROPOSAL AND SELECTION OF PROPOSED OPTION

From an economic view-point, the gold mineralization identified by the TJV is of a sufficient size and grade to warrant development and extraction. The TJV considers that the proposed TGP can be developed and managed to have an overall positive outcome by balancing environmental and social factors with economics. Many economic factors have associated environmental benefits, for example optimizing plant or mine design to reduce costs, fuel and energy consumption, and greenhouse emissions.

7.1. KEY UTILITIES

As the proposed TGP Operational Area is in a remote location, key utilities such as the communications system, access road, water source and power supply will require development by the TJV. In selecting the preferred option for each utility, the TJV has taken into account environmental considerations including clearing footprint, greenhouse emissions, and sustainability considerations. The main options considered and their environmental constraints are summarized in Table 10 (page 39). The ranking of impacts has been undertaken with current data available to the TJV. Relative rankings may change with further data.

7.2. OPERATIONAL AREA

There is a degree of flexibility in the placement of infrastructure for the TGP except for the position of the Resource Area, which is pre-determined by geology. The TJV has taken into account environmental constraints including clearing footprints, greenhouse gas emissions, alterations to biodiversity and / or ecosystem function and the overall efficiency of the layout. Table 11 (page 40) presents the environmental constraints and opportunities considered by the TJV in determining the preferred layout for the Operational Area. The ranking of impacts has been undertaken with current data available to the TJV. Relative rankings may change with further data. The conceptual layout illustrated in Figure 2 is based on environmental surveys completed to date, and may change pending the results of ongoing environmental surveys or for project optimization reasons. The PER will document the final layout of Operational Area infrastructure.

7.3. OFFSETS

In developing the TGP, the TJV aims to deliver an environmentally responsible project with a minimum standard of ‘no net environmental loss’ or alternatively with ‘net conservation benefit’ (EPA 2006). Specifically, the PER offsets section will address the following documents:

- Environmental Protection Authority. 2006. Position Statement No. 9. Environmental Offsets.
- Environmental Protection Authority. 2008a. Guidance for the Assessment of Environmental Factors (in Accordance with the Environmental Protection Act 1986). Statement No. 19 Environmental Offsets- Biodiversity. August.
- Environmental Protection Authority. 2008b. Environmental Protection Bulletin. No.1. Environmental Offsets – Biodiversity.

- Australian Government, Department of the Environment and Water Resources. 2007a. Draft Policy Statement: Use of Environmental Offsets Under the *Environment Protection and Biodiversity Conservation Act 1999*. August.
- Australian Government, Department of the Environment and Water Resources. 2007b. Use of Environmental Offsets Under the *Environment Protection and Biodiversity Conservation Act 1999*. Discussion Paper. August.

In line with State and Commonwealth guidance documents, environmental offsets are only being considered to mitigate impacts for which best practice management options are insufficient (EPA 2006, 2007b; Commonwealth Government 2007). The key environmental factors of the TGP that cannot be fully managed / mitigated without the use of offsets are:

- Clearing: Although the TJV will rehabilitate in accordance with requirements under the Mining Act 1978 there will be some clearing impacts that will remain post-closure. Consideration will be given to addressing residual clearing impacts by offset, through off-site rehabilitation / ecosystem enhancement in the area. This may include rehabilitation / enhancement of fire affected or otherwise degraded areas in the Queen Victoria Spring Nature Reserve or Plumridge Lakes Nature Reserve. Appropriate areas and activities will be determined in consultation with relevant regulators and stakeholders. There will be some impacts to species of conservation significance and their habitat e.g. individuals and habitat that exist under the footprint of critical infrastructure that cannot be moved (such as the resource body). Unavoidable clearing and the associated impacts will be detailed in the PER and offset as part of the project.
- Improved infrastructure and increased access into a remote area: As the TGP will require the development of a Mine Access Road of higher quality than the existing tracks in the area, visitor numbers to the wider region may increase. This impact cannot be completely offset by direct means, however indirect offsets including the funding of regional research and environmental management will be considered in consultation with relevant stakeholders.

The EPA has requested (meeting 22/1/2009 and correspondence of the 13/2/2009) that the TGP offsets hierarchy be clearly articulated in the PER documentation, further to meeting with the Department of Environment and Conservation Environmental Management Branch.

TJV understand that any expected on-site activities do not qualify as offsets (e.g., the rehabilitation of disturbed areas which will be required under the TGPs Mining Act 1974 approvals). Any offset activity should take place offsite, and not in an area that would have benefited without the implementation of the proposed project. The EPA applies the following principles to environmental offsets (EPA 2006):

- Environmental offsets should only be considered after all realistic attempts at mitigating negative impacts have been scrutinized and exhausted;
- An environmental offset plan should include both direct (e.g. restoration or rehabilitation off site) and contributing offsets (e.g. contributing financially to an approved “bank”, credit trading scheme or trust fund);
- Environmental offsets should aim to be ‘like for like or better’;

- The size of the offset to impact ratio should be larger than 1:1 and be proportional to both the importance of the environmental asset being impacted, and the likelihood that the offset is unlikely to achieve a 'net environmental benefit' outcome. Offset ratios should be based on past findings, success rates, current research or other similar projects being undertaken.
- Environmental offsets must entail a robust and consistent assessment process. Offsets should entail a thorough and transparent assessment process;
- Offsets are obliged to meet all statutory and legal requirements;
- Offsets must be clearly defined, transparent, measurable and enforceable; and
- Offsets are required to ensure a long-term benefit to the environment

Environmental offsets should only be applied when other mitigating avenues have been exhausted. The mitigation sequence involves the following steps for offset determination:

- Avoidance: Within reason, alternative locations or actions should be investigated to enable significant impacts to be avoided;
- Minimisation: If adverse impacts are unavoidable, all practicable steps should be taken to minimize the impacts;
- Rectification: Where adverse impacts cannot be minimized, action should be taken to repair, rehabilitate or restore the site as soon as possible;
- Reduction: Where action cannot be taken immediately, steps should be taken to repair/restore the impact over time through preservation and maintenance activities throughout the life of the action; and
- Offsets: Where residual negative impacts are still apparent an offsets package can be utilized to achieve a "net environmental benefit".

The TGP will document the proposed offset package in the PER document. It is envisaged that the potential offset strategy for the TGP will be a combination of:

- Direct offsets, such as restoration and rehabilitation; and
- Contributing offsets, such as the establishment of an environmental trust.

Table 10: Options for Key Utilities Considered by the Tropicana Joint Venture. Preferred options are highlighted in orange. The approximate potential impact of each utility option is ranked qualitatively with respect to alternate options for that utility.

Key Environmental Considerations		Communications				Mine Access Road [1]		Water Supply Areas		Power Supply Options				
		Microwave (including service track)	Satellite	Fibre Optic - via Cable Haul (including service track)	Fibre Optic - via Laverton (including service track)	Pinjin	Cable Haul	Minigwal Trough	Officer Basin	Diesel	Gas Pipeline	Gas transported by Road	Wind	Solar thermal
Clearing footprint	Area cleared	Medium	None	Medium	Highest (longer route)	Lowest (approx 366 ha)	Highest (approx 843 ha)	Lowest	Highest (longer pipeline)	Equal lowest	Equal highest	Equal lowest	Medium	Equal highest
Loss or change to Biodiversity Values	Disruption to ecosystem functionality e.g., loss of corridors or keystone species	Medium	None	Medium	Highest	Lowest	Highest (longer route)	Lowest	Highest		Medium		Low	Medium
	Biodiversity loss - impact on threatened species	Medium	None	Medium	Highest	Lowest	Highest	Lowest	Highest		Equal highest			Equal highest
	Introduction or spread of weeds (new or existing)	Medium	None	Medium	Highest	Lowest	Highest	Lowest	Highest			Highest		
	Loss of fauna or fauna habitat	Medium	None	Medium	Highest	Lowest	Highest	Lowest	Highest		Equal highest			Equal highest
Opening up of country	Increased risk of anthropogenic fires	Medium	None	Medium	Highest	Lowest	Highest							
	Increased clearing impacts (e.g. off-track driving by tourists)	Medium	None	Medium	Highest	Equal	Equal				Highest			
	Other increased anthropogenic influences (e.g. increased litter)	Medium	None	Medium	Highest	Lowest	Highest				Highest			
	Feral animal introduction or spread	Medium	None	Medium	Highest	Lowest	Highest	Lowest	Highest		Highest			
Greenhouse	Efficiencies					Best	Worst	Best	Worst		Requires Diesel Back-up	Requires Diesel Back-up	Requires Diesel Back-up	Requires Diesel Back-up
	Transport of fuel to site									Medium	Low	Highest	NA	NA
	Infrastructure requirements (e.g. storage or piping)	Medium	None	Medium	Highest	Lowest	Highest	Lowest	Highest	Medium	Highest	Medium	Lowest	Medium
	Greenhouse footprint					Lowest	Highest			Highest	Medium	High	Low	Low
Sustainability	Natural topography - flooding/droughts	Medium	None	Medium	Highest	Lowest	Highest				Highest			
	Economics	Medium	Medium	Medium	Highest	Lowest	Highest	Lowest	Highest	Low	High	Medium	High	High
	Availability of locally sourced inputs including labour and materials	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No
Future opportunities	Sandalwood resource				Highest opportunity		Highest opportunity							
	Comment	Towers required either between Tropicana and Kalgoorlie or Laverton	Not suitable for Remote Control applications	Most direct route from existing fibre optic line	Significant number of stakeholders along proposed route	Most direct route	Synergy option with communication system	Water quality between 35,000 - 70,000 mg/l TDS	Better water quality, higher pumping requirements	Existing technology, but high operating cost and significant greenhouse implications	Connection possible, supply not guaranteed	Currently only one location in WA producing LNG, supply limited	Does not guarantee 24 hr power supply, requires diesel back-up	Untried technology off grid, requires diesel back-up
	Preferred	**No**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Back-up supply**	**No**	**No**	**No**	**Yes**

1: Disturbance considered includes modification to existing roads

Table 11: Options Considered for Key Infrastructure at the Operational Area. Preferred options are highlighted in orange. The approximate potential impact of each option is ranked qualitatively with respect to alternate options.

Key Environmental Considerations		Mining Technology		Method/ Position of Tailings Storage Facility (TSF)				Position/Method of Waste Rock Disposal			Position of Airstrip		Position of Village		
		Underground mining	Open pit mining	Dune TSF	Stand alone Central Tailings Disposal (CTD)	Stand alone paddock	Integrated Waste dump TSF	Inpit	Surface Waste Rock Landform (WRL)	Combination of inpit and surface WRL	North, near proposed Quarry	Current location	NW of Processing Plant	Central option	Southern option
Clearing footprint	Area cleared	Lowest	Highest	Equal lowest (approx 240ha)	Highest (approx 350 ha)	Equal lowest (approx 240ha)	Equal lowest (approx 240ha)	No additional clearing	Highest	Medium	Highest	Lowest			
Loss or change to Biodiversity Values	Disruption to ecosystem functionality e.g., loss of corridors or keystone species	Lowest	Highest	Highest	Medium	Medium	Lowest	NA	Highest	Medium		Lowest	Medium	Medium	Medium
	Biodiversity loss - impact on threatened species	Lowest	Highest	Highest	Medium	Lowest	Lowest	NA	Highest	Medium			Medium	Medium	Medium
	Introduction or spread of weeds (new or existing)														
	Introduction of disease/ pathogen														
	Loss of fauna or fauna habitat	Lowest	Highest	Highest	Medium	Medium	Lowest	NA	Highest	Medium					
Greenhouse	Efficiencies				Worst		Best			Medium	Best	Worst		Worst	
	Interrelationships of infrastructure e.g. processing plant, pit void							Lowest	Highest	Medium	Lowest	Highest	Medium	Low	Medium
	Greenhouse footprint	Lowest	Highest	Medium	Highest	Medium		Lowest	Highest	Medium	Lowest	Highest		Lowest	
	Selection of mining fleet							Lowest	Highest	Medium					
Future opportunities	Accessibility of gold resource - future cutbacks to pit							Poor accessibility	Best accessibility	Medium					
	Accessibility of gold resource - potential for underground						Highest	Poor accessibility	Best accessibility	Medium					
	Sandalwood resource														
Sustainability	Natural topography - flooding/droughts	Lowest	Highest	Equal lowest	Medium	Medium	Equal lowest	Lowest	Highest	Medium					
	Economics	Highest	Lowest					Not viable		Best					
Comment		Resource low grade deposit generally not suitable for U/G. U/G mining only would reduce minable resource		Initially preferred, found to be inhabited by Threatened Species	Bleed water management challenging and rehabilitation cost high	Rehabilitation delayed due to un-consolidated tailings	Avoids long term management of the tailings facility	Limits future mining opportunities	Waste dump slope optimized to ensure stability and visual amenity	Provides a balance between minimising footprint and keeping the viability of future mining opportunities		Located on the eastern side of the proposed operation. A separate access track will be required.	Location to be within 4-6km of site to encourage staff to walk to work	Close to the plant and waste dumps, noise and dust will be issues	Close to the SW waste dump noise and dust will be issues
Preferred		**No**	**Yes**	**No**	**No**	**No**	**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**

8. ENVIRONMENTAL STUDIES

In 2006, the TJV commenced investigations to describe the environmental setting of the TGP and to identify potential environmental impacts of exploration and mining activities. As there was little existing knowledge of the area to put the local environment into context, the commissioned surveys have incorporated a wider area than the TJV plans to utilize; for example, vegetation mapping will be completed over an area of approximately 200,000 ha. Surveys commissioned by the TJV are summarized in Table 12 and further detailed in Appendices 1 - 4; results will be reported in the PER. Please note that in this document and the appendices 'threatened' refers to:

- Species or communities protected under State or Commonwealth legislation (the WC Act and the EPBC Act respectively);
- Species or communities recognized under the Department of Environment and Conservation (DEC) Priority scheme; or
- Other species that are new to science, or previously undescribed, or at the periphery of their known distribution, or have been identified as a range extension during the TJVs surveys.

With regard to flora and fauna surveys, initially, general surveys (e.g., flora inventory, vegetation mapping and general vertebrate trapping) were commissioned. These surveys recorded evidence of all species when they were observed, whether common or threatened. Further surveys targeted to various threatened species were commissioned where appropriate (e.g., *Conospermum toddii* and Sandhill Dunnarts), particularly in the case of species for which standard sampling methodology was inappropriate (e.g., Southern Marsupial Mole).

Table 12: Environmental Investigations Commissioned.

(Note that in most cases field surveys have also involved desktop assessments).

Subject	Operational Area	Pinjin Option	Cable Haul Option	Minigwal Trough
Landscape Assessment	Desktop – Great Victoria Desert			
Hydrology	Field Survey	Desktop	Desktop	
Hydrogeology	Field Survey	Desktop	Desktop	Field Survey
Soil and Regolith	Field Survey			
Soil Water Erosion Study	Laboratory and Computer Modeling			
Soil Wind Erosion Study	Laboratory and Computer Modeling			
Geochemical (waste)	Field Survey			
Flora and Vegetation	Field Survey	Field Survey	Field Survey	Field Survey
Vertebrate Fauna	Field Survey	Field Survey	Field Survey	Field Survey
Threatened Species (targeted surveys)	Field Survey	Field Survey	Field Survey	Field Survey
SRE Invertebrate Fauna	Field Survey			
Stygofauna	Field Survey			Field Survey
Troglofauna	Field Survey			
Indigenous Archaeology	Field Survey	Field Survey	Field Survey	Field Survey
Indigenous Ethnography	Field Survey	Field Survey	Field Survey	Field Survey
European Heritage		Desktop		

Assessments yet to be commissioned, but which will be completed prior to the submission of the PER include air quality assessments, greenhouse gas assessment, and assessments relevant to the eventual rehabilitation of the disturbance zones of the TGP (Appendix 5).

9. REHABILITATION

The TGPs life is expected to be 10 -15 years. In the event that all or part of the infrastructure is no longer required by the TJV or another party, the unused facilities will be decommissioned and the site rehabilitated to return the environment to as close to its original state as possible. A conceptual mine closure plan will be developed for decommissioning and rehabilitation of the project and this will be presented in the PER documentation. This closure plan will include information on progressive rehabilitation of areas as they become decommissioned / available for revegetation and present draft completion criteria against which the progress of the rehabilitation can be assessed.

Successful rehabilitation will require trials and ongoing monitoring to assess the effectiveness of the methodology and to undertake remedial works if required. This may include repair of eroded areas, weed control, and seeding or planting of areas where vegetation has not established from natural seed sources in the topsoil / sand applied to

rehabilitated areas. Several of the surveys detailed in Appendices 1 and 5 will provide information relevant to the rehabilitation and closure of the TGP including:

- Characterization of soil and regolith material;
- Characterization of the geochemical properties of waste rock; and,
- Erodability of sands and waste rock.

10. PROJECT AND ASSESSMENT SCHEDULE

The anticipated milestones for the EIA process for the TGP are shown in Table 13.

Table 13: Anticipated Key Milestones for the Tropicana Gold Project.

Milestone	Anticipated Date
Draft ESD submitted to EPA	Early December 2008
Draft ESD considered by EPA	EPA meeting 22 January 2009
Final ESD submitted to EPA	25 February 2009
Final ESD endorsed by EPA	18 March 2009
Draft PER submitted to EPA and DEWHA	March 2009
PER approved for public comment	May 2009
Public comment period ends	July 2009
TJV finalize response to public comments and submits to EPA	August 2009
EPA report is released	November 2009
Ministerial Approval	First Quarter 2010
Other approvals (e.g., mining and water extraction)	The majority of approvals are dependent on EPA/ Ministerial approval of the TGP. Documentation for other approvals will proceed in tandem with EIA documentation, for submission immediately following the anticipated approval of the TGP.
Construction commences	First Quarter 2010

11. STUDY TEAM

A number of specialists have been engaged by the TJV to conduct environmental surveys and assist in the preparation of this ESD and the ensuing PER. The team consists of:

- 360 Environmental –
  - Compilation of referral, ESD and PER documentation; and
  - Support to Environmental Manager
- Surveys and Studies:
  - Artefaxion;
  - Botanica Consulting;
  - *ecologia* Environment;
  - GHD;
  - Hocking Planning and Architecture;
  - Landloch;
  - Mattiske Consulting;
  - MBS;
  - Ninox Wildlife;
  - Outback Ecology;
  - Pennington Scott;
  - SRK Consulting;
  - Subterranean Ecology;
  - URS;
  - Waru;
  - Independent Consultants –
    - Dr Joe Benshemesh;
    - Jeff M. Turpin;
    - Glen Gaikhorst and Cathy Lambert; and
    - Dr Barrie Machin and Wayne Glendenning.

Other specialists may be engaged for expert input as the studies progress.

12. PEER REVIEW

The TJV recognizes the importance of accurate and detailed technical assessments in the overall EIA process. A panel of community representatives and experts in the mining and / or environmental disciplines has been established to guarantee and provide opportunities to improve the quality of environmental documentation. The ESD has been the subject of review by the Peer Review Panel. In addition, the Peer Review Panel has / will provide support to the project team through the provision of expert input where required, peer review of documents associated with the environmental approval process and the provision of feedback through stakeholder engagement opportunities. The Peer Review Panel will review the draft and final PER document.

The following people are assisting with the review process:

- Kingsley Dixon – Botanical Garden Authority;
- Jonathan Majer – Curtin University of Technology;
- Tony van Merwyk – Freehills;
- Stephen Tonkin – Shire of Menzies; and
- Gail Reynolds-Adamson – Community Representative.

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APPENDIX 1: Environmental Surveys Commissioned for the Tropicana Gold Project. Further details of the scope and perceived limitations of the flora, vegetation and fauna surveys are provided in Appendix 2.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Physical Environment						
Landscape Assessment	Great Victoria Desert	GHD	Desktop	Assessment commenced in 2007	Draft	GHD were commissioned to prepare a high level and broad based assessment of the landscape across the Operational Area to better place into context landscape and environmental elements identified at Tropicana. The study was aimed to identify potential impacts at the regional scale and provide input into the development of broader environmental management strategies for the TGP.
Soil and Regolith	Operational Area	Outback Ecology	Field Survey	Assessment commenced in 2007	Final Draft	A baseline characterisation study of soils and regolith materials from aircore (AC) drilling samples was conducted at the Operational Area. The aim of the survey was to develop a greater understanding of the soil and regolith materials to enable potentially problematic materials to be identified and to provide recommendations for managing soils / regolith materials for optimum rehabilitation outcomes. AC drilling samples to a depth of 9m at 45 locations were used for the analysis which was undertaken by CSBP Soil and Plant Laboratories.
Soil Water Erosion Study	Operational Area	Landloch	Laboratory and Computer Modeling	March – October 2008	Draft	The report outlines the potential runoff and associated erosion impact from the waste dumps proposed for the TGP. Soil samples were taken from the surface and subsurface horizons to enable particle size distributions analysis and infiltration measurements.
Soil Wind Erosion Study	Operational Area	Landloch	Laboratory and Computer Modeling	Report dated October 2008	Draft	The aim of this study was to determine the risk associated with the wind erosion of dune sand used during the restoration of the TGP area. The approach adopted to assess the likelihood of wind erosion at the Operational Area and to provide guidance on strategies to manage and mitigate the impacts of wind erosion involved: 1. An assessment of important characteristics of Quaternary aeolian sands at the site; 2. Determination of the threshold wind velocity required to initiate wind erosion of those sands; and 3. Use of wind data for the area to assess the likelihood of wind erosion occurring from an unvegetated surface.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Geochemical	Operational Area	SRK Consulting	Static and Kinetic Testing	Oct 2007 – ongoing	Draft	The aim of the geochemical survey was to establish the acid generating potential of selected diamond drill (DD) core and reverse circulation (RC) samples from the Operational Area. The samples were analysed for pH, electrical conductivity, sulfate sulphur content, carbon content, acid-base accounting test work, net acid generation test work and multi-element analysis. Two rounds of static testing and one round of kinetic testing to date have been undertaken to date.
Hydrology and Hydrogeology						
Hydrology	Operational Area	GHD	Desktop with a 2 day site visit	Report dated September 2008	Draft	The general objective of the surface water study was to review the impact of the proposed TGP and associated mine infrastructure on existing hydrology and to characterise flood risk for the open pit. A concept stormwater management plan for the site was developed. The work was undertaken as a desktop review with a 2 day site visit and the analysis was based on information provided by AngloGold and readily available topographic details.
Hydrology	Operational Area	URS	Desktop	Report dated August 2007	Draft	A desktop assessment was undertaken to determine the surface water drainage regime in and around the TGP area. Drainage lines that may influence the development of the mine site were identified and catchment areas estimated using a digital elevation model (DEM) geological data and aerial photography.
Hydrology	Pinjin and Cable Haul Mine Access Road Options	GHD	Desktop	Report dated October 2008	Draft	The objective of the surface water evaluation for the Mine Access Roads was to review the the impact of new sections of the proposed mine access roads on existing hydrology. A concept stormwater management plan for the access roads was developed. The work was undertaken as a desktop review based on information provided by AngloGold Ashanti and on readily available topographic information. The evaluation was limited to the new sections of the proposed mine access roads.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Hydrogeology	Operational Area	Pennington Scott	Field Assessment	May 2008-December 2008	In progress	A hydrogeological assessment for the TGP Operational Area to determine potential groundwater volumes, yields and potential drawdown impacts from mine dewatering activities. Assessment utilises monitoring and production bore data from over 100 bores within the proposed resource area. An indicative mine site water balance will be produced.
Hydrogeology	Minigwal Trough	Pennington Scott	Field Survey	October 2007 and September 2008	Draft	Water investigations for the Minigwal Trough, the preferred water supply area for the TGP, included a literature review, airborne TDEM using Rep TEM system, drilling 9 RC holes of 230 m depth to define geometry of the sandstone aquifers, drilling and testing eight mud rotary test production water bores and two observation water bores to between 250 and 350 m depth, hydro-chemical analysis of groundwater samples and numerical simulation of borefields development and impacts.
Flora and Vegetation						
Flora and Vegetation Assessment	Operational Area	*ecologia* Environment	EPA Guidance 51 - Level 2	November 2006, June 2007 and July 2007	Draft	The survey methods used by *ecologia* were based on the Environmental Protection Authority's Guidance Statement 51 and on consultation with staff at the Department of Environment and Conservation (pers. comm. Wendy Thompson 2006). The field surveys involved quadrat-based and opportunistic floristic sampling and targeted rare flora and declared weed surveys. A total of 137 survey quadrats were sampled.
Threatened Flora Survey	Operational Area	*ecologia* Environment	Targeted to threatened species	August 2005, July 2006, October 2007 & July 2008, November 2008	Draft	A threatened species survey of 23 sand dunes within the proposed TGP operational area was conducted in spring 2007 to determine the location and numbers of plants of any populations of the DRF *Conospermum toddii.* In addition, the location and number of any other conservation significant flora species populations were also recorded. No EPA guidelines currently exist for threatened flora

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
						species surveys, however the known habitat of *Conospermum toddii* was targeted in this survey (sand dunes) and foot traverse surveys were conducted along each sand dune zigzagging from crest to swale of dune on both the north and south facing slopes covering approximately 23km of linear sand dune. Targeted flora surveys focusing on resource definition drilling areas has also been undertaken previously (August 05 & July 06), possible DRF habitat (October 07) and infrastructure areas (July 08). Each survey involved walking transects that varied from 100 – 500 m spacings. Scope and methodology used was developed in consultation with Goldfields DEC in 2005.
Flora and Vegetation Assessment	Pinjin Option	Mattiske Consulting	EPA Guidance 51 - Level 2	December 2007, March 2008 and May 2008	Draft	The aim of these surveys was to define the flora and vegetation values of the proposed Pinjin Access Road and Infrastructure Corridor from the proposed Operational Area to Pinjin Station, a distance of approximately 220 km. The flora and vegetation was sampled systematically at each survey site in accordance with EPA guidance Statement No 51 and extensive targeted searches for the DRF *Eucalyptus articulata* were undertaken within potential habitat for this species.
Flora and Vegetation Assessment	Cable Haul Option	*ecologia* Environment	EPA Guidance 51 - Level 1	July - August 2007	Draft	A single phase baseline survey of the flora and vegetation along the proposed access road corridor was conducted in winter 2007. The aim of the survey was to determine the potential impacts of the proposed road on the vegetation and flora of the proposed road corridor. The survey was developed to meet EPA Guidance Statement No 51 requirements and included a detailed site assessment of 20 x 20 m quadrats, less detailed assessments along transects and broad-scale vegetation mapping. 114 quadrats and 59 transects were surveyed along the road corridor.
Flora and Vegetation Assessment	Minigwal Trough	Botanica Consulting	EPA Guidance 51 - Level 1	November and December 2008	Draft	A single phase baseline survey of the flora and vegetation within the preferred water supply area and pipeline corridor was conducted in Spring 2008. The aim of the survey was to determine the potential impacts of the water supply area and pipeline on the vegetation and flora of the area. The survey was developed to meet the EPA Guidance Statement No 51 requirements and included a detailed site assessment of 50 x 50 m quadrats, less detailed assessments along transects and broad-scale vegetation mapping. 54 quadrats were surveyed.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Flora and Vertebrate Fauna Assessment	Gas Pipeline Options	360 Environmental	Desktop	Report dated August 2008 (desktop only)	Draft	A desktop assessment for flora, fauna and ecological communities of conservation concern was conducted along two potential gas pipeline alignments. Regional vegetation types, landforms and soil types were also described to provide a broad setting of the alignments. The survey aim was to identify potential environmental constraints to enable the TJV to make an informed decision on an appropriate power supply for the TGP.
Conservation Significant Species (Flora and Fauna)	Operational Area	MBS	Desktop	Report dates September 2008 (collation of existing reports)	Draft	This report provides an overview of all the conservation significant species surveys conducted to date for the TGP and provides comment on the potential impact of the proposal on those species. A residual risk assessment for conservation significant species has also been undertaken for the TGP and is outlined in this report.
Flora and Vertebrate Fauna Assessment	Officer Basin	360 Environmental	Desktop	September 2008	Draft	A desktop assessment for flora, fauna and ecological communities of conservation concern was conducted within the proposed Officer Basin water supply area. Regional vegetation types, landforms and soil types were also described to provide a broader environmental setting. The aim of the survey was to ensure environmental constraints were identified to enable the TJV to determine an appropriate water supply area for the TGP with minimal environmental impact.
Vertebrate Fauna						
Vertebrate Fauna Assessment	Operational Area	*ecologia* Environment	EPA Guidance 56 - Level 2	October-November 2007 and March 2007	Draft	A two phase fauna survey was conducted during spring and autumn with the aim of providing an inventory of the fauna species and fauna habitats occurring in the TGP study area. The methodology was developed in accordance with the EPA Position Statement 3 and EPA Guidance Statement No 56 and was confirmed by Nick Woolfrey, Mark Cowan, John Dell and Karl Brennan from DEC. Ten trapping sites were established during Phase 1 and were re-sampled during Phase 2. Pit traps, Elliot box traps, funnel traps, cage traps, ANABAT detectors and opportunistic methods were adopted. During Phase 2 additional methodology was developed in consultation with Glen Gaikhorst and Cathy Lambert for the Sandhill Dunnart (SHD) and Dr Joe Benshemesh for the Southern Marsupial Mole (SMM). Two additional sites for the SHD and four additional sites for the SMM were established during Phase 2. Glen Gaikhorst also visited the two SHD trap sites to undertake a habitat assessment.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Threatened Fauna (Malleefowl and Mulgara)	Operational Area	URS	Targeted to threatened species	April 2008 and August 2008	Draft	URS conducted a baseline presence assessment of Malleefowl using survey methods consistent with DEC requirements and Malleefowl survey protocol (National Heritage Trust, 2007). Survey methodology included a road system that traversed the study area searching for fresh tracks and a foot transect survey searching for nest mounds. The Mulgara survey involved identifying burrows, diggings, scats and tracks of the Mulgara. Predator scats were also collected.
Threatened Fauna (Sandhill Dunnart)	Operational Area and Pinjin Option	Gaikhorst and Lambert	Targeted to threatened species	March 2008 and May 2008	Draft	Two experienced Zoologists Glen Gaikhorst and Cathy Lambert with extensive knowledge on the Sandhill Dunnart and the Great Victoria Desert conducted a study to identify the presence of the Sandhill Dunnart with the Operational Area and preferred access road. The survey included desktop assessment, targeted trapping program and opportunistic observations. The aims of the survey were to identify suitable habitat for the SHD, conduct trapping in suitable habitat, provide recommendations to minimise potential impacts of the SHD from the TGP and identify any additional survey requirements. 29 sites were assessed, 14 of which were the subject of a targeted trapping survey for SHD (Elliot and pit fall trapping).
Vertebrate Fauna Assessment	Pinjin Option	Ninox Wildlife Consulting	EPA Guidance 56 - Level 1	December 2007 and March 2008	Draft	A level 1 reconnaissance survey along the proposed Pinjin access route in accordance with EPA Guidance Statement No 56 was conducted in Summer 2007 and Autumn 2008 for vertebrate fauna. The aim of the survey was to assess the significance of the vertebrate fauna and their habitats along the proposed access route between Pinjin and the Operational Area, covering an area of approximately 600ha.
Vertebrate Fauna Assessment	Pinjin Option	Jeff Turpin	Incidental observations	February 2008 and March 2008	Draft	Opportunistic fauna assessment was conducted as part of an archaeological survey of the Pinjin area. The field survey included foot traverse along transects within the proposed Pinjin access road and all fauna sighted as well as scats, tracks and shelter identified in the field were recorded. Each fauna habitat encountered along the route was assessed for its suitability to support conservation significant species.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Threatened Fauna (Southern Marsupial Mole)	Pinjin Option	URS	Targeted to threatened species	November 2007, March 2008 and April 2008	Draft	URS conducted a study to determine the presence of the Southern Marsupial Mole along the proposed Pinjin access route. The primary objective of the study was to determine whether the mole occurs within potentially suitable habitat along the proposed access road alignment through desktop assessment, testing soil compaction using a penetrometer and digging trenches to observe mole holes in accordance with Dr Benshemesh's methodology. A secondary aim was to opportunistically collect predator scats and any observations suggesting the presence of the Sandhill Dunnart, Malleefowl and Mulgara.
Vertebrate Fauna Assessment	Cable Haul Option	*ecologia* Environment	EPA Guidance 56 - Level 1	July-August 2007	Draft	The survey aimed to determine the suitability of habitat to support 12 species of conservation significance with the potential to occur within a 200 m corridor along the proposed Cable Haul Road. Opportunistic searches were undertaken when suitable habitat was encountered. The survey also aimed to determine the impacts of upgrading and developing the Cable Haul road as the main access to the proposed Operational Area on native fauna, particularly conservation significant species. During the survey, SMM trenches at several locations opened during a previous survey (March 2007) were reestablished and monitored.
Threatened Fauna (Southern Marsupial Mole)	Operational Area	*ecologia* Environment	Targeted to threatened species	August 2007 and September 2007	Draft	A targeted survey for the SMM within the TGP and water supply areas and determine the habitat preference of the species within these areas. Survey techniques used were in accordance with Dr Joe Benshemesh and included digging trenches. A total of 273 mole trenches were dug throughout the area.
Threatened Fauna (Southern Marsupial Mole)	Regional	Joe Benshemesh and Martin Schulz	Targeted to threatened species	April - May 2008	Draft	Benshemesh and Schulz conducted a broad area search for evidence of the Southern Marsupial Mole in a vast area around the TGP and adjacent areas within the GVD region. The survey involved 89 trenches at 35 sites and aimed at finding evidence the SMM occurs throughout the GVD region. Soil structure, soil type, soil compaction and vegetation types at each site were recorded. The data collected from this survey was compared statistically with that of a previous detailed survey by Benshemesh in the South Australia portion of the GVD

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Vertebrate Fauna Assessment and Targeted SMM survey	Minigwal Trough	*ecologia* Environment	EPA Guidance 56 - Level 1	March 2008	Draft	A Level 1 fauna assessment was undertaken using a variety of sampling methods including systematic and opportunistic sampling. The aim of the survey was to identify and describe the fauna and fauna habitats found within the survey area and determine the suitability of the habitats to support significant fauna species. In total 26 sites were surveyed. (Note that this report will be combined with the targeted SMM survey for the Minigwal Trough).
Threatened Fauna (Southern Marsupial Mole)	Minigwal Trough	*ecologia* Environment	Targeted to threatened species	Sept 2007 & Jan-Feb 2008	Draft	Targeted surveys for the southern marsupial mole using trenches was undertaken at an additional 41 sites with a total of 123 trenches surveyed. (Note that this report will be combined with the general fauna survey for the Minigwal Trough).
Vertebrate Fauna and Flora Assessment	Gas Pipeline Options	360 Environmental	Desktop	Report dated August 2008	Draft	See *Flora and Vegetation* section, above.
Conservation Significant Species (Flora and Fauna)	Operational Area	MBS	Desktop	September 2008	Draft	This report provides an overview of all the conservation significant species surveys conducted to date for the TGP and provides comment on the potential impact of the proposal on those species. A residual risk assessment for conservation significant species has also been undertaken for the project area and is outlined in this report.
Flora and Vertebrate Fauna Assessment	Officer Basin	360 Environmental	Desktop	September 2008	Draft	See *Flora and Vegetation* section, above.
Invertebrate Fauna – Terrestrial						
Short Range Invertebrate Assessment	Operational Area	*ecologia* Environment	Field Survey Level 2	17th September – 18th October 2006	Draft	A SRE survey was conducted for the TGP area during spring by installing 22 pitfall trap sites (each containing 10 invertebrate pitfall traps) which remained open for 30 days and employing foraging techniques at 46 sites. The survey methodology was developed in consultation with invertebrate experts at the WA Museum and other local experts. Suitable microhabitats were selected for sampling including areas of dense leaf litter, shaded areas beneath dense shrubs, hill tops, rocky outcrops and near water sources. Specimens collected were sent to experts of each invertebrate family for positive identification.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Subterranean Fauna						
Stygofauna Assessment	Minigwal Trough	Subterranean Ecology	Desktop and Field Survey	May 2008	Draft	A detailed literature review and a pilot field survey for stygofauna were undertaken for the proposed Minigwal water supply borefield north of the TGP area. The pilot study aimed at establishing the presence or absence of stygofauna in the bores of the proposed borefield and evaluate the likelihood of stygofauna occurring in the proposed borefield aquifer. The methodology adopted for the pilot study was developed in accordance with EPA Guidance Statement No 54 and involved pump sampling and net hauling.
Stygofauna Assessment	Operational Area	*ecologia* Environment	Field Survey - EPA Guidance Statement 54 and 54a (draft)	September 2007, November 2007 and May 2008	Draft	Twenty one existing bores across the Operational Area and 12 bores from regional areas were sampled as part of this survey. The sampling method involved three steps being 1. initial assessment of the bore condition 2. water chemistry of water bailed from the bore 3. six trawls of stygofauna nets. The survey aimed to provide an inventory of subterranean fauna species occurring in the study area.
Troglofauna Assessment	Operational Area	*ecologia* Environment	Desktop	December 2007	Draft	The aim of the desktop review was to determine whether the geology of the Operational Area is conducive to the formation of subterranean habitat and thus the potential presence of troglofauna. The geology would have to contain cavities or voids in which invertebrate organisms could live, and these cavities would have to be connected throughout the geological profile and also to the surface in order to supply food or energy sources, water and oxygen. The review was undertaken using a variety of published and unpublished data sources. A precautionary approach to interpretation was taken because troglofauna is an emerging area of the Environmental Impact Assessment process in WA and as such, there is currently only scant data available. The review focussed on the geological setting in which known troglobitic fauna from Western Australian and elsewhere are found. In this way the review aimed to compare the geology of the Operational Area with that of known troglobitic habitats elsewhere in order to determine the likelihood of occurrence.

Survey Type	Survey Area	Conducted By	Standard of Survey	Survey Timing	Report Status	Overview of Survey Methodology / Scope
Troglofauna Survey	Operational Area and Surrounds	*ecologia* Environment	Field survey - EPA Guidance Statement 54 and 54a (draft)	Sept to Nov 2007 (Phase 1) and April to June 2008 (Phase 2). Aug to Oct 2008 (Phase 3) Oct to Dec 2008 (Phase 4) Work is ongoing.	Draft	A detailed troglofauna sampling program was conducted with samples being taken both within and outside the Operational Area to enable potential conservation significance and extent of impact by the project on troglobitic species to be determined. In total, 140 drill holes were sampled with 60 located within the project area and 80 outside of the project area in geology considered suitable as troglobitic habitat. Traps were set at three different depths within the RC drill holes and at one level within the narrower AC drill holes. The traps remained open for a minimum of 60 days before collection. Samples were analysed and species identified initially by *ecologia* and confirmed by experts at the WA Museum.
Heritage						
Former Pinjin Townsite European Heritage Survey	Pinjin Option	Hocking Planning and Architecture	Desktop	Report dated June 2008	Final	The Pinjin pastoral area and former townsite was identified through an initial desktop assessment as being a potential European heritage site. As part of the pre-feasibility study for the TGP, the TJV commissioned Hocking Planning & Architecture to conduct a desktop heritage study of Pinjin pastoral area to identify the heritage value of Pinjin. The survey aimed to provide a brief history of the Pinjin mining industry, town and pastoral lease and provide sufficient detail on the heritage value of the area for AngloGold to incorporate into the road alignment design and evaluation process and any potential impact on any identified heritage value will be avoided where possible.
Ethnographic	Operational Area, Pinjin Option, Cable Haul Option, Minigwal Trough	Artefaxion Pty Ltd	Field Survey	From June 2002 to July 2008	Draft	Seven ethnographic surveys have been commissioned for the proposed TGP disturbance areas and surrounds and have followed a model of site identification with the stated objective of finding and recording any sites of ethnographic or historical significance. This document provides an overview of all 7 surveys.
Archaeological	Operational Area, Pinjin Option, Cable Haul Option, Minigwal Trough	Artefaxion	Field Survey	March 2006 – August 2008	Draft	The entire TGP disturbance area has been covered by archaeological surveys commissioned by the TJV. Initial investigations commenced in March 2006 and have been completed in August 2008. All of the field work has been supervised by Joe Mattner to ensure consistency across the project area. The field survey component of the studies included walking transects and inspecting potential key areas where archaeological sites may occur such as rocky outcrops and at the edge of lakes.

APPENDIX 2: Scope of Surveys Commissioned to Date. (See Appendix 3 for the location of sampling sites for Flora and Fauna surveys around the Operational Area).

Operational Area

Target: Vegetation and Flora
Area: Operational Area (and surrounds, approximately 1,356km^2 [135,600ha])
Objective: • Provide an inventory of vegetation types, flora species and species of biological and conservation significance recorded or likely to occur within the project area and surrounds. • A review of regional and biogeographical significance, including the conservation status of species recorded in the project area. • A risk assessment to determine likely impacts of threatening processes on vegetation and flora.
Consultant: *ecologia*
Timing: • November 2006 • June 2007 • July 2007
Survey Effort: • 34 days over three months. • 89 quadrats (20m x 20m or 400m^2 in communities that were narrow) in 2006, focusing on the Operational Area. • 74 quadrats (20m x 20m or 400m^2 in communities that were narrow) in 2007, of which 49 had previously been sampled in 2006. • Opportunistic sampling to identify species not present in the quadrats, and to define the edges of vegetation communities.
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 51 (Level 2). • Quadrat locations were selected on the basis of aerial photography, topographical features and field observations such that the array of vegetation types was represented. • At each quadrat the following was recorded: o comprehensive list of flora species o vegetation types, life-form strata and percentage cover of individual species o surface soil type and litter cover o fire history and other disturbances. • Data collected from quadrats was analyzed using the multivariate program SYSTAT™, using both presence / absence and cover-weighted records with Pearson complete linkage analysis to produce dendrograms showing the similarities between sites and to classify the vegetation types present. • Vegetation types were mapped at a scale of 1:25,000. • Documented voucher specimens of all flora of conservation significance will be lodged with the WA Herbarium.
Consultation/Guidance: • Consultation with regional DEC staff (Wendy Thompson).
Limitations: • Limited data available for regional context. • Access to some areas outside of the Operational Area was constrained by lack of vehicle tracks. Quad bikes were used to improve access and though still less comprehensive than elsewhere in the survey area, all vegetation types, as assessed by aerial photography, were accessed. • A significant proportion of the survey area has been subject to recent (i.e. within the last five years) fire, particularly in the south western portion, which influenced interpretation of the aerial photography and statistical analysis of vegetation communities.

Target: Terrestrial Vertebrates

Area: Operational Area

Objective:

- Provide an inventory of fauna species and fauna species recorded or likely to occur within the project area and surrounds.
- A description of fauna habitat.
- A review of regional and biogeographical significance, including the conservation status of species recorded in the project area.
- A risk assessment to determine likely impacts of threatening processes on fauna within the study area.

Consultant: *ecologia*

Timing:

- October – November 2006
- March 2007
- March 2008.

Survey Effort:

Ten survey sites were established within the Operational Area, and sampled during both 2006 and 2007. Replication of sites was determined such that variation within each major habitat type was captured. An additional eight sites were sampled in 2008, focusing on the areas of greatest impact for the TGP. In total, the following minimum sampling effort was carried out:

- 2800 pitfall trap-nights
- 4600 funnel trap-nights
- 5600 Elliot trap-nights
- 560 cage trap-nights
- 80.6 hours opportunistic searches
- 67.9 hours head-torching/ spotlighting
- 86.3 hours Anabat recording
- 71.3 hours bird surveys.

Methodology:

- Compliance with Environmental Protection Authority Guidance Statement 56 (Level 2).
- Sites were selected to correspond with major vegetation communities and landforms present within the Operational Area, and to correspond with main areas of impact (e.g., the pits).
- The survey was undertaken using systematic and opportunistic sampling.

Systematic Sampling

Mammals and vertebrates

- Pitfall traps and drift fence: Five PVC pipe (16 cm diameter, minimum 50 cm deep) and five 20 L plastic buckets (30 cm diameter, 40 cm deep) were established at each site. A six metre flywire drift fence (30 cm high) bisected the pits, directing fauna into the traps.
- Elliot box traps: Twenty medium sized Elliot box traps (9 x 9 x 32 cm) were placed at each survey site, and baited with a mixture of peanut butter, rolled oats and sardines.
- Funnel traps: Funnel traps (Ecosystematica Type III) were placed in association with drift fences. Ten funnel traps were used per site during the 2006 survey with traps being placed at the end of the drift fence. Twenty traps were used per site during the 2007 and 2008 surveys, with each trap being placed parallel to the drift fence.
- Cage traps: Two baited traps were used per site with one trap placed at each end of the trap line.

Avifauna

- Set-time (20 minute) / set area (2 ha) surveys were used to document the avifauna present at each of the sampling sites.
- Survey effort was concentrated between the post-dawn (06:00-09:00) and pre-dusk (15:00- 18:00) time periods, as these are deemed to be the optimal time to record most bird species. However, surveys were also carried out at other times to sample diurnal species (e.g., raptors)

Bats

- Bat echolocation calls were detected using an ANABAT II system. The transformed calls were stored on Minidiscs and played back onto a PC for analysis.
- Mr Bob Bullen identified acoustic calls.
- Acoustic calls were recorded at each of the survey sites and opportunistically throughout the project area.

Opportunistic Data

Spotlighting

- The general area was searched at night using a combination of road transects using vehicle-mounted spotlights and opportunistic ground searches using head torches and hand held spotlights for nocturnal species, such as geckos, snakes and nocturnal birds.

Hand Searching

- Opportunistic sites were hand searched for cryptic species, which comprised searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows and recording tracks, diggings and scats, and over-turning logs and stones.
- Sites were selected on the basis of their representative nature of the study area, and also based upon whether they were well represented by the systematic trapping effort.

Secondary Evidence

- Tracks, diggings, scats, burrows and nests were recorded where possible.

Opportunistic Sightings

- The presence of species was recorded while searching, travelling and during trap establishment within the study area during the day and night.

Consultation/Guidance:

- Birds Australia Atlas Project.
- Fauna species potentially occurring in the area and survey methodology was discussed (either in meetings or in written correspondence) with the following people:
  - David Pearson (10/03/08)
  - Nicholas Woolfrey (23/02/07)
  - Mark Cowan (16/02/07)
  - Karl Brennan (19/02/07)
  - Kellie Mantle (13/02/07)
  - Pia Courtis (04/07/07)
  - Wendy Thompson (04/07/07)
  - Brad Maryan (22/02/07 and 17/06/07)
  - Glen Gaikhorst (08/03/07)
  - Joe Benshemesh (27/02/07)
- The above list refers to formal consultation only, other discussions regarding survey technique, results and targets have occurred over the course of the surveys.

Limitations:

- Little contextual information is available for the region.
- To enable sites to be checked as early as possible each day, sites were located close to access tracks. Consequently, large areas within the eastern section of the survey area which were inaccessible were not surveyed using systematic methods (note that the entire Operational Survey area was accessible and therefore was surveyed).

Target: Short Range Endemic Invertebrates

Area: Operational Area

Objective:

- Provide an inventory of Short Range Endemic (SRE) fauna species occurring in the study area, incorporating recent published and unpublished records
- A review of regional and biogeographical significance, including the conservation status of species recorded in the project area.
- A risk assessment to determine likely impacts of threatening processes on SRE fauna within the study area.

Consultant: *ecologia*

Timing:

- September - October 2006.
- April - September 2008.

Survey Effort:

2006

- 30-day wet-pitfall-trapping program in conjunction with extensive foraging:
  - 22 pitfall sites in and around the Operational Area
  - 25 pitfall sites outside the disturbance footprint
  - Each site comprised 10 pitfall traps and approximately 30 minutes (per person) of targeted foraging was spent at each trapping site.

2008

- Wet pitfall-trapping for a total period of six months.
- Sites and methodology as above. Note that targeted foraging was carried out once per site in April only.

Methodology:

- Each pitfall trapping site consisted of 10 wet pitfall traps. Each trap consisted of a two-litre container, containing 1 L of trapping solution (ethylene glycol 30%: Formaldehyde ca 4%). To minimise the chance of vertebrate by-catch, each trap is roofed with a plastic lid positioned 3 cm above the soil surface and weighed down with rocks and/or branches.
- Both surveys incorporated wet pitfall trapping and active foraging to record species that are usually not collected using pitfall traps alone (e.g., pseudoscorpions and female trapdoor spiders).
- After retrieval, specimens were grouped in *ecologia's* invertebrate laboratory and SRE species were provided to relevant experts for identification.

Consultation/Guidance:

- The survey methods adopted by *ecologia* have been developed in consultation with senior Western Australian Museum (WAM) staff and other local experts.
- DEC Environment Management Branch.

Limitations:

No significant limitations other than a general lack of contextual information for the region.

Target: Stygofauna
Area: Operational Area
Objective: • Provide an inventory of Subterranean fauna species and subterranean species of biological and conservation significance occurring in the study area. • A description of the characteristics of the faunal assemblage • An appraisal of the current knowledge base for the area, including a review of previous surveys conducted in the area which are relevant to the current study.
Consultant: *ecologia*
Timing: • September 2007 • November 2007 • May 2008.
Survey Effort: • Bores: o 21 existing exploration bores were sampled within the disturbance footprint. o 12 bores were sampled outside the disturbance footprint. • Sampling: o 11 bores in September 2007 o 23 bores in November 2007 o 30 bores in May 2008.
Methodology: • Compliance with Environmental Protection Authority Guidance Statements 54 and 54a (draft). • For each bore: o Casing size was recorded (mm) o Standing water level (m) was measured using a dipper. o Water samples were withdrawn using a bailer submerged into the water column to enable physico-chemical parameters to be measured. o The entire water column was dragged a total of six times, using a 50 µm net three times and a 150 µm net a further three times. • Any potential stygobitic species were collected and vouchered to be retained for reference. • Where identifications were beyond *ecologia*'s available expertise, specimens were sent to relevant taxonomic experts.
Consultation/Guidance: • Dr Simon Judd was consulted about the troglobitic isopod collected in one stygofauna sample.
Limitations: • Slotting size of bore casings presented a moderate limitation to the survey and may have affected the results. The majority of bores inside and outside of the disturbance area had casings with slotting size smaller than 3 mm and some had slotting sizes of 1 mm only. The small slotting size may have been accountable for the lack of stygofauna found, particularly with respect to larger stygofauna as they would be unable to penetrate the casing. However, the slotting size does not explain the lack of common microscopic stygofauna (e.g., copepods) for which the slotting size did not present a barrier. Moreover, regional bores sampled outside the disturbance area were relatively old (10+ years) and thus it was assumed that their casings have been slotted manually (as was the practise at the time), resulting in slots larger than 3 mm and thus allowing potential larger stygofauna inside the bore.

Target: Troglofauna
Area: Operational Area
Objective: • To determine the presence of troglofauna in the Operational Area. • To determine the impact of the TGP on troglofuana present in the Operational Area.
Consultant: *ecologia*
Timing: • September - November 2007 • April - June 2008
Survey Effort: • 60 drill holes were sampled within the disturbance footprint • 80 drill holes outside the disturbance footprint.
Methodology: • Compliance with Environmental Protection Authority Guidance Statements 54 and 54a (draft). • 40 drill holes were sampled in September-November 2007. • 100 drill holes were sampled in April – June 2008. • Drill holes had previously been drilled for exploration purposes by reverse circulation (RC) and air core (AC) rigs. • Each RC drill hole contained three traps (80 mm diameter) at approximately ten metre (10 m) intervals (i.e. at 10 m, 20 m and 30 m below ground level). • AC drill holes are narrower and were sampled using one longer, thinner traps (50 mm diameter). These traps were placed at either 10 or 20 m depths depending on the total depth and geology of the hole. • Each trap was filled with damp leaf litter sourced from near each drill hole. The leaf litter was sterilised using a microwave in order to ensure that no contaminates (bacteria or surface invertebrates) could colonise the traps. Traps remained in situ in the drill holes for a 60-day colonisation period. • The contents of each trap were stored in a cool, dry environment prior to processing. • Processing was via Tullgren funnels which use a light / heat source to encourage the movement of invertebrate species out of the leaf litter and into vials of 70% ethanol. • All potential troglofauna were examined and vouchered for future reference. • Initial taxonomic identification was conducted by *ecologia* invertebrate zoologists; troglobitic species have been submitted to experts in WA Museum for taxonomic confirmation.
Consultation/Guidance:
Limitations: No significant limitations other than a general lack of contextual information for the region.

Target: Threatened Flora
Area: Operational Area
Objective: • Provide sufficient information for AGAA to assess the potential impact of the project on the conservation significant flora taxa occurring on the sand dunes of the operational areas, and allow the company to plan activities and infrastructure accordingly.
Consultant: *ecologia*
Timing: • August 2005 • July 2006 • October 2007 • July 2008 • November 2008
Survey Effort: • Compliance with Environmental Protection Authority Guidance Statement 51. • The surveys covered all areas subject to high density exploration drilling (prior to drilling) and 23 sand dunes located in the proposed Operational Area (previous work had indicated that dunes were the preferred habitat for many threatened species, in particular *Conospermum toddii*).
Methodology: • Pre-drilling surveys: o Populations/ individuals of threatened species were identified prior to drilling and disturbance footprints (e.g., drill pads) were altered to avoid sensitive areas. Locations were added to the TJVs threatened species database. • Targeted dune surveys: o Dunes were identified using aerial photography and field observations. o Each dune was traversed on foot by experienced botanists: o Locations of populations or individual plants were recorded by GPS. o The number of plants in each population was recorded.
Consultation/Guidance:
Limitations: No significant limitations other than a general lack of contextual information for the region.

Target: Threatened Fauna – Sandhill Dunnarts

Area: Operational Area

Objective:

- Identify potentially suitable Sandhill Dunnart habitat within a defined area.
- Conduct trapping sessions within identified potentially suitable Sandhill Dunnart habitat.
- Provide recommendations regarding potential impacts of the proposed project on Sandhill Dunnarts.
- Identify any future survey work that may be required.

Consultant: Glen Gaikhorst, Cathy Lambert and *ecologia*

Timing:

- March 2007 (*ecologia*).
- March 2008 (Gaikhorst and Lambert)
- May 2008 (Gaikhorst and Lambert)

Survey Effort:

- *ecologia*:
  - Two trapping sites were established, one (SHD1) approximately 15 km west-south-west of the Tropicana and Havana prospects, at a prospect named "Kamikaze." The second was located in the Rusty Nail prospect (SHD2).
  - SHD1: 180 pit trap nights, 360 medium Elliot box trap nights.
  - SHD2: 140 pit trap nights, 280 medium Elliot box trap nights.
- Gaikhorst and Lambert:
  - Eight sites with potentially suitable habitat
  - Total of 448 pitfall trap nights, 580 medium Elliot box trap nights

Methodology:

- Compliance with Environmental Protection Authority Guidance Statement 56.
- *ecologia*:
  - Each trapping site comprised 20 pit traps (PVC pipes measuring 60 cm in depth and 30 cm in width) located on three 50 m long parallel fence lines (aluminium flywire fencing, 60 cm in height with 40 cm above ground), and 4 lines of 10 medium Elliot box traps located parallel to the fence lines. Elliot traps were spaced approximately 5 m apart.
- Gaikhorst and Lambert:
  - Desktop assessment of aerial photography of the Operational Area was used to identify potential areas of Sandhill Dunnart habitat. These areas were confirmed by field observations.
  - On-ground assessment of areas of potential habitat. Only areas fulfilling the majority of the following three criteria were deemed to provide suitable habitat and were used for the subsequent trapping program:
    - Deep yellow (occasionally orange) sands, ranging from gently undulating sand plains to well defined sand ridges.
    - Vegetation structure: tall mallee (10 - 30% cover), or, tall open mallee (<10%), or, mixed shrubland (10 - 30% cover), or a combination of mallee and shrubland.
    - Presence of dense, compact clumps of Spinifex (at least 10 – 30% cover) which have been unburnt for between approximately 10 and 30 years.
  - Sampling sites were composed of seven pitfall traps (60 cm deep) spaced at seven metre intervals along a 50 m fly-wire fence (approximately 30 cm high) and up to 20 medium Elliott box traps set at five metre intervals along the drift fence on both sides.

Consultation/Guidance:

- Survey methodology was discussed with David Pearson (DEC – Science; 10/03/08)

Limitations:

No significant limitations other than a general lack of contextual information for the region.

Target: Threatened Fauna – Southern Marsupial Mole (SMM)
Area: Operational Area
Objective: • To assess the abundance of the Southern Marsupial Mole (SMM) underground by trench survey techniques. • Examine environmental features in relation to the abundance of the SMM • Discuss the conservation status and threats to the SMM in regard to the data collected.
Consultant: *ecologia,* Joe Benshemesh
Timing: • August 2007 (*ecologia*) • September 2007 (*ecologia*) • April – May 2008 (Joe Benshemesh)
Survey Effort: • *ecologia:* 91 sampling sites (total 273 trenches). • Benshemesh: 35 sampling sites comprised of up to three trenches (total 89 trenches). Note that this survey aimed to sample the western portion of the Great Victoria Desert and thus provides regional context for the TGP rather than a specific survey within the project's disturbance areas.
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 56. • *ecologia's* targeted SMM surveys were undertaken according to *Manual for Marsupial Mole Survey and Monitoring by Trenches* (Benshemesh 2005). • In brief: o Sampling sites were located throughout the Operational Area and surrounds. o Trenches were dug with dimensions 120 cm long by 80 cm deep by 40 cm wide. o On dunes, trenches were dug on the north facing slope, running in an east-west direction to maximise exposure to the sun and therefore speed drying time. o Trenches were inspected for evidence of moles after five days of drying time.
Consultation/Guidance: • Benshemesh J. (2005) Manual for Marsupial Mole Survey and Monitoring by Trenches. Version 1.0. Report to Anangu-Pitjantjatara Land Management and the Department of Heritage and Environment (SA). March 2005. • Survey methodology was discussed with David Pearson (DEC – Science; 10/03/08) and Joe Benshemesh (27/02/07). Joe Benshemesh also inspected the work of *ecologia* while on a site visit in July 2008.
Limitations: During *ecologia*'s second survey, the mole trenches were left open to dry for four days prior to checking. On the evening prior to checking, however, there was some light rainfall which may have served to obscure or obliterate evidence of moleholes in the trench wall.

Target: Threatened Fauna – Mulgara and Malleefowl
Area: Operational Area
Objective: • To determine whether the Malleefowl and Mulgara are likely to occur within the Operational Area. • Opportunistically collect information on the SMM through the collection of predator scats. • Record information on conservation significant fauna species and any potentially suitable habitat observed.
Consultant: URS
Timing: • April 2008
Survey Effort: • 8 days • 35.9 km of road survey, route designed to traverse as much of the survey area as possible as well as bisecting prospective Malleefowl habitat and traversing through a range of plant communities representative of the vegetation within the greater area. • Walked searches in areas of potential habitat
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 56. • Desktop assessment of aerial photography to identify areas of potentially suitable Malleefowl or Mulgara habitat. • Additional areas of potential habitat were identified and surveyed during the field visit. • Road traverses and foot traverses were undertaken throughout the Operational Area to identify tracks and Malleefowl mounds. In brief: o The field team 'cleared' the designated roads of fauna tracks using a tyre grader dragged behind a 4WD vehicle. The clearing removed most previous signs of animal tracks (foot / paw prints) and vehicles from the road. o During the initial clearing, the location of any Malleefowl or other interesting tracks were recorded using a GPS. In the following three mornings, the field team traversed the same roads to identify any tracks (including introduced predator) that had been made on the road since the previous road clearing. o Once a track had been recorded, all tracks for the next 200 m made by the same species were ignored before the visual identification survey process began again. o Foot transects were conducted by URS field staff at several sites determined to be potential habitat for Malleefowl or Mulgara (e.g., exhibiting overstorey vegetation that was dominated by Mulga, or contained vegetation that was deemed to be dense enough to provide material for nesting purposes). Foot transects were generally conducted for periods of one to three hours, and covered a corridor of approximately 60 m around the extremity of the search areas.
Consultation/Guidance: • Methodology for the Malleefowl survey was consistent with the *National Manual for the Malleefowl Monitoring System: Standards, Protocols and Monitoring Procedures* (National Heritage Trust, National Malleefowl Monitoring Project 2007). • *National Manual for the Malleefowl Monitoring System: Standards, Protocols and Monitoring Procedures* (National Heritage Trust 2007). Pia Courtis and Wendy Thompson were contacted for information on the location of Malleefowl mounds in the vicinity of the Operational Area • The approximate age of Malleefowl mounds was determined according to categories defined by Dr Mike Bamford.
Limitations: Further targeted surveys are recommended prior to land disturbing activities.

Target: Hydrology
Area: Operational Area
Objective: • Undertake a hydrological investigation to determine what effect the TGP will have on the surface water regime of the area.
Consultant: URS and GHD.
Timing: • Timing is not critical to the results.
Survey Effort: The literature review used data and descriptions from the following sources: • Australian Rainfall and Runoff (2001). • American Society of Civil Engineers (1996) • Bureau of Meteorology (2007), http://www.bom.gov.au/climate/ • Various reference books and scientific / environmental articles on the area.
Methodology: The hydrological investigation comprises the following: • Collection and Evaluation of hydrological data and defining surface water runoff regimes. • Undertake a Flood risk assessment. • Identification of areas affected by flood risks. • Identification of potential environmental impacts. • Assessment of potential for surface water harvesting and water resource development. • A concept stormwater management plan for the site was developed.
Consultation/Guidance: • Department of Water
Limitations: No site visit was carried out.

Target: Materials Characterization - Potential for acid drainage and metal leaching
Area: Operational Area, in particular proposed tailings, waste rock, stockpiled ore and pits within both the Tropicana and Havana regions.
Objective: To provide an assessment of the potential for acid drainage and metal leaching associated with the tailings, waste rock, low grade stockpiled ore and the pit: • Determine the implications of the materials characteristics on effluent from the waste rock, dumps, tailings dam, low and high grade stockpiles and pit walls. • Develop recommendations for design of the waste rock dumps, tailings dam, low and high grade stockpiles and pit walls. • Identify any remaining unresolved issues so as to confidently plan for the management of wastes and any potential acid drainage related issues.
Consultant: SRK Consulting
Timing: • Phase One : July 2007 –September 2007 • Phase Two: September 2007- February 2008
Survey Effort: • Approximately 80 samples were collected from the Havana region and 70 samples from the Tropicana area. • Phase One o Data collection, Inspection of Drill core, lithologies and Fate of Wastes - 6 days o Sample test and sample selection – 3 days o Laboratory Analysis (4 Weeks) : Elemental decomposition, Paste pH and EC, Acid base accounting and Net acid generation • Phase Two o Sample/ test selection and sample collection – 4 days. o Laboratory Analysis – Rate of Oxidation, Kinetic net acid generation, acid buffering capacity, sequential net acid generation, Kinetic column tests (operating for six months).
Methodology: The study will be undertaken in two phases: • Phase One: A scoping study in which the overall magnitude of the potential for acid generation will be determined based primarily on static test procedures. Sample selection will be based on the geological model and the available chemical properties. The program will identify lithologies that may produce acid and those that may consume acid. The overall variability in the lithological units will also be determined. With the estimates of volumes of materials that will be generated, the overall potential for acid drainage will be determined. • Phase Two: Will establish the potential acid generation and metal leach rates through improved characterization of the materials using kinetic tests procedures and supplemental static tests. Materials for testing will be selected based on the outcomes of Phase One and additional information obtained from AngloGold Ashanti Australia. The results from the second phase of testing will be used to estimate acid and metal leach rates, assess material management requirements and determine potential solute release rates which may be used as input to a water and load balance to determine potential impacts on receiving water quality and determine potential closure requirements.
Consultation/Guidance: • Consultation with Analytical Laboratories (AMMTEC or Genalysis). • Consultation with AngloGold Ashanti Australia staff.
Limitations: • Limited data available on volumes of various rock types, as such drill core length was used a a proxy for volume.

Target: Contamination Assessment – Potential Contamination Risk Associated With the Proposed Mining Operations
Area: Operational Area, in particular proposed tailings storage facility, waste rock landforms, workshops and chemical storage areas.
Objective: To provide an assessment of the potential contamination risk to the local and surrounding environment associated with the proposed operation, with particular reference to the tailings and waste rock run-off and seepage, and hydrocarbon or other environmentally hazardous substance spillage.
Consultant: 360 Environmental
Timing: Desktop Assessment: February 2009
Methodology: The desktop study has included: • A review of existing soil and water quality data collected for the Tropicana Gold Project against the DEC Contaminated Sites Management Series (2003) Assessment of Soil, Sediment and Water guideline document, to better understand the occurrence and distribution of potential elements of concern in the natural environment and the material proposed to be mined, and their potential impact on the surrounding environment following closure of the mine, and as such, their potential to become a source of contamination. Data that has been reviewed include: - Baseline characterisation data of soils and regolith from Reverse Circulation drilling undertaken across the Operational Area. - Static and kinetic test data from soil samples across the Operational Area. - Surface soils samples collected across a larger regional area. - Water quality results from groundwater monitoring bores located across the Operational Area, and incidental groundwater intercepted during drilling programs. • A review of other relevant available information relating to characterisation of the surrounding environment including topography, geology, climate data, soil profiles, surface hydrology and groundwater, to develop an understanding of potential contaminant pathways and receptors. • A review of the proposed construction specifications for the project, particularly for the tailings storage facility and the waste rock landform to assess their suitability in managing or minimising the risk of contaminant impact on the surrounding environment. • Development of a Conceptual Site Model detailing potential contaminant sources, pathways and receptors associated with the proposed mine operations and surrounding environment and assessment of the risks to the environment based on this model. • Assessment and reporting with reference to the Dec (2001-2006) Contaminated Sites Management Series, with recommendations for further assessment and appropriate management strategies to minimise identified risks associated with potential site contamination related issues.
Consultation/Guidance: • Consultation with AngloGold Ashanti Australia staff. • Consultation with the Contaminated Sites Branch of the Department of Environment and Conservation • Consultation with the Environmental Branch of the Department of Mines and Petroleum
Limitations: • Limited data available on samples collected at depth.

Target: Hydrogeology
Area: Operational Area and Minigwal Trough
Objective: • The objective of the investigation is to summarise the potential water resources available to meet Project water requirements. • To determine the dewatering requirements for the pits, and proposed use or disposal of this water; and to determine the availability of the required volume of water for project construction and operation. • Assess the sustainability of these identified resources for their proposed use and means through which water use can be minimized.
Consultant: Pennington Scott
Timing: • Water investigations in the Minigwal Trough were conducted between October 2007 and September 2008.
Survey Effort: • Drilling of nine (9) reverse circulation exploratory holes of 230 m depth to define the geometry of the sandstone aquifers. • Drilling and hydraulic testing of eight (8) mud rotary test production water bores and two (2) observation water bores to between 250 and 350 m depth in the Minigwal Trough.
Methodology: • Interpretation of thematic remote sensing data including digital air photography, Ikonos, ALOS and Landsat 7 satellite imagery • Acquisition of 2306 line km of airborne time domain electromagnetic (TDEM) geophysical traverses conducted orthogonal to the present day drainage in both areas. • Construction of nine (9) reverse circulation exploratory holes drilled to define the extents and shape of the sandstone in the Minigwal Trough • Construction of eight (8) mud rotary test production water bores and two (2) observation water bores in the Minigwal Trough. • Hydraulic pump test and recovery analyses on eight (8) test production bores to determine intrinsic properties of the aquifer such as permeability, storage and boundary conditions. • Down hole geophysical logging of ten (10) test production and observation bores using long and short normal resistivity, together with natural gamma to define the lithological stratification within the sediments. • Hydrochemical analysis of groundwater samples taken from each bore. All samples submitted to a NATA registered laboratory for major component analysis. • A regional water level survey of Project and historic third party investigation bores to define a regional water table surface.
Consultation/Guidance: • Department of Water
Limitations: No significant limitations.

Mine Access Road Options and Linear Infrastructure

Target: Vegetation and Flora
Area: Pinjin Access Road
Objective: • Collect and identify the vascular plant species present within the proposed corridor. • Review the conservation status of the vascular plant species • Define and map the native vegetation communities and their condition. • Provide recommendations on the local and regional significance of the vegetation communities.
Consultant: Mattiske Consulting Pty Ltd
Timing: • December 2007 • March 2008 • May 2008.
Survey Effort: • Four botanists completed the survey during three trips and a total of 17 days.
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 51 (Level 2). • Sampling sites were selected to sample representative vegetation types within the proposed corridor. • The flora and vegetation was described and sampled systematically at each survey site, and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. • At each site the following floristic and environmental parameters were noted: GPS location, topography, percentage litter cover, soil type and colour, percentage of bare ground, outcropping rocks and their type, gravel type and size, time since fire and the percentage cover and average height of each vegetation stratum. • For each vascular plant species, the average height and percent cover (both live and dead material) were recorded. • All plant specimens collected during the field surveys were dried and fumigated in accordance with the requirements of the Western Australian Herbarium.
Consultation/Guidance:
Limitations: No significant limitations other than a general lack of contextual information for the region.

Target: Vegetation and Flora
Area: Cable Haul Access Road
Objective: • Survey the flora and vegetation along the proposed track to determine whether any species or ecological communities of conservation significance along the route, and if present, indicate management options to prevent or minimise the impacts due to disturbance. • Map the main vegetation units occurring along the length of the proposed track.
Consultant: *ecologia*
Timing: • July 2007 • August 2007.
Survey Effort: • 16 days • 114 20 m x 20 m quadrats • 59 transects of variable length.
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 51 (Level 1). • Quadrat sites were chosen on the basis of topography, interpretation and ground truthing of aerial photographs and field observations of vegetation structure, floristics and condition. • The number of sites established was determined by the size and the heterogeneity of the study area and the time allowed for the survey. • The floristic field survey involved systematic flora sampling in quadrats approximately 20 m by 20 m, or of an equivalent area of 400 m^2 in sites that were less than 20 m wide. • These quadrats provide the information needed to accurately map the small-scale vegetation units and allow a comprehensive floristic inventory of the survey area to be generated. • Transects were walked through representative stretches of vegetation to provide more information on vegetation units and also to ensure that a comprehensive species list was collated for the extensive study area. • Opportunistic collections of any species not already collected were also made by the botanists when walking from site to site.
Consultation/Guidance:
Limitations: No significant limitations other than a general lack of contextual information for the region.

Target: Vertebrate Fauna
Area: Pinjin Access Road
Objective: • 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: 1. the *Environment Protection and Biodiversity Conservation Act 1999* 2. the *Wildlife Conservation Act 1950* 3. Department of Environment and Conservation Priority Fauna list.
Consultant: Ninox Wildlife Consulting
Timing: • December 2007 • March 2008
Survey Effort: • The field surveys were carried out by a Senior Zoologist and field assistant on both occasions.
Methodology: • Environmental Protection Authority Guidance Statement 56 (Level 1). • Desktop Assessment including a a detailed literature review of both published and unpublished data, and searches of the vertebrate fauna databases held by the Western Australian Museum DEC and DEWHA. • Field survey of a corridor or approximately 200 m in width along the proposed Pinjin Access Road option by two personnel.
Consultation/Guidance:
Limitations: • Existing data for the area was scarce. • The survey was done during the driest and hottest periods and much of the area had been severely burnt, particularly those areas of yellow sandplains and dunes.

Target: Opportunistic Fauna Records (undertaken while carrying out an Archaeological survey)
Area: Pinjin Access Road
Objective: • To document details of opportunistic fauna records and significant fauna habitats encountered in the Pinjin along the route of the proposed haul road in the Pinjin area.
Consultant: Jeff M. Turpin
Timing: Between the 11th to the 15th February, and 12th to 15th March.
Survey Effort: • 9 days, during which the primary purpose of the survey was to carry out an archaeological assessment of the area.
Methodology: • Opportunistic fauna records and significant fauna habitats. • The field survey included a combination of transects traversed by foot, following the location of the proposed access road
Consultation/Guidance:
Limitations: • Not all fauna habitats were surveyed within the study area as the emphasis was on archaeology during the survey period.

Target: Vertebrate Fauna and Targeted SMM survey
Area: Cable Haul Access Road
Objective: • Determine impacts of the development of the mine service road on native fauna. • Determine the suitability of habitat to support the SMM, the Sandhill Dunnart, Crest-tailed Mulgara and the Malleefowl and where suitable habitat exists, undertake a search for secondary evidence. • Determine the suitability of habitat to support any other rare fauna potentially impacted by the construction project as determined through literature reviews and consultation with the DEC. • Document habitat trees suitable to provide nesting sites for rare parrots Naretha Blue Bonnet and Princess Parrot.
Consultant: *ecologia*
Timing: • July - August 2007
Survey Effort: • The field work was conducted by a team of four personnel for a total of 36 person days. • For the road survey site the existing access track was surveyed at a rate of approximately 25 km per day (for 200 km plus 30 km of alternate route), while the new track was surveyed at a rate of approximately 10 km per day (for approx 70 km). • 7 mole trenching sites with three to four trenches each.
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 56 (Level 1). • During the survey records were made of all fauna habitats traversed by the proposed haul road. • Where the road impacted on habitat suitable to support fauna species of conservation significance a foot survey (opportunistic sampling) was undertaken within a 200 m corridor to identify any secondary evidence i.e. tracks, scats, moleholes, feeding signs and breeding structures. • Opportunistic searches were undertaken when suitable fauna habitats were encountered and all significant finds recorded. • In large areas walking transects parallel to the road were conducted by all personnel, spaced 25 – 50 m apart, to cover a 200 m corridor. • Where extensive sand dune fields were encountered marsupial mole monitoring trenches were excavated to detect the presence of the Southern Marsupial Mole using the methodology of Benshemesh (2005).
Consultation/Guidance: • Benshemesh J. (2005) Manual for Marsupial Mole Survey and Monitoring by Trenches. Version 1.0. Report to Anangu-Pitjantjatara Land Management and the Department of Heritage and Environment (SA). March 2005.
Limitations: • Collection of data relied mainly on secondary evidence of species. Most evidence was identified with a high level of confidence. Scats could not be identified to species level. • This survey was conducted during the winter. Activity of reptile taxa was reduced by cold wet weather, but mammal, amphibian and bird activity were affected less. Fauna habitats and secondary evidence were still recognised. • Extensive areas of burnt vegetation reduced fauna numbers in the southern section (approx. 35 km continuous stretch burnt) • Little contextual information is available for the region.

Target: Marsupial Mole Survey
Area: Pinjin Access Road
Objective: • Determine whether the Marsupial Mole occurs within potentially suitable habitat (believed to be yellow sand dunes) along the Survey Area. • Opportunistically collect information on: o Sandhill Dunnart o Malleefowl o Mulgara.
Consultant: URS
Timing: • November 2007 • March 2008 • April 2008
Survey Effort: • Two Environmental Scientists conducted the field components in three field trips (total of 22 days). • 27 trench sites, each comprised of three trenches and 38 penetrometer sites.
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 56 (Level 2). • A “Perth Sand” penetrometer was utilized at potentially suitable sites to establish substrate compactness. • Mole trenching survey, generally following Benshemesh (2005). • Trenches were inspected for mole holes two to three days after excavation. • Mole hole measurements were recorded to describe the location, shape and condition of the mole hole. • The habitat immediately surrounding the trenches was then characterized. • Soil samples (approximately two kilograms each) were collected in double ziplock bags from sites where mole holes were located, for potential future laboratory analysis. • Canine and feline scats were opportunistically collected during the survey. Scats collected were bagged, labelled and locations recorded by GPS. • The field team opportunistically collected information on conservation significant fauna species and potentially suitable habitat, observed in the Survey Area
Consultation/Guidance: • Benshemesh J. (2005) Manual for Marsupial Mole Survey and Monitoring by Trenches. Version 1.0. Report to Anangu-Pitjantjatara Land Management and the Department of Heritage and Environment (SA). March 2005. • Joe Benshemesh also inspected the work of URS while on a site visit in July 2008.
Limitations: • Light rainfall during five of the 16 days of the survey. This period of inclement weather would have slightly reduced the drying ability of the trenches, and therefore the clarity of, and ability to locate, mole holes within the trenches. Benshemesh (2004) recommends a drying period of three to four days per trench. Trenches excavated for this report generally had two to three days drying time, with some sites also receiving very small amounts of rainfall during this time. It is not known whether this rainfall and drying time difference affected the results of this study. • The paucity of information on the ecology of the Marsupial Mole. • Recent fires affecting penetrometer results.

Target: Hydrology
Area: Pinjin and Cable Haul Option
Objective: • Review the impact of new sections of the proposed mine access roads on existing hydrology. • Assess impacts of the proposed haul roads on hydrology, flow patterns and shadowing of downstream areas. • Development of a concept stormwater management plan for the haul roads. • Summary of findings and recommendations, and comment on further work if required.
Consultant: GHD
Timing: • Report drafted October 2008. As the assessment was a review only, the timing is not critical to the results.
Survey Effort: The Surface Water Evaluation used data and descriptions from the following sources: • Australian Natural Resources Atlas • Bureau of Meteorology. • CSIRO. • Department of Environment • Department of Water. • Scientific / environmental articles on the area.
Methodology: The following data and information were utilised: • 2 m and 4 m contour data, supplied by AngloGold Ashanti, for 9,000 km^2 of the catchment area surrounding the mine site. • Aerial imagery, covering the area of the mine site and proposed new Mine Access Roads, supplied by AngloGold Ashanti. • 1:250,000 scale regional topographic and geological mapping. • Results of infiltration measurements undertaken by AngloGold Ashanti. • Various environmental and engineering reports commissioned by the TJV.
Consultation/Guidance: • Department of Water
Limitations: • No site visit was carried out. • Accuracy was limited by existing data. In particular, site survey and hydrologic information were not available for the entire alignment.

Target: Flora, Vegetation and Terrestrial Vertebrates
Area: Gas Pipeline Alignments (two options)
Objective: • Describe the regional setting of both pipeline options. • Desktop search for Declared Rare, Priority or other significant flora, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) and Threatened Fauna, Priority of other significant fauna. • Identify environmental constraints and present a preliminary indication of potential environmental impacts and management.
Consultant: 360 Environmental
Timing: • As the assessment was a literature review only, the timing is not critical to the results.
Survey Effort: The literature review used data and descriptions from the following sources: • Australian Geological Survey data • Australian Natural Resources Atlas • Bureau of Meterology • Resources and databases of the Department of Environment and Conservation and Department of the Environment, Water, Heritage and the Arts • Various reference books and scientific / environmental articles on the area • All species and communities of conservation concern recorded or expected to occur in the survey area were cross-checked against the Federal Environment Protection and Biodiversity Conservation (EPBC) Threatened Matters Database and Government Gazette Number 12 (Government of Western Australia 2008) for their status under the EPBC Act and WC Act, respectively.
Methodology: • Partial compliance with Environmental Protection Authority Guidances 51 and 56 (Level 1). • Description of the survey area in a regional context incorporating major vegetation types, land forms, soil types and any unusual features of the survey area and surrounding region. • Desktop search detailing any Declared Rare, Priority or other significant flora known from the area. • Desktop search for Threatened Ecological Communities and Priority Ecological Communities known from the area. • Desktop search for Threatened Fauna, Priority of other significant fauna known from the area.
Consultation/Guidance:
Limitations: • No site visit was carried out, hence this desktop assessment does not meet all the criteria of a Level 1 Reconnaissance survey under the Environmental Protection Authority's Guidance Statement 51 or Guidance Statement 56. However, the intent of this desktop assessment was to be a first-pass only; if the Officer Basin is selected by the TJV a physical survey should be arranged in the future.

Water Supply Areas

Target: Vegetation and Flora
Area: Minigwal Water Supply Area
Objective: • Compile a broad scale vegetation community and flora map and species list of the survey area. • Document and map locations of any Declared Rare, Priority listed flora species located; and threatened ecological communities within the survey area. • Identify and GPS occurrences or any Declared and Environmental Weeds within the survey area.
Consultant: Botanica Consulting
Timing: • November 2008.
Survey Effort: • A total of 458 man hours were spent in the field over a period of 9 days.
Methodology: • Compliance with Environmental Protection Authority Guidance Statement 51 (Level 1). • Priority Flora and their respective vegetation types were targeted in the survey area and all areas of occurrence were traversed on foot specifically looking for the threatened flora associated with that vegetation description. • Sample sites were chosen based on the best representative areas of the vegetation groups identified during field work. • Sites were also chosen based on very little disturbance apart from fire. • Vegetation groups were not broken up based on the age of regenerating vegetation after fire disturbance due to general observations noting similar stages of regeneration.
Consultation/Guidance:
Limitations: Fieldwork was not completed during the EPA's recommended time period (i.e. sporadic rainfall events in the Eremaean) for detecting most ephemeral flora. However the majority of species were either in flower, late flower or possessed fruiting material needed for sufficient identification. In the months preceding the survey, rainfall was well below normal in the Laverton area.

Target: Vertebrate Fauna

Area: Minigwal Water Supply Area

Objective:

- Identify and describe the fauna habitat types found within the proposed area.
- Determine the suitability of habitat to support Sandhill Dunnart, SMM , Brush-tailed Mulgara, and Malleefowl. Where suitable habitat exists, undertake a search for secondary evidence and Malleefowl mounds.
- Map the occurrence of SMMs in the study area using survey trenches to determine former presence.
- Record soil hardness of sites with a penetrometer to help develop new methods of determining suitable SMM habitat.
- Determine the suitability of habitat to support any other rare fauna potentially impacted by the construction project.
- Provide a risk assessment to determine likely impacts of threatening processes on vertebrate fauna within the project area.

Consultant: *ecologia*

Timing:

- March 2008 (general fauna survey).
- The targeted SMM survey consisted of two separate surveys:
  - September 2007
  - January - February 2008.

Survey Effort:

- Sampling for general fauna:
  - 580 minutes of bird surveys
  - 780 minutes of foraging for reptiles, mammals and amphibians.
  - 240 minutes was spent conducting nocturnal surveys
  - 185 minutes of bat recordings were made. Secondary evidence of animals was also recorded, as were opportunistic sightings of fauna during activities on site.
- 41 sites (with 3 trenches each) were selected to survey for evidence of SMMs: 12 sites in 2007 and 29 sites in 2008.

Methodology:

- Compliance with Environmental Protection Authority Guidance Statement 56 (Level 1).
- General survey:
  - Fauna survey sites (e.g., for foraging) were selected to represent all major fauna habitats present.
  - During each bird survey an ornithologist recorded the number of individuals of each species seen while actively searching a 2 ha area. Surveys were conducted throughout the daylight hours.
  - Bat echolocation calls were detected using an ANABAT II system, recordings were made at all sites.
  - Two sites were searched at night using opportunistic ground searches. Head torches and hand held spotlights were used to search for nocturnal fauna such as geckoes, snakes, mammals and nocturnal birds.
- Targeted Marsupial Mole survey:
  - The methodology of Benshemesh (2005) was used to survey 123 trenches spread across 41 sampling locations.

Consultation/Guidance:

- Benshemesh J. (2005) Manual for Marsupial Mole Survey and Monitoring by Trenches. Version 1.0. Report to Anangu-Pitjantjatara Land Management and the Department of Heritage and Environment (SA). March 2005.

Limitations:

Cool autumn weather and rainfall events limited the amount of observed fauna and resulted in low reptile activity during the survey.

Target: Stygofauna
Area: Minigwal Water Supply
Objective: • Undertake a pilot study of bores in the proposed water supply borefield to establish the presence or absence of stygofauna. • Characterize the environmental conditions for groundwater fauna in the study area • Evaluate the likelihood that stygofauna occur in the aquifer proposed for the water supply borefield.
Consultant: Subterranean Ecology
Timing: • May 2008
Survey Effort: • 10 bores.
Methodology: • Compliance with Environmental Protection Authority Guidance Statements 54 and 54a (draft). • Of the ten bores successfully sampled for stygofauna, eight bores were sampled by net hauling and two bores, which had pump equipment installed, were sampled by pumping water through a net. • Prior to net haul sampling for stygofauna, water samples were collected by bailer at 0-1 m water depth except TWB018 and TWB026 where a pumped sample was collected. • Groundwater physico-chemistry parameters were measured at the same time as stygofauna sampling. • Bores were sampled for stygofauna using a plankton net of suitable diameter (45mm to 300 mm) to match the bore/well. • At most bores six hauls of the entire water column were conducted, comprising three hauls with a 150 µm net and three hauls with a 63 µm net. • Samples with large quantities of sediment were elutriated prior to preservation. • Each net haul sample was transferred to a labeled polycarbonate container and preserved in 100% alcohol. • Sorting occurred in the laboratory under a 40x dissecting microscope. • Each taxon was identified to the lowest taxonomic rank possible using published keys and descriptions, and the numbers of each taxon were recorded. • Where necessary, identification of microfauna and dissected macrofauna used a compound microscope.
Consultation/Guidance: • Collecting methods used were similar to those used by the DEC Pilbara Stygofauna Survey (Eberhard S.M., Halse S.A., Scanlon M.D., Cocking J.S. & Barron H.J. (2004). Assessment and conservation of aquatic life in the subsurface of the Pilbara region, Western Australia. In: World Subterranean Biodiversity. Proceedings of an International Symposium, 8th - 10th December 2004.
Limitations: • The age of the sampled bores may be considered less than optimal (3 bores were > 3 months old, all bores < 6 months old) for valid assessment of stygofauna according to the EPA guidelines. • To the knowledge of Subterranean Ecology Pty Ltd there are no published studies on the time frames required by stygofauna to colonise bores, but in the absence of supporting data the precautionary approach adopted by the EPA guidelines seems reasonable even if arbitrary. In this respect, it is worth noting that stygofauna have been collected from bores less than 3 months old (P. Hancock pers. comm. 2008, H. Barron pers. comm. 2005). • The uncertainty concerning the validity of samples collected from recently constructed bores may be circumvented to some extent by pump sampling of the surrounding aquifer water. Based on this concept, pump sampling was undertaken when possible at two bores during this survey.

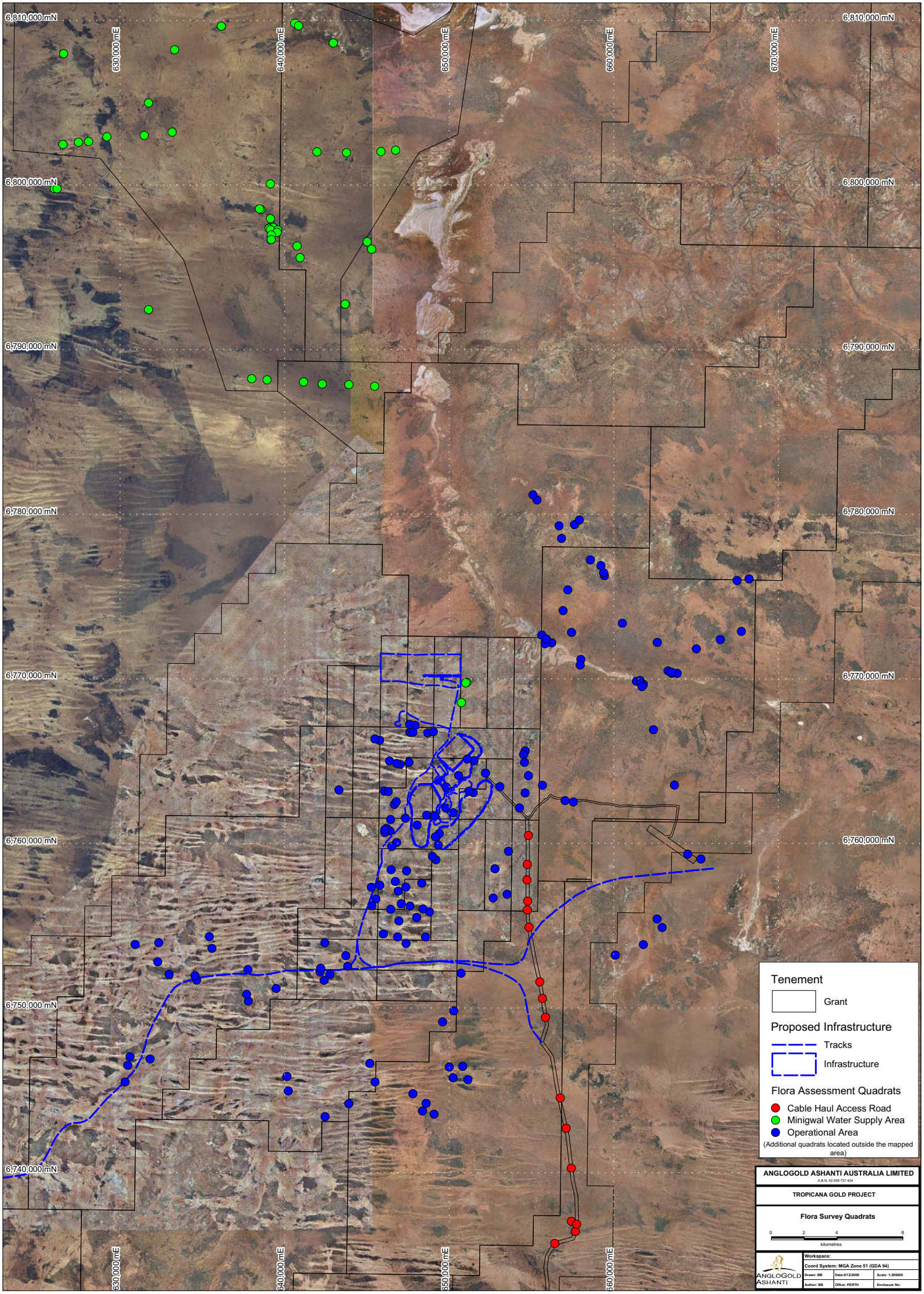
Target: Flora, Vegetation and Terrestrial Vertebrates
Area: Officer Basin Water Supply Area
Objective: • Describe the regional setting of the Officer Basin survey area. • Desktop search for Declared Rare, Priority or other significant flora, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) and Threatened Fauna, Priority of other significant fauna. • Identify environmental constraints and present a preliminary indication of potential environmental impacts and management.
Consultant: 360 Environmental
Timing: • As the assessment was a literature review only, the timing is not critical to the results.
Survey Effort: The literature review used data and descriptions from the following sources: • Australian Geological Survey data • Australian Natural Resources Atlas • Bureau of Meterology • Resources and databases of the Department of Environment and Conservation and Department of the Environment, Water, Heritage and the Arts • Various reference books and scientific / environmental articles on the area • All species and communities of conservation concern recorded or expected to occur in the survey area were cross-checked against the Federal Environment Protection and Biodiversity Conservation (EPBC) Threatened Matters Database and Government Gazette Number 12 (Government of Western Australia 2008) for their status under the EPBC Act and WC Act, respectively.
Methodology: • Partial compliance with Environmental Protection Authority Guidances 51 and 56 (Level 1). • Description of the survey area in a regional context incorporating major vegetation types, land forms, soil types and any unusual features of the survey area and surrounding region. • Desktop search detailing any Declared Rare, Priority or other significant flora known from the area. • Desktop search for Threatened Ecological Communities and Priority Ecological Communities known from the area. • Desktop search for Threatened Fauna, Priority of other significant fauna known from the area.
Consultation/Guidance:
Limitations: • No site visit was carried out, hence this desktop assessment does not meet all the criteria of a Level 1 Reconnaissance survey under the Environmental Protection Authority's Guidance Statement 51 or Guidance Statement 56. However, the intent of this desktop assessment was to be a first-pass only; if the Officer Basin is selected by the TJV a physical survey should be arranged in the future.

Heritage Surveys

Target: Indigenous Heritage
Area: All proposed disturbance areas
Objective: To identify areas of ethnographic or archaeological significance to the indigenous community in the proposed impact areas of the TGP.
Consultant: Artefaxion Pty Ltd.
Timing: • Assessments have been undertaken since March 2006
Survey Effort: • Desktop Assessment • Field surveys by experienced archaeologists and ethnographers • Site visits by Traditional Owners
Methodology: Compliance with Environmental Protection Authority Guidance Statement 41 (Assessment of Aboriginal Heritage. Assessment of indigenous heritage has followed a three step process, beginning in the exploration: • Desktop assessment to identify traditional owners and areas likely to have significance (e.g., rocky outcrops, water courses) • Site assessment of areas of proposed disturbance (e.g., around proposed drill sites during exploration) • Survey for archaeological material and ethnographic sites (with the aid of Traditional Owners) in and around all proposed disturbance areas of the TGP
Consultation/Guidance: • Local indigenous communities. • Formal indigenous groups including the GLSC, NEIB and CDNTS. • Department of Indigenous Affairs.
Limitations: No significant limitations other than a general lack of contextual information for the region.

Target: Early Settler Heritage
Area: Pinjin pastoral area
Objective: To identify the heritage values in and around the Pinjin area that may be impacted by the proposed Pinjin mine access road.
Consultant: Hocking Planning and Architecture
Timing: • Draft report dated June 2008
Survey Effort: • Desktop assessment
Methodology: • Provide a brief history of the Pinjin mining industry, town and pastoral lease • Identify objects or areas of heritage value and any potential impact on heritage values (if present).
Consultation/Guidance: •
Limitations: No significant limitations other than a general lack of contextual information for the region.

APPENDIX 3: Sampling Sites for Flora, Vegetation and Fauna Surveys Completed to Date.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Tracks
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Flora Assessment Quadrats
Cable Haul Access Road
Minigwal Water Supply Area
Operational Area
(Additional quadrats located outside the mapped area)
ANGLOGOLD ASHANTI AUSTRALIA LIMITED
A.B.N. 42 008 737 424
TROPICANA GOLD PROJECT
Flora Survey Quadrats
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kilometres
ANGLOGOLD ASHANTI
Workspace:
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Date:6/12/2006
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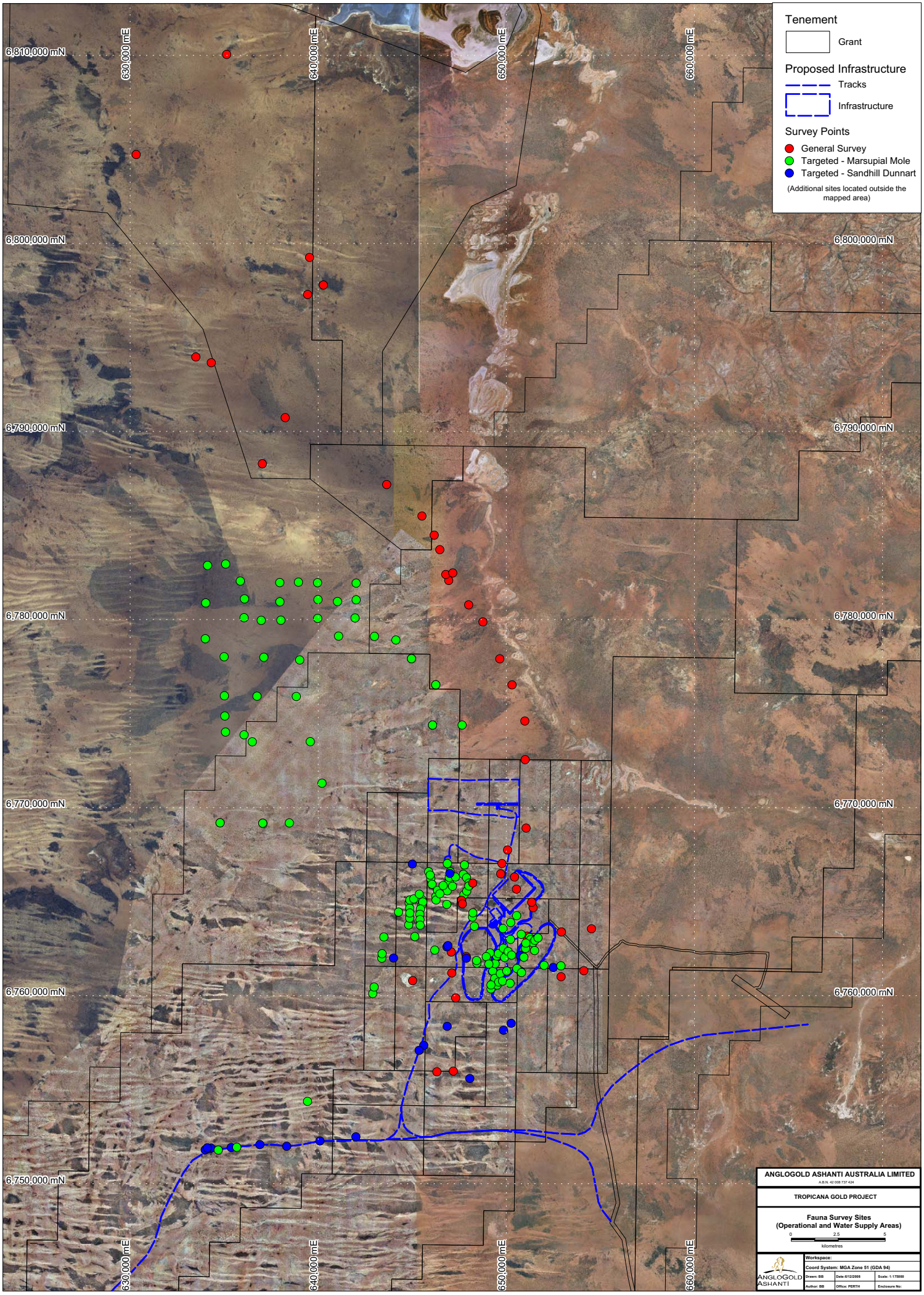
Author: BB
Office: PERTH
Enclosure No: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General Survey
Targeted - Marsupial Mole
Targeted - Sandhill Dunnart
(Additional sites located outside the mapped area)
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TROPICANA GOLD PROJECT
Fauna Survey Sites
(Operational and Water Supply Areas)
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kilometres
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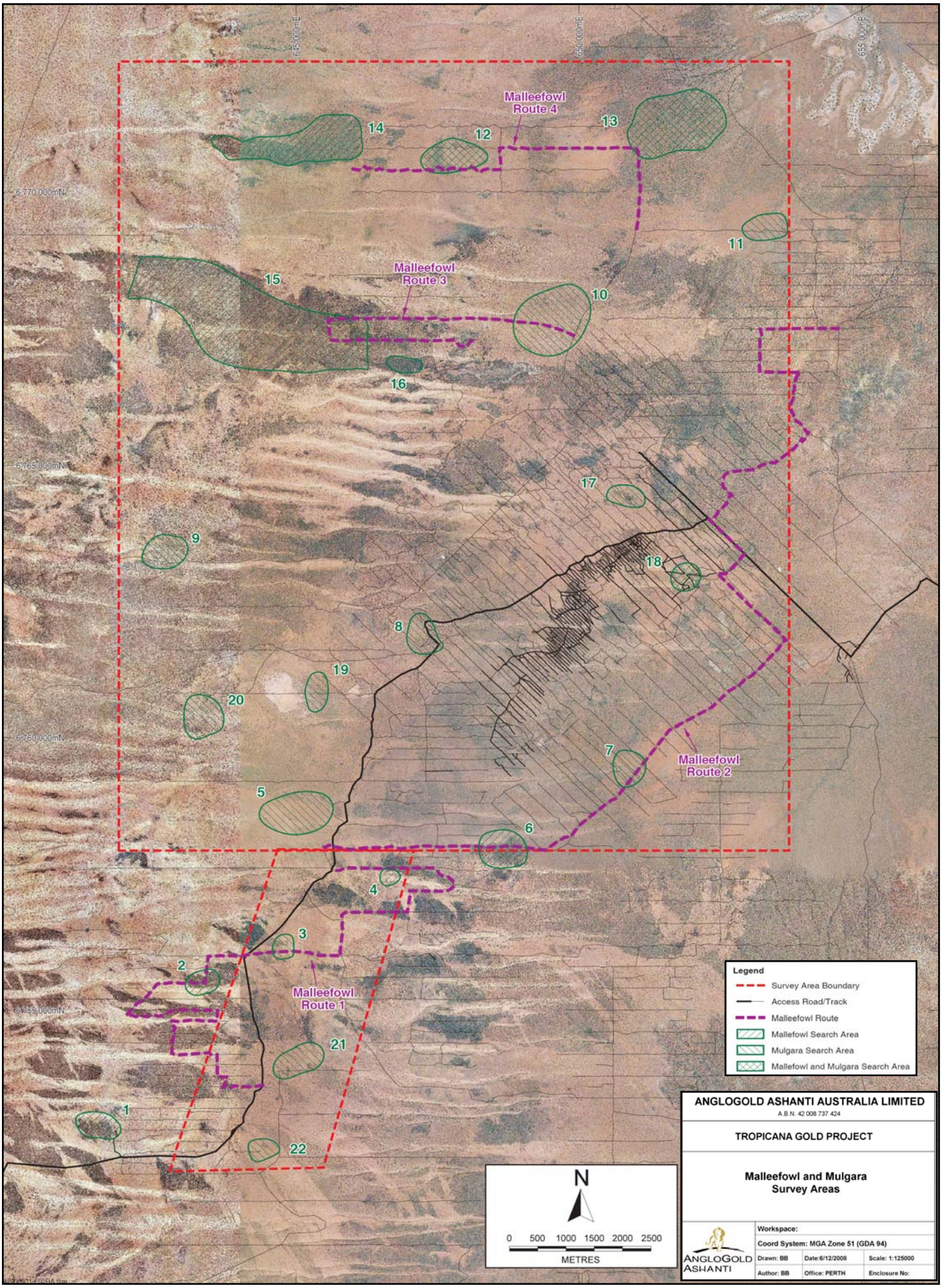
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Malleefowl Search Area
Mulgara Search Area
Malleefowl and Mulgara Search Area
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A.B.N. 42 008 737 424
TROPICANA GOLD PROJECT
Malleefowl and Mulgara Survey Areas
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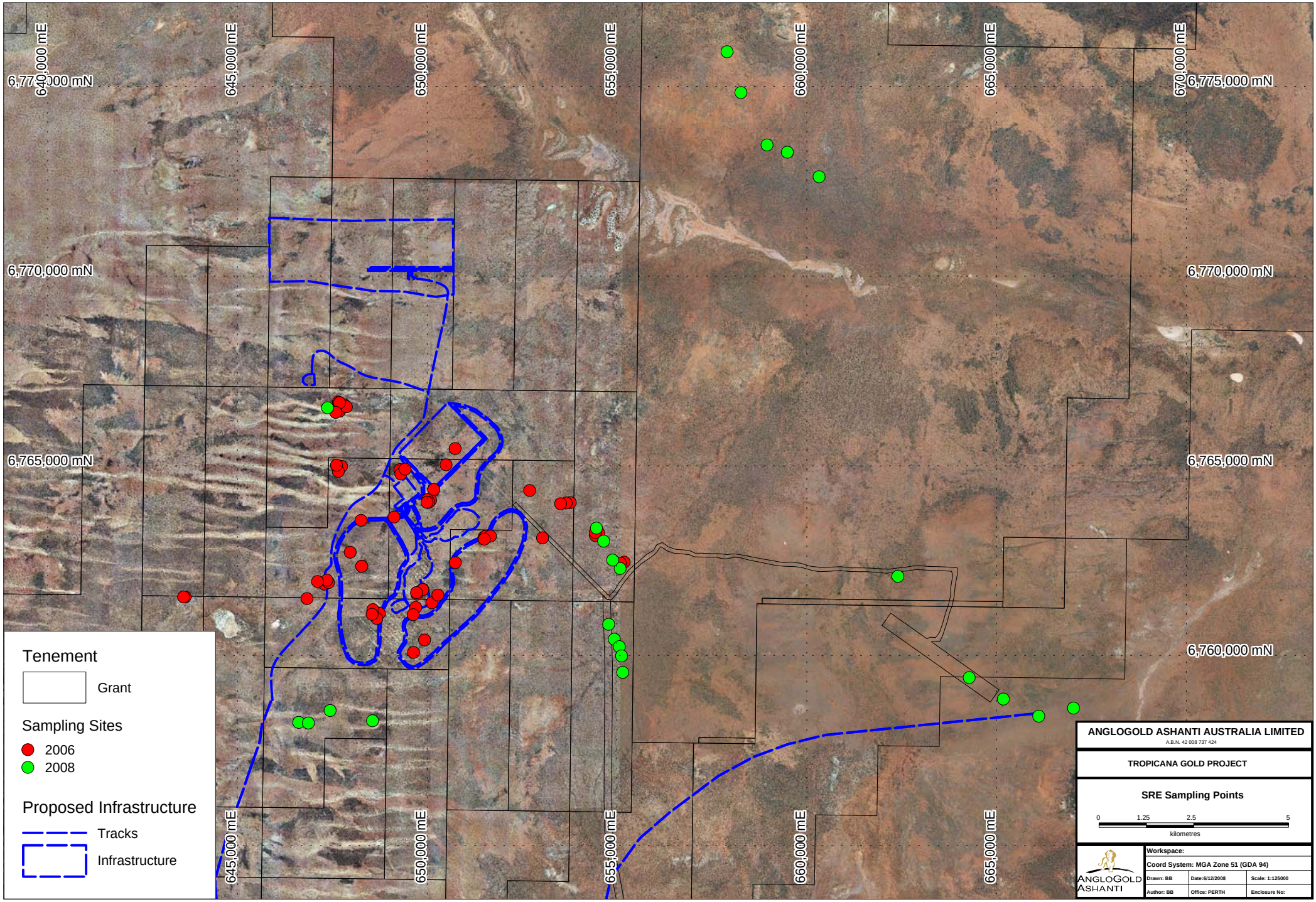
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Sampling Sites
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TROPICANA GOLD PROJECT
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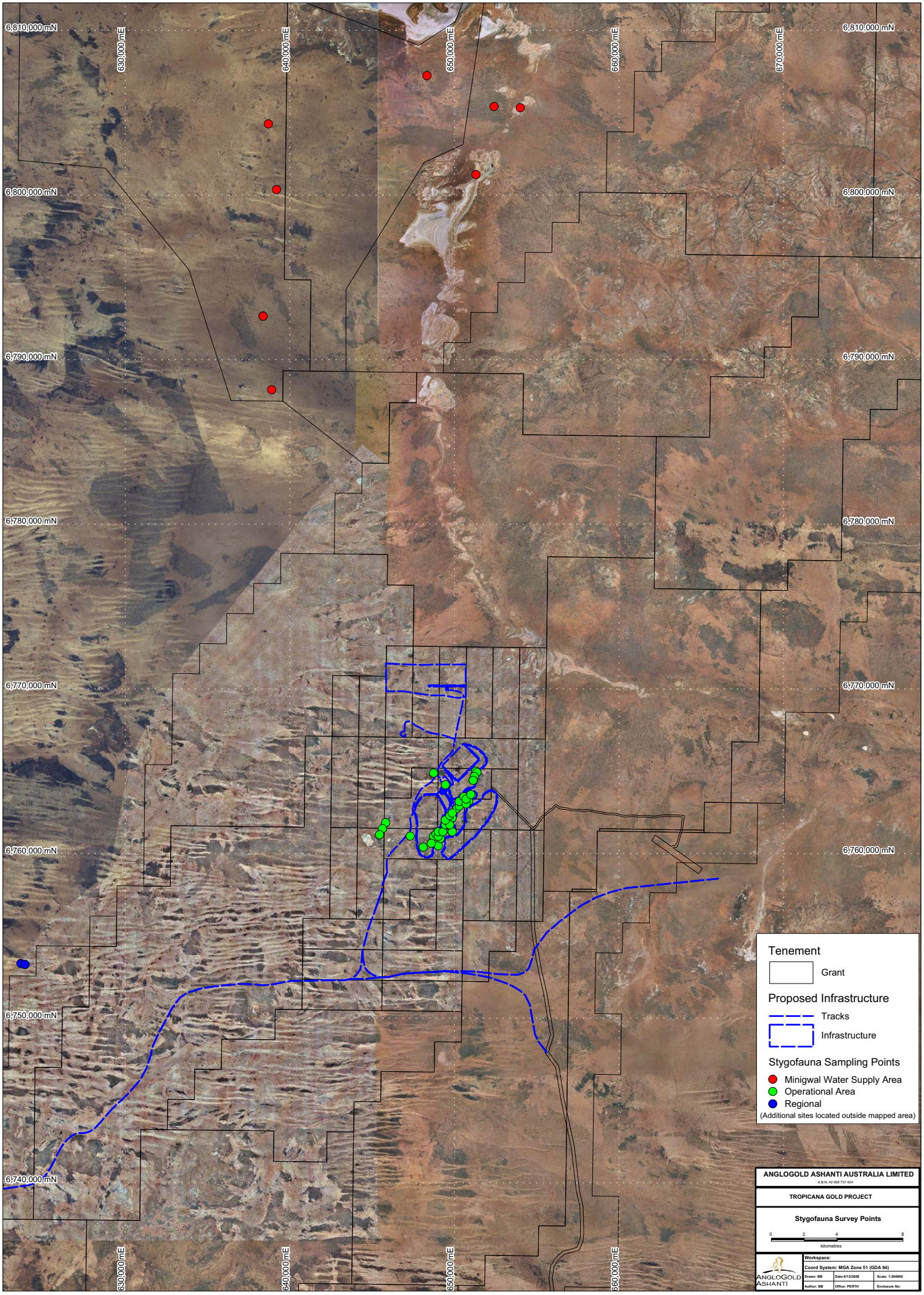
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650,000 mE
660,000 mE
670,000 mE
Tenement
Grant
Proposed Infrastructure
Tracks
Infrastructure
Stygofauna Sampling Points
Minigwal Water Supply Area
Operational Area
Regional
(Additional sites located outside mapped area)
ANGLOGOLD ASHANTI AUSTRALIA LIMITED
A.B.N. 42 006 737 424
TROPICANA GOLD PROJECT
Stygofauna Survey Points
0 2 4 8
kilometres
ANGLOGOLD ASHANTI
Workspace:
Coord System: MGA Zone 51 (GDA 94)
Drawn: BB
Date:6/12/2008
Scale: 1:200000
Author: BB
Office: PERTH
Enclosure No:

Proposed Infrastructure

Tenements

Granted

Sampling Phase

- Phase 1
- Phase 1 & 2
- Phase 2
- Phase 2 & 3
- Phase 3
- Phase 4

645,000 mE
650,000 mE
655,000 mE
660,000 mE
640,000 mE

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6,755,000 mN
6,750,000 mN

ANGLOGOLD ASHANTI AUSTRALIA LIMITED

A.B.N. 42 008 737 424

TROPICANA GOLD PROJECT

Troglofauna Sampling Points

0 1 2 4

kilometres

ANGLOGOLD ASHANTI

Workspace:

Coord System: MGA Zone 51 (GDA 94)

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Author: BB	Office: PERTH	Enclosure No:

APPENDIX 4: Rainfall and Timing of Flora, Vegetation and Fauna Surveys Completed to Date. (Data from Bureau of Meterology).

2005	Balgair	Laverton Airport	Operational
Jan	3	7.8	
Feb	1.8	0.4	
Mar	8	3	
Apr	11	0.2	
May	33.4	13	
Jun	11.4	12.2	
Jul	17.4	14.4	
Aug	38.4	29.8	• Threatened Flora
Sep	9.4	3.6	
Oct	15.4	8.2	
Nov	11.4	3.8	
Dec	10.4	22.2	
Total	*171*	*118.6*	

2006	Balgair	Laverton Airport	Operational
Jan	102	90.8	
Feb	9	69.2	
Mar	29.4	56	
Apr	27.2	41	
May	9.3	2.2	
Jun	1.6	0	
Jul	2.2	0.2	• Threatened Flora
Aug	5	5.6	
Sep	4	14.8	• Terrestrial Invertebrates
Oct	6.2	17	• Terrestrial Invertebrates
Nov	22.4	12.6	• Terrestrial Vertebrates • Flora and Vegetation
Dec	30	28.2	
Total	*248.3*	*337.6*	

2007	Balgair	Laverton Airport	Operational	Pinjin	Cable	Minigwal
Jan	18.2	98				
Feb	3.6	23				
Mar	88.1	26.6	• Terrestrial Vertebrates			
Apr	62.6	6.4				
May	7.6	4.6				
Jun	22.4	3	• Flora and Vegetation			
Jul	12	23.6	• Flora and Vegetation		• Terrestrial Fauna • Flora and Vegetation	
Aug	16	0	• SMM		• Terrestrial Fauna • Flora and Vegetation	
Sep	1	0.6	• SMM • Troglofauna • Stygofauna			• SMM
Oct	22.4	0.8	• Troglofauna • Threatened Flora			
Nov	3.8	12	• Stygofauna • Troglofauna	• SMM		
Dec	17	62.8		• Flora and Vegetation • Vertebrate Fauna		
Total	*274.7*	*261.4*				

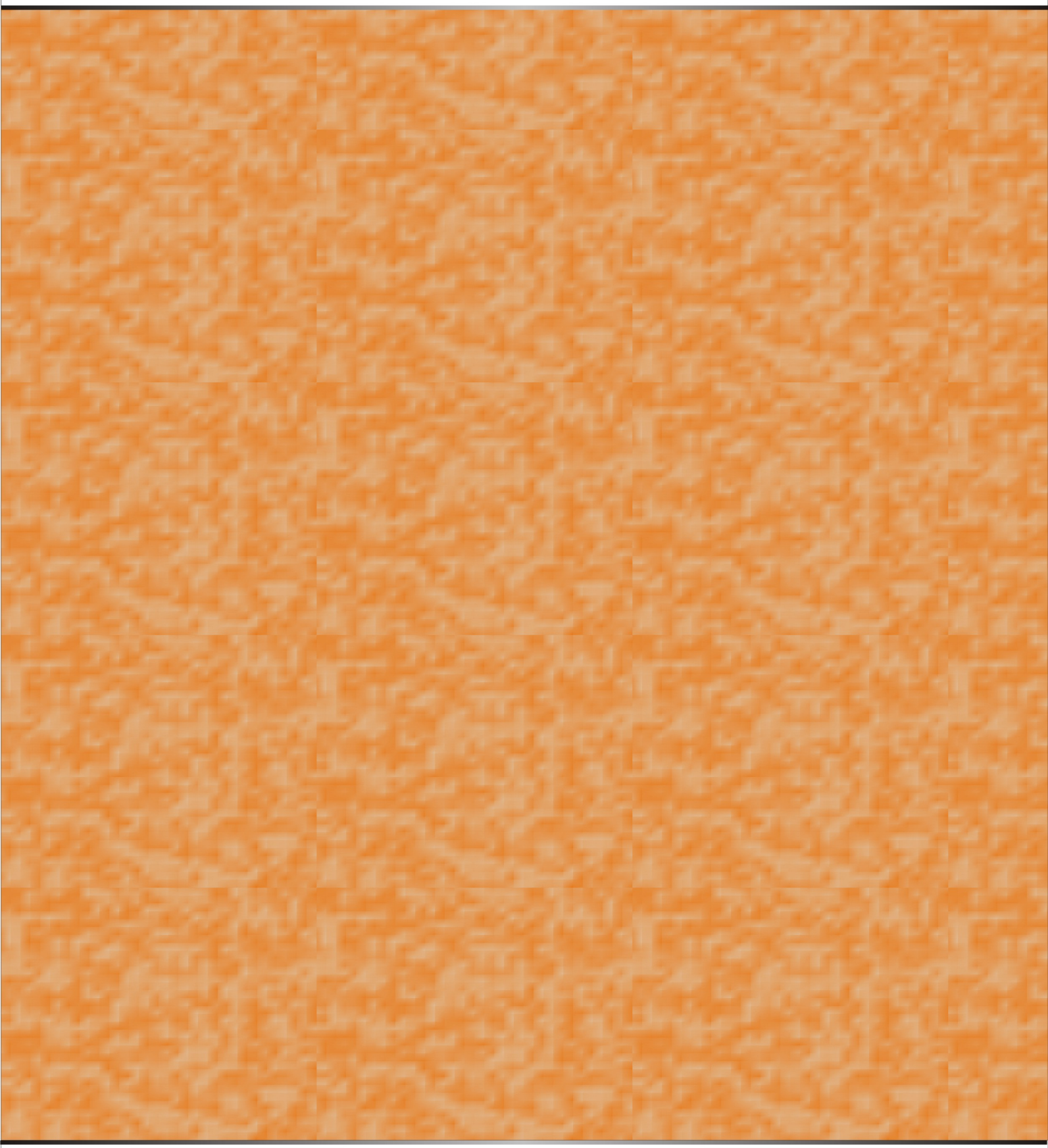
2008^	Balgair	Laverton Airport	Operational	Pinjin	Minigwal
Jan	0	14.2			• SMM
Feb	40.2	51.8		• Vertebrate Fauna	• SMM
Mar	0.6	0	• Terrestrial Vertebrates • Sandhill Dunnart	• Vertebrate Fauna (Turpin) • Flora and Vegetation • SM • Sandhill Dunnart • Vertebrate Fauna	• Terrestrial Vertebrates
Apr	23.6	6	• Terrestrial Invertebrates Malleefowl and Mulgara • Troglofauna • SMM	• SMM	
May	0.6	0	• Terrestrial Invertebrates Stygofauna • Sandhill Dunnart • Troglofauna	• Flora and Vegetation • Sandhill Dunnart	• Stygofauna
Jun	33.8	10.8	• Terrestrial Invertebrates • Troglofauna		
Jul	15.6	5.4	• Terrestrial Invertebrates Threatened Flora		
Aug	3	1.2	• Terrestrial Invertebrates Malleefowl and Mulgara • Troglofauna		
Sep	1.6	1.8	• Troglofauna		
Oct	25	0.4	• Troglofauna		
Nov	50.7	77	• Threatened Flora		• Flora and Vegetation
Dec					
Total	*194.7#*	*168.6#*			

^ Joe Benshemesh and Martin Schultz carried out a regional survey of the Western Great Victoria Desert in April-May 2008. This survey included the area around the Tropicana Gold Project.
# Excludes December 2008

APPENDIX 5: Assessments Yet to be Commissioned

Proposed Study	Proposed Scope	Proposed methodology	Proposed survey timing
Air Quality	An air quality impact assessment of the proposed TGP will be undertaken with the objective of ensuring that air emissions are managed so they do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards. The scope of works to undertake the air quality impact assessment will include: • Identification of applicable air emissions legislation, standards and EPA position and guidance statements; • Assessment of impact of the Operational Area on local air quality; • Assessment of the impact of the development on regional air quality; and, • Preparation of a report detailing the results of the above.	Air quality impact modeling will be carried out in a manner consistent with the DEC's AMQB Air Quality Monitoring Guidelines.	February 2009
GHG Emissions/EEO	A Greenhouse Gas Assessment will be completed to estimate greenhouse gas emissions and evaluate the project against Australia's proposed emission reduction targets. The specific objectives of the study will be to: • Identify the greenhouse gases that are relevant to this proposal; • Undertake greenhouse gas estimates as described in the National Greenhouse Accounts (NGA) Factors and Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006; • Undertake an evaluation of the proposed emissions against national and international best practice; • Suggest options for GHG minimization and abatement using best practice technology and offsets and provide an implementation timeline; • Estimate the abatement of the proposed mitigation strategies; and, • Comment on how the proposed Carbon Pollution and Reduction Scheme may affect abatement option.	Meet the requirements of the EPA' Guidance Statement 12 for '*Minimising Greenhouse Gases'*; National Greenhouse Accounts (NGA) Factors and Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006	January 2009

Proposed Study	Proposed Scope	Proposed methodology	Proposed survey timing
Soil Characterisation for Rehabilitation	To ensure that the characteristics of all materials present within the dunes are adequately assessed for their potential to impact negatively on rehabilitation efforts, the following scope of work is proposed: • Sampling of dune materials to depths of 5-6 m, with samples taken every 300-500 mm; • Characterisation of materials sampled in terms of their particle size distribution, salinity, exchangeable cations, exchangeable sodium percentage, and their tendency to disperse and hard-set. The hard setting may be due to specific particle sizes rather than to soil chemistry; and, • Develop recommendations on the suitability of all dune materials for use in rehabilitation activities.		February 2009
Soil water storage capacity and biomass production	The following scope of works is proposed to determine the water storage capacity of the soils within the TGP and the biomass production for the various vegetation communities, as this will give insights into annual nutrient requirements and some indication of likely biomass recycling: • Site visit to assess vegetation communities (canopy and contact cover, surface litter cover, canopy volume) and soil surface conditions – including source sink relationships for various communities; • Excavation of a number of observation pits to depths of up to 5 m to investigate rooting depth in relation to soil layers; • Development of suitable climate file for water balance modelling; • Water balance simulations for the site and local soils; and • Development of guidelines for soil reconstruction.		February 2009



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