

Appendix G

Specialist reports

- Ecology (African Litany, February 2018)
- Heritage and cultural (Archaeos Culture and Cultural Resource Consultants, February 2018, Reference: AE01804V)
- Geotechnical (Rocksoil, March 2018)



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

- (1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and
- (2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

PROPOSED DEVELOPMENT AND RELATED OPERATION OF THE EPG GAS STORAGE AND HANDLING FACILITIES AND INFRASTRUCTURE FOR DANGEROUS GOODS INCLUDING LIQUEFIED PETROLEUM GAS (LPG) AND DIESEL ON ERF 125 KLERKSOORD X2, CITY OF TSHWANE, GAUTENG PROVINCE.

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4.2 The specialist appointed in terms of the Regulations_

I, **Melissa Moffett**, declare that - - General declaration:

I act as the independent specialist in this application;

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;

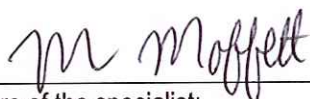
I will comply with the Act, Regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the specialist:

African Litany cc

Name of company (if applicable):

1 March 2018

Date:

GDARD could not provide their own template for this and therefore the national template was used.

**ECOLOGICAL SURVEY OF KLERKSOORD
AGRICULTURAL HOLDINGS EXT 2, HOLDING NUMBER
125, PORTION 0, CITY OF TSHWANE (PRETORIA)
GAUTENG PROVINCE**



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FEBRUARY 2017

DECLARATION OF INDEPENDENCE

African Litany cc has no connection with the development company and is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this study is not linked to approval by decision-making authorities responsible for permitting this activity and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project.

Melissa Moffett of African Litany is a registered as a professional member of the Southern African Institute of Ecologists and Environmental Scientists.

SCOPE AND PURPOSE OF REPORT

The scope and purpose of the report are reflected in the 'Terms of Reference' section of this report.

INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

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LIST OF ABBREVIATIONS AND ACRONYMS

AIS	Alien and Invasive Species Regulations (2014)
BSP	Biodiversity Sector Plan
CARA	Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983)
CBA	Critical Biodiversity Area
DEA	Department of Environmental Affairs (National)
DEAT	former Department of Environmental Affairs and Tourism (National)
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
ESA	Ecological Support Area
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
LPG	Liquefied Petroleum Gas
MHI	Major Hazardous Installation
Mamsl	Metres Above Mean Sea Level
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998) as Amended
NEM:BA	National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003)
POSA	Plants of Southern Africa
PRECIS	National Herbarium Pretoria (PRE) Computerised Information System
QDGC	Quarter Degree Grid Cell
SANBI	South African National Biodiversity Institute
SABAP 2	Southern African Bird Atlas Project 2
SDF	Spatial Development Framework

GLOSSARY

Biodiversity: The diversity of genes, species and ecosystems on Earth, and the ecological and evolutionary processes that maintain this diversity.

Biodiversity Sector Plan (BSP): A map of Critical Biodiversity Areas and Ecological Support Areas accompanied by contextual information, land and resource-use guidelines and supporting GIS data. The map must be produced using the principles and methods of systematic biodiversity planning. A BSP is the precursor to a bioregional plan.

Biodiversity Target (Threshold): The minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state in the long term in order to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystem types.

Biome: An ecological unit of wide extent, characterised by complexes of plant communities and associated animal communities and ecosystems, and determined mainly by climatic factors and soil types. A biome may extend over large, more or less continuous expanses of land surface, or may exist in small discontinuous patches.

Core Biodiversity Areas: Broad geographic areas that contain the majority of the provinces important areas for biodiversity and where development of the provinces' Protected Area Network and green economy are centred. Core Biodiversity Areas include large open landscapes with "wilderness" characteristics. These landscapes are inherently more resilient to the impacts of climate change and have important human well-being values (aesthetic, sense of place, naturalness). The Core Biodiversity Areas mapped for the province represent generalised core biodiversity, environmental or green economy nodes based on the underlying Critical Biodiversity Area (CBA) map that should be captured in Spatial Development Frameworks (SDFs).

Critical Biodiversity Areas (CBAs): CBAs include natural or near-natural terrestrial and aquatic features that were selected based on an areas biodiversity characteristics, spatial configuration and requirement for meeting both biodiversity pattern and ecological process targets. CBAs include irreplaceable sites where no other options exist for meeting targets for biodiversity features, as well as best-design sites which represent an efficient configuration of sites to meet targets in an ecologically sustainable way that is least conflicting with other land uses and activities. These areas need be maintained in the appropriate condition for their category. Some CBAs are degraded or irreversibly modified but are still required for achieving specific targets, such as cultivated lands for threatened species.

Critically Endangered Ecosystem: An ecosystem type that has very little of its original extent (measured as area, length or volume) left in a natural or near-natural condition. Most of this ecosystem type has been severely or moderately modified from its natural state. This ecosystem type is likely to have lost much of its natural structure and functioning; and the species associated with the ecosystem may have been lost.

Data Deficient (DD): A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.

Ecological Status Category: A measure of the extent that an ecosystem has been altered from natural condition due to human impact. There are six ecological categories ranging from A (natural) to F (critically/extremely modified), derived using expert and quantitative assessments of specific criteria.

Ecological Corridors: Ecological corridors, also referred to as biodiversity corridors, can be landscape structures of various size, shape and habitat composition that maintain, establish or re-establish natural landscape connectivity.

Ecological Support Areas (ESAs): Natural, near-natural, degraded or heavily modified areas required to be maintained in an ecologically functional state to support Critical Biodiversity Areas and/or Protected Areas. ESAs maintain the ecological processes on which CBAs and Protected Areas depend. Some ESAs are irreversibly modified, but are still required as they still play an important role in supporting ecological processes.

Ecological Processes: The functions and processes that operate to maintain and generate biodiversity. In order to include ecological processes in a biodiversity plan (CBA Map), their spatial components need to be identified and mapped. It includes those actions and interactions which enable natural systems to function and run as healthy, working systems.

Ecosystem threat status: Indicator of how threatened ecosystems are, *i.e.* the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function or composition. Ecosystem types are categorised as Critically Endangered, Endangered, Vulnerable or Least Threatened, based on the proportion of the original extent of each ecosystem type that remains in a good ecological condition relative to a series of biodiversity targets. Critically Endangered, Endangered and Vulnerable ecosystems are collectively referred to as threatened ecosystems, and may be listed as such in terms of the Biodiversity Act.

Endangered Ecosystem: An ecosystem type that is close to becoming Critically Endangered.

Endemic: A vegetation type, plant or animal species, which is naturally restricted to a particular defined region.

Environmental Management Plan (EMP): An environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of construction, operation and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced.

IUCN Critically Endangered (CR): A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the criteria set out by the IUCN.

IUCN Endangered (EN): A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the criteria set out by the IUCN.

IUCN Least Concern (LC): A species that has been categorised by the IUCN as evaluated but not qualified for any other category. They do thus not qualify as threatened, near-threatened, or conservation dependent.

IUCN Vulnerable (VU): A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future as defined by criteria set out by the IUCN.

Important Bird Areas (IBA): The Important Bird and Biodiversity Areas (IBA) Programme is one of BirdLife International's most important conservation initiatives. The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened; have a restricted range; are restricted to specific biomes/vegetation types, or that have significant populations, for example 20 000 waterbirds (www.birdlife.org.za).

Protected Areas (PA): Protected Areas are areas which have legal protection under relevant legislation or which are managed with a primary conservation objective. Importantly, the Protected Area definition used and the areas included in Gauteng C-Plan v3.3 deviate from those typically used in other South African conservation plans, as the key criteria used to guide inclusion or exclusion is the type of conservation management applied in an area rather than its legal status.

Threatened Ecosystem: An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function or composition.

Threatened Species: A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment (Red List), using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.

Vegetation Type: Defined in terms of dominant, common and rare species, as well as association with landscape features such as soil, geology, topography and climate (SANBI).

Vulnerable Ecosystem: An ecosystem type that still has the majority of its original extent left in a natural or near-natural condition, but has experienced some loss of habitat or deterioration in condition. The ecosystem type is likely to have lost some of its structure and functioning, and will be further compromised if it continues to lose natural habitat or deteriorate in condition.

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1 INTRODUCTION

1.1 BACKGROUND AND BRIEF PROJECT DESCRIPTION

The development and proposed operation of the EPG Gas storage and handling facility and infrastructure for dangerous goods, including liquefied petroleum gas (LPG) and diesel, is proposed on Portion 0 of Klerksoord Agricultural Holdings Extension 2, Holding No. 125, in the City of Tshwane (referred to as the project site) in Gauteng Province (Figure 1).

HydroScience cc, an independent Environmental Assessment Practitioner (EAP), has been appointed by the Developer (EPG Gas) to undertake an Environmental Impact Assessment (EIA) in support of environmental authorisation for the proposed development. The EIA will be undertaken in compliance with the requirements of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998), as amended and associated EIA Regulations of 2014, as amended in 2017. The EIA will ensure that the potential environmental and social impacts resulting from the proposed development are taken into consideration and mitigated. HydroScience has appointed African Litany cc to undertake an ecological specialist study of the project site (this report).

1.2 TERMS OF REFERENCE

The terms of reference for this study are to conduct a specialist ecological survey of the flora and fauna on Portion 0 of Klerksoord Agricultural Holdings, Extension 2, Holding no. 125, City of Tshwane (Pretoria) in Gauteng Province by undertaking the following tasks:

- Analyse and describe the baseline (current) situation on the project site;
- Assess the various ecological impacts in terms of their anticipated magnitude; and
- Recommend relevant and practical mitigation and monitoring measures that enhance potential benefits and minimise harmful effects.

1.3 METHODS

The methods and approach adopted during this specialist ecological study included referring to relevant scientific literature; undertaking a field survey; and impact prediction and management and are broadly described below:

- Biodiversity information provided in the Gauteng Conservation Plan Version 3.3 (Gauteng C-Plan V3.3, GDARD, 2014) was referred to prior to the site visit;
- Faunal and floral Red Data Lists were referred prior to the site visit as species of high-conservation priority and / or sensitive habitats may potentially be impacted by the proposed development;
- A site visit of the project area was conducted in summer (15 February 2017). The area was traversed on foot and species of plants and terrestrial vertebrate fauna seen or deduced as present were recorded;
- The state of the fauna and flora and the current land use in and adjacent to the project area were noted;
- Habitat structure, as well as aspects of floristic composition were noted;
- Faunal and floral groups were further assessed using field guides, the South African National Biodiversity Institute (SANBI) Red List website (www.redlist.sanbi.org) and other relevant literature;
- Application of specific and consistent impact assessment criteria as described in Chapter 4; and
- Development of relevant and practical mitigation and monitoring measures to address the significant impacts identified.

The groups of species broadly investigated that are likely to be affected by the proposed project included:

- Vegetation;
- Avifauna;
- Mammals; and
- Herpetofauna.

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1.3.1 Vegetation

An initial desktop study and literature review was undertaken prior to undertaking a field visit. A classification of the vegetation types in the study area was obtained from Mucina and Rutherford (2006). Trees, forbs, shrubs and grasses falling within the study area were identified and noted using field guides such as Van Oudtshoorn (1999) [grasses], Van Wyk and Malan (1998) [flowers] and Van Wyk and Van Wyk (1997) [trees]. The approach adopted was to identify vegetation areas (and associated faunal habitat) within the property that would be negatively impacted by the proposed development.

Data for the relevant quarter grid square cell (QDGC) (2528CA) were retrieved from the SANBI National Herbarium Pretoria Computerised Information System (PRECIS) database. The historical occurrence of Red List plant species in this QDGC was noted.

All exotic species categorised as alien invaders or weeds, as listed in amendments to Conservation of Agricultural Resources Act (CARA), 1983 (Act 43 of 1983) and in terms of the Alien and Invasive Species Regulations (2014) under the National Environmental Management: Biodiversity Act (NEM:BA) of 2004, were recorded.

1.3.2 Avifauna

Birds were identified by means of sightings and the identification of bird calls and were recorded. The conservation status and endemism of all species considered likely to occur in the area was determined from the national Red List for birds, literature relating to southern African bird biology (Hockey et al. 2005) and from the GDARD C-Plan V3.3.

1.3.3 Mammals

Identification of mammals in the area was based on sightings, scats, burrows and other ecological indicators. Smithers' Mammals of Southern Africa (Apps, 2000) was used for identification purposes. A list was compiled of the species that may occur in the area and their Red List status is described.

1.3.4 Herpetofauna

A list of herpetofauna that may occur in the project area was compiled and their Red List status is described: Marais (2004) and Alexander and Marais (2010) were used to determine the herpetofauna, *i.e.* snakes, tortoises, lizards, agamas, geckos and frogs that may occur in the project area based on distribution maps. Du Preez and Carruthers (2009) was used to determine which Red List amphibia may occur in the area based on distribution maps. Reference was also made to the GDARD C-Plan (V3.3).

1.4 INFORMATION GAPS, UNCERTAINTIES, STUDY LIMITATIONS AND UNDERLYING ASSUMPTIONS

Historical data on the flora and fauna obtained through official websites is assumed to be correct. There is a possibility that plant species that have not been captured in the Plants of Southern Africa (POSA) SANBI species online database for the area may occur in the study area. Similarly, the avifaunal data sourced from the SABAP 2 project website represent a minimum scenario and represent the species that have been recorded in the area.

The survey will not provide an exhaustive list of species likely to occur on the site owing to seasonal constraints. The site survey was conducted in summer and the information obtained on the species and vegetation communities during the survey period is deemed adequate to assess the potential impact on the fauna and flora in the project area.

1.5 LEGISLATIVE REQUIREMENTS

Cognisance has been taken of the legislative requirements described in this section during the preparation of this specialist ecological study.

1.5.1 National Environmental Management Act (NEMA), 1998 (Act 107 of 1998), as Amended and the associated EIA Regulations of 2014

The major environmental legislation is the National Environmental Management Act (NEMA), (Act 107 of 1998), as Amended and the associated EIA Regulations of 2014. No activity identified as threatening, may take place in a listed ecosystem without authorisation of the Minister of Environmental Affairs. The principles within NEMA have guided the formulation of the environmental management measures provided in this study:

Section 2(4)a of NEMA specifies that sustainable development requires the consideration of all relevant factors including the following:

- i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- ii) That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- vi) That the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;
- vii) That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- viii) That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

1.5.2 National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act 10 of 2004)

The enactment of biodiversity legislation (National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act 10 of 2004) promulgated in June 2004 confirmed South Africa's commitment to biodiversity and conservation. One of the objectives of this Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and to ensure the sustainable use of indigenous biological resources.

The Act, in protecting biodiversity, deals with the protection of threatened ecosystems and species, the control of alien invasive species, genetically modified organisms and regulates bioprospecting. As with NEMA, NEMBA incorporates and gives effect to international agreements relating to biodiversity.

Ecosystems that are Critically Endangered, Endangered or Vulnerable can be listed in terms of Section 52 of the Biodiversity Act as threatened ecosystems at both national and provincial level. For example, Critically Endangered ecosystems are defined in the Act as being 'ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation'.

Threatened or Protected Species Regulations of 2013 (General Notice R388 of 2013): Part 2 of NEMBA provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival. In February 2007, the Minister of Environmental Affairs and Tourism published a list of Critically Rare, Endangered, Vulnerable and Protected Species, according to Section 56(1) of the Act, which was updated in 2013.

Alien and Invasive Species Regulations, 2014 (General Notice R598): Similarly, the Alien and Invasive Species Regulations (Government Notice R. 598) were published in 2014 in terms of Section 97(1) of the NEMBA, 2004 (Act No. 10 of 2004). These Regulations provide categories of Listed Invasive Species.

1.5.3 Conservation of Agricultural Resources Act (CARA), 1983 (Act 43 of 1983)

In 1984, regulations were passed in terms of the CARA, regulations declaring about 50 species 'weeds' or 'invader plants'. These regulations were amended in 2001 and now contain a comprehensive list of species that are declared weeds and invader plants consisting of three categories as follows:

- Category 1: Declared weeds that are prohibited on any land or water surface in South Africa. These species must be controlled, or eradicated where possible;
- Category 2: Declared invader species that are only allowed in demarcated areas under controlled conditions and prohibited within 30m of the 1:50 year floodline of any watercourse or wetland; and
- Category 3: Declared invader species that may remain, but must be prevented from spreading. No further planting of these species are allowed.

The list of weeds and invader plant species published under CARA was used together with the NEMBA lists to identify alien and invasive species. In terms of the amendments to the regulations under the CARA, landowners are legally responsible for the control of alien species on their properties. Exotic/invasive species identified to occur on the project site, should be removed as recommended by CARA.

1.5.4 Gauteng Conservation Plan (C-Plan V3.3, 2013)

A systematic conservation plan for the Gauteng Province was undertaken by Gauteng Nature Conservation, a division within the Gauteng Department of Agriculture and Rural Development (GDARD). The main aims of the Gauteng C-Plan v3.3 (2014) are to:

- Serve as the basis for biodiversity inputs into land use planning processes in the province;
- Serve as the basis for biodiversity inputs into bioregional plans for municipalities within the province;
- Serve as the primary informant for the biodiversity component of the Basic Assessment and EIA processes; and
- Guide protected area expansion and biodiversity stewardship programmes in the province.

The Gauteng C-Plan v3.3 delineates the Critical Biodiversity Areas Map, biodiversity priority areas called Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Protected Areas and provides a list of threatened species. The list of threatened species has been referred to in this report (Chapter 3).

2 STUDY AREA

2.1 LOCALITY

The project site is located roughly 13.6 km north of Pretoria's central business district (CBD) in the Akasia Industrial area (Figure 1) in Gauteng Province. It is located immediately to the north of the R566 road and to the west of the Bon Accord Dam (Figure 1).

The geographical coordinates for the centre of the site are roughly as follows:

25°38'03.25"S

28°07'52.91"E

2.2 TOPOGRAPHY, GEOLOGY, SOILS AND CLIMATE

The site is relatively small in extent, *i.e.* 2,1838 hectares (ha). The terrain is flat and slopes slightly in a southerly direction. It is located at an altitude of 1,258 metres above mean sea level (mamsl). The Onderstepoort Nature Reserve including the Pyramid Koppies hill is located north of the site (Figure 1). The study area is underlain by the mafic intrusive rocks of the Rustenburg Layered Suite of the Bushveld Igneous Complex (Mucina and Rutherford, 2006). Rocks include gabbro, norite, pyroxenite and anorthosite. The shales and quartzites of the Pretoria Group also contribute.

Residual soils of the Norite of the Bushveld Igneous Complex, often referred to as 'black turf' underlie the site (Plate 1). The black turf is an expansive clay and cracking in the ground surface was seen during the survey. This may pose a problem to infrastructure stability and a geotechnical survey is recommended.



Plate 1: Black turf soils underlie the project site

The project site, located in a summer rainfall region, has a mild climate, characterised by warm, moist

summers and cool dry winters. Most of the rainfall in Pretoria occurs from October to March with a mean annual precipitation (MAP) of 732 mm. The driest weather is in July with an average rainfall of 3 mm. The wettest weather is in January with an average rainfall of 154 mm (www.pretoria.climateemps.com). The annual mean temperature in Pretoria is 17.3°C. Due to the long clear nights, little wind and dry air in Gauteng in winter, the occurrence of frost is common in the province and the area experiences on average 30 days of frost per year (Schulze, 1997).

2.3 REGIONAL VEGETATION PATTERNS

Two-thirds of Gauteng Province is located within the Grasslands Biome and the remaining third is classified as Savanna (GDARD, 2011). The project area is located within the Savanna Biome in Gauteng Province in the *SVcb 6 Marikana Thornveld* Vegetation Type (Mucina and Rutherford, 2006) (Figure 2). This vegetation unit is also referred to as Veld Type 19 Sourish Mixed Bushveld (46%) and Veld Type 13 Other Turf Thornveld (34%) by Acocks (1988) and as 14 Clay Thorn Bushveld by Low and Rebelo (1996).

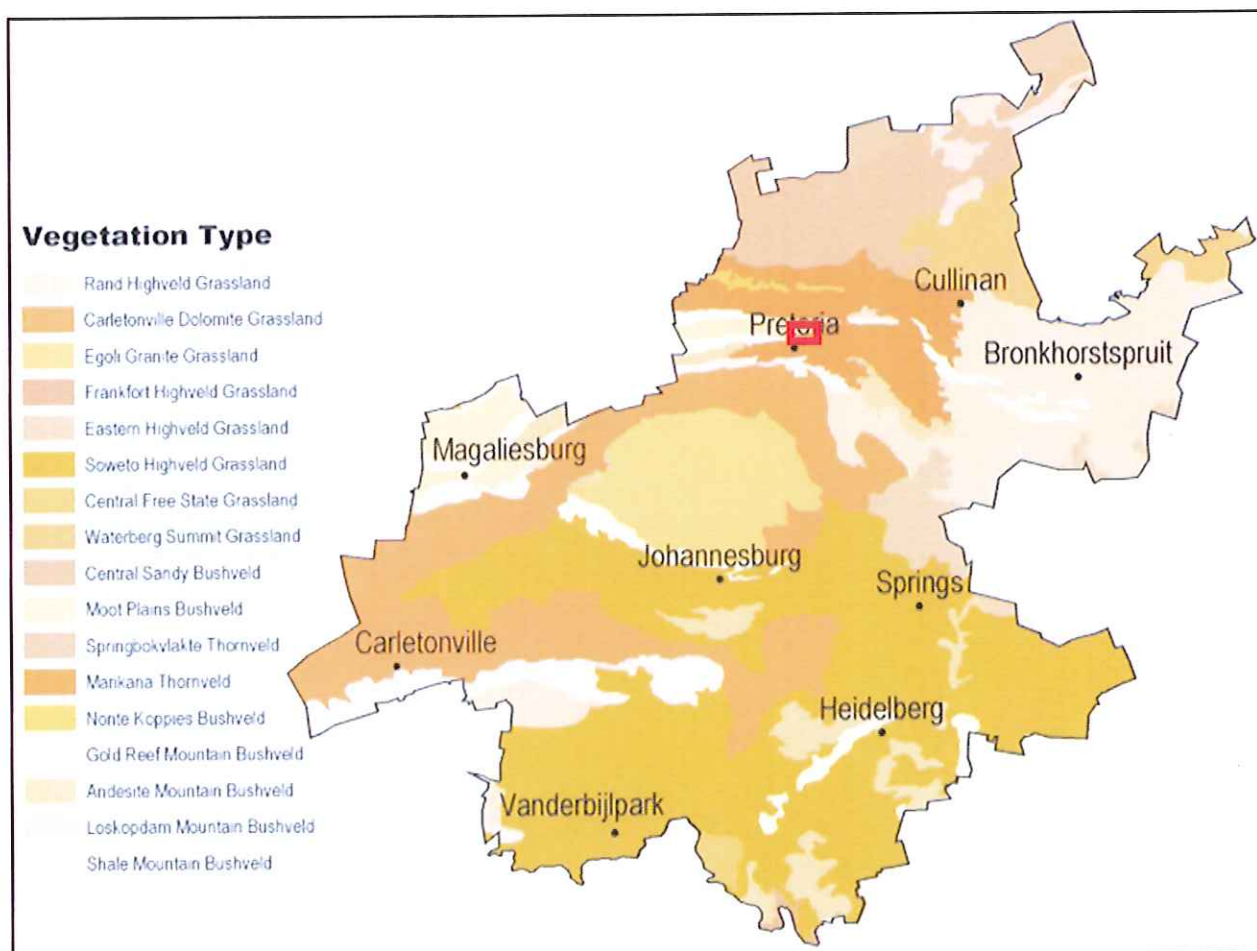


Figure 2: Vegetation Types in Gauteng (Source: Mucina and Rutherford, 2004)

The Gauteng C-Plan (V3.3 of 2014) produced a new vegetation map indicating 12 vegetation types occur in Gauteng province. In terms of this map the project site is located within the SVcb 6 *Marikana Thornveld* vegetation type (Figure 3).

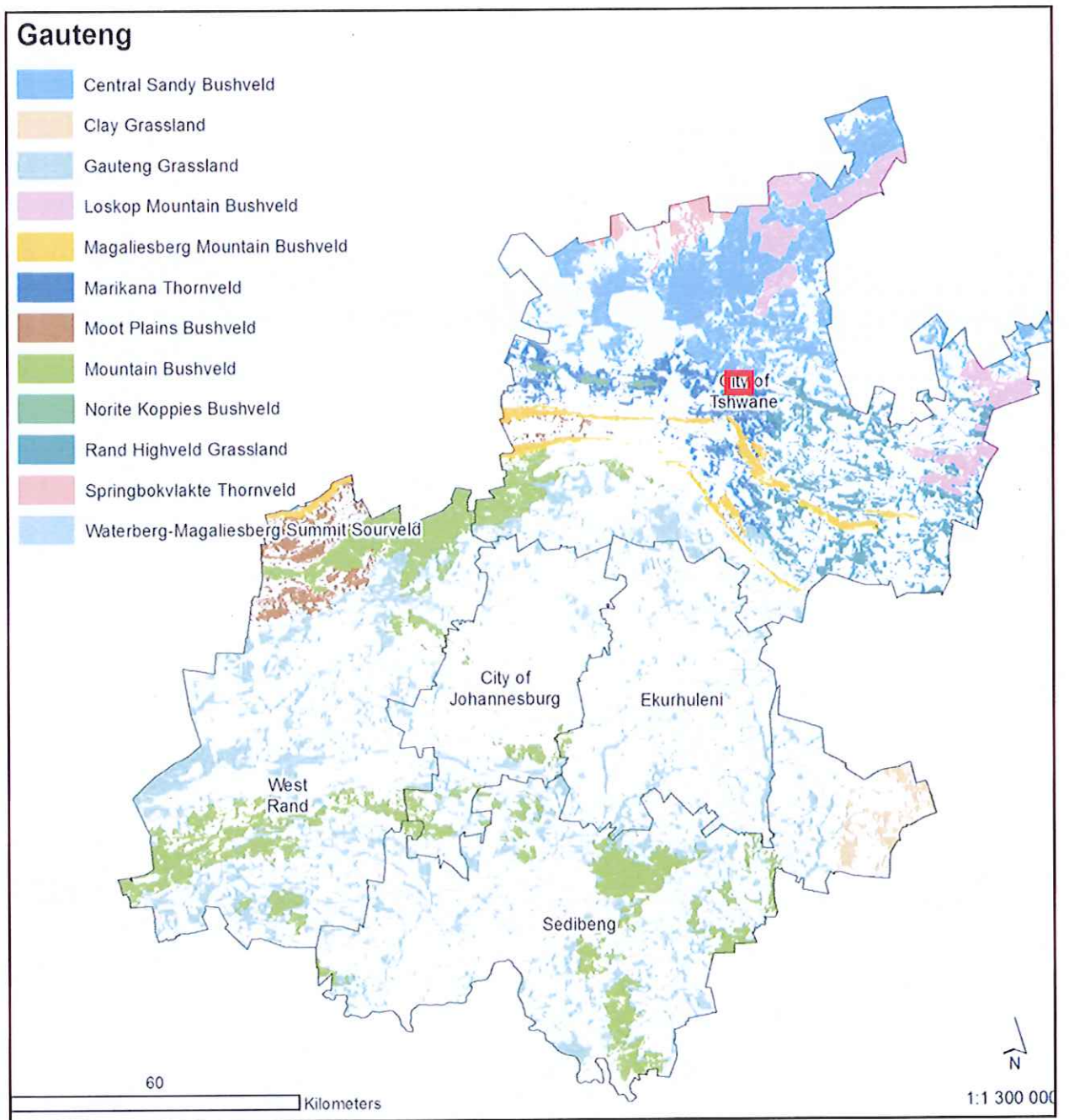


Figure 3: Gauteng C-Plan vegetation map showing 12 vegetation types (red square = project area)

3 FINDINGS

3.1 FLORA

The vegetation in the project area consists of a mix of indigenous vegetation, exotic garden plants and many weedy species. The project site is fenced and has a number of existing buildings located on it. There has been extensive dumping of general waste and bricks and much of the vegetation on the site has been transformed. This section describes vegetation that typically occurs in the SVcb 6 Marikana Thornveld vegetation type and lists species observed during the site visit.

3.1.1 Important Taxa

Important taxa occurring in the SVcb 6 Marikana Thornveld include the following (Mucina and Rutherford, 2006):

Tall Trees:

Acacia burkei.

Small Trees:

Acacia caffra (d)¹, *A. gerrardii* (d), *A. karroo* (d), *Combretum molle* (d), *Searsia lancea* (d), *Ziziphus mucronata* (d), *Acacia nilotica*, *A. tortilis* subsp. *heteracantha*, *Celtis africana*, *Dombeya rotundifolia*, *Pappea capensis*, *Peltophorum africanum* and *Terminalia sericea*.

Tall Shrubs:

Euclea crispa subsp. *crispa* (d), *Olea europaea* subsp. *africana* (d), *Searsia pyroides* var. *pyroides* (d), *Diospyros lycioides* subsp. *guerkei*, *Ehretia rigida* subsp. *rigida*, *Euclea undulata*, *Grewia flava* and *Pavetta gardeniifolia*.

Low Shrubs:

Asparagus cooperi (d), *Rhynchosia nitens* (d), *Indigofera zeyheri* and *Justicia flava*.

Woody Climbers:

Clematis brachiata (d) and *Helinus integrifolius*.

Herbaceous Climbers:

Pentarrhinum insipidum (d) and *Cyphostemma cirrhosum*.

Graminoids:

Elionurus muticus (d), *Eragrostis lehmanniana* (d), *Setaria sphacelata* (d), *Themeda triandra* (d), *Aristida scabrivalvis* subsp. *scabrivalvis*, *Fingerhuthia africana*, *Heteropogon contortus*, *Hyperthelia dissoluta*, *Melinis nerviglumis* and *Pogonarthria squarrosa*.

Herbs:

Hermannia depressa (d), *Ipomoea obscura* (d), *Barleria macrostegia*, *Dianthus mooiensis* subsp. *mooiensis*, *Ipomoea oblongata* and *Vernonia oligocephala*.

Geophytic Herbs:

Ledebouria revoluta, *Ornithogalum tenuifolium* and *Sansevieria aethiopica*.

3.1.2 Floral species observed during survey

The POSA website indicated that 2048 different plant species have been recorded in the 2528CA QDGC (<http://posa.sanbi.org>) and species richness is thus deemed to be very high.

The following tree and shrub species were noted (Plate 2):

Trees included *Acacia karroo* (Sweet Thorn), *A. caffra* (Common Hookthorn), *A. burkei* (Black monkey thorn), *Searsia lancea* (Karee), *S. leptodictya* (Mountain karee), *Ziziphus mucronata* (Buffalo thorn), *Celtis africana* (White stinkwood), *Ehretia rigida* (Puzzle bush), *Euclea crispa* (Blue guarri) and *Olea*

¹ (d) denotes dominant species

europaea subsp. *africana* (Wild olive). Shrubs noted on site included *Searsia dentata* (Raisin bush).

Forbs include *Berkheya radula*, *Aloe greatheadii* var. *daveyana*, *Ledebouria cooperii*, *Crinum bulbispermum*, *Albuca setosa*, *Hermannia depressa*, *Helichrysum coriaceum*, *H. melanacme*, *H. nudifolium*, *Euphorbia schinzii*, *Leonotis dysophylla*, *Protoasparagus setaceus* (Asparagus fern), *P. laricinus*, *Senecio venosus*, *Hypoxis rigidula*, *Vernonia oligocephala*, *Acalypha angustata*, and *Eriospermum cooperii*.

Grasses noted included species such as *Cynodon dactylon* (Couch Grass), *Elionurus muticus*, *Eragrostis curvula*, *E. chloromelas*, *Themeda triandra* (Red Grass), *Heteropogon contortus* (Spear Grass), *Hyparrhenia tamba*, *Setaria sphacelata* (Setaria), *Hyparrhenia tamba* (Blue Thatching Grass), *H. hirta*, **Chloris pycnothrix*, *Melinis nerviglumis* (Natal redtop), **Paspalum dilatatum*, *Microchloa caffra* (Pincushion Grass), *Aristida scabrivalvis* subsp. *scabrivalvis* and *Panicum schinzii* (Sweet Grass).

	
<p>Dense ground cover of grasses and small forbs with geophyte <i>Hypoxis rigidula</i></p>	<p>Stem of exotic palm tree (left) with <i>Leonotis dysophylla</i> in foreground and indigenous <i>Acacia</i> trees in the background. Note dense grass cover.</p>
	
<p>Bulbous geophyte <i>Crinum bulbispermum</i></p>	<p>Bulbous geophyte <i>Scadoxus puniceus</i></p>



	
<p>Small geophyte, <i>Ledebouria revoluta</i></p>	<p>Typical bushveld vegetation consisting of <i>Protoasparagus laricinus</i> bushes in foreground and <i>Acacia</i> sp. in the background</p>

Plate 2: Geophytes, shrubs, grasses and trees observed on site

3.1.3 Exotic and Invasive Species

A high number of invasive and exotic plant species were observed throughout the project site including *Eucalyptus* sp., **Tagetes minuta* (Khakiweed), **Bidens pilosa* (Blackjack), **Verbena. bonariensis* (Wild Verbena), **Campuloclinium macrocephalum* (Pompom weed), **Zinnia peruviana* (Red Zinnia), **Melia azederach* (Syringa), **Lantana camara*, **Morus alba* (White Mulberry), *Oenothera* sp., **Ipomoea purpurea*, **Solanum mauritianum* (Bugweed), **Pennisetum clandestinum* (Kikuyu Grass), large palm trees, **Opuntia* sp. and **Conyza podocephala*, amongst others. Plate 3 illustrates some of the alien invasive species seen in the project site.



Alien **Opuntia* species located in *Eragrostis chloromelas* grass cover



Exotic small forb *Zinnia peruviana*

Plate 3: Exotic and invasive plant species observed within the project site

3.1.4 Red Data List and Endemic Species

Lists of plant species recorded in the 2528CA QDGC that are currently considered to be threatened were obtained from the South African National Biodiversity Institute (SANBI) Plants of Southern Africa (POSA) website (Table 1). Similarly, the list of Threatened species that includes Near Threatened and Rare species was obtained from the Gauteng C-Plan (V3.3 of 2014) (Table 1).

The likelihood of these species occurring on site is indicated in Table 1 based on descriptions provided in the SANBI Red List (<http://redlist.sanbi.org>) and on observations made during the site survey. Species that have a MEDIUM probability of occurring on site have been highlighted in the table.

None of the species listed in Table 1 was observed during the survey. Species that have a MEDIUM probability of occurring on site include *Argyrobolus megarrhizum*, *Stenostelma umbelluliferum*, *Hypoxis hemerocallidae*, *Searsia gracillima* var. *gracillima*, and *Trachyandra erythrorrhiza* (Table 1). These species were not observed during the site survey. Some of these species such as *Trachyandra erythrorrhiza* and *Stenostelma umbelluliferum* typically occur in black turf soils which are found in the project site.

Table 1: List of Threatened Plant Species (<http://posa.sanbi.org> and Gauteng C-Plan, V3.3)

FAMILY	Species Name	Threatened Status (RSA Red List Status http://redlist.sanbi.org / Gauteng C-Plan V3.3)	Likelihood of Occurring ²
EUPHORBIACEAE	<i>Acalypha caperonioides</i> var. <i>caperonioides</i> (False Nettle bush)	Data Deficient	Unknown.
CRASSULACEAE	<i>Adromischus</i> <i>umbraticola</i> subsp. <i>umbraticola</i>	Near Threatened	LOW South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range and Andesite Mountain Bushveld in the south.
APIACEAE	<i>Alepidea attenuata</i>	Near Threatened	LOW Wetlands in grassland up to 2 200 m.
	<i>Alepidea peduncularis</i>	Data Deficient	Unknown
FABACEAE	<i>Argyrolobium campicola</i>	Near Threatened	LOW Highveld grassland.
	<i>Argyrolobium</i> <i>megarrhizum</i>	Near Threatened	MEDIUM Mixed bushveld habitat.
ACANTHACEAE	<i>Blepharis uniflora</i>	Rare	LOW Dry acacia woodland on sandy soil, 1000- 1250m.
HYACINTHACEAE	<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	Vulnerable	LOW Known to occur in Suikerbosrand Nature Reserve.
APOCYNACEAE	<i>Brachystelma</i> <i>discoideum</i>	Endangered	MEDIUM Major habitat is savanna.
	<i>Stenostelma</i> <i>umbelluliferum</i>	Near Threatened	MEDIUM TO HIGH Savanna. Deep black turf in open woodland mainly in the vicinity of drainage lines.

² LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species.

MEDIUM: habitats on site match general habitat description for species, but detailed micro habitat requirements are absent on the site or are unknown from the descriptions given in the literature or from the authorities.

HIGH: habitats found on site match very strongly the general and microhabitat description for the species.

DEFINITE: species found on site.

FAMILY	Species Name	Threatened Status (RSA Red List Status http://redlist.sanbi.org / Gauteng C-Plan V3.3)	Likelihood of Occurring²
	<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	Vulnerable	LOW Savanna habitat. Associated with ridges and quartzitic rocky outcrops in pockets of soil among rocks in direct sunshine.
	<i>Ceropegia turricula</i>	Near Threatened	LOW Savanna with a range from Lichtenburg to Gravelotte
SINOPTERIDACEAE	<i>Cheilanthes deltoidea</i> subsp. nov. <i>Gauteng</i> <i>form</i>	Vulnerable	LOW Found near Irene.
ASTERACEAE	<i>Cineraria</i> <i>austrotransvaalensis</i>	Near Threatened	LOW Amongst rocks on steep hills and ridges, at the edge of thick bush or under trees on a range of rock types: quartzite, dolomite and shale, 1400 - 1700 m.
	<i>Cineraria longipes</i>	Vulnerable	LOW Grassland, amongst rocks and along seepage lines, exclusively on basalt koppies on south- facing slopes.
	<i>Callilepis leptophylla</i>	Declining	LOW Grassland or open woodland, often on rocky outcrops or rocky hill slopes.
	<i>Gnaphalium nelsonii</i>	Rare-sparse	LOW Pretoria to Wolmaransstad. Savanna. Seasonally wet grasslands.
CAPPARACEAE	<i>Cleome conrathii</i>	Near Threatened	LOW Grassland and savanna. Stony quartzite slopes, usually in red sandy soil, grassland or deciduous woodland,

FAMILY	Species Name	Threatened Status (RSA Red List Status http://redlist.sanbi.org / Gauteng C-Plan V3.3)	Likelihood of Occurring²
			all aspects.
CUCURBITACEAE	<i>Cucumis humifructus</i>	Vulnerable	LOW It is entirely dependent on aardvarks for dispersal and recruitment, and is probably declining due to local extinctions of aardvarks outside reserves in South Africa.
AIZOACEAE	<i>Delosperma gautengense</i>	Vulnerable	LOW Found in savanna vegetation on south facing slopes. Range is the Magaliesberg Mountains.
	<i>Delosperma leendertziae</i>	Near Threatened	LOW Steep, south-facing slopes of quartzite in mountain grassland.
	<i>Delosperma macellum</i>	Endangered	LOW In grasslands growing in loose gravel in open places near trees.
	<i>Delosperma purpureum</i>	Endangered	LOW Grassland and savanna. Occurs on south-facing slopes, in shallow soils among crystalline or conglomerate quartzitic rocks, in sun or in partial shade, in grassland with some trees.
	<i>Frithia humilis</i>	Vulnerable	LOW Bronkhorstspuit to Middelburg. Grassland and Savanna. Very shallow soils derived from coarse sediments, Irrigasie Formation of the Ecca group.
	<i>Frithia pulchra</i>	Rare	LOW Magaliesberg and Savanna. Coarse, shallow, quartzitic soils

FAMILY	Species Name	Threatened Status (RSA Red List Status http://redlist.sanbi.org / Gauteng C-Plan V3.3)	Likelihood of Occurring²
			on sandstones.
<i>DIOSCOREACEAE</i>	<i>Dioscorea sylvatica</i>	Vulnerable	LOW Wooded and relatively mesic places, such as the moister bushveld areas and wooded mountain kloofs.
<i>HYACINTHACEAE</i>	<i>Drimia elata</i>	DDT	Not known.
<i>ZAMIACEAE</i>	<i>Encephalartos lanatus</i>	Vulnerable	LOW The species occurs in rural areas.
	<i>Encephalartos middelburgensis</i>	Critically Endangered	LOW Witbank and Middelburg area.
<i>IRIDACEAE</i>	<i>Gladiolus pole-evansii</i>	Rare-sparse	LOW Granite basement rock.
	<i>Gladiolus robertsoniae</i>	Near Threatened	LOW Moist highveld grasslands.
<i>ORCHIDACEAE</i>	<i>Habenaria barbertoni</i>	Near Threatened	LOW Rocky hillsides, in bushveld in association with acacias, 1 000 - 1500 m.
	<i>Habenaria bicolor</i>	Near Threatened	LOW Occurs in well-drained grasslands at around 1600 m in South Africa.
	<i>Habenaria kraenzliniana</i>	Near Threatened	LOW Occurs in stony, grassy hillsides, 1 000-1 400 m
	<i>Habenaria mossii</i>	Endangered	LOW Range includes Johannesburg, Pretoria and Krugersdorp. Open grassland on dolomite or in black, sandy soil.

FAMILY	Species Name	Threatened Status (RSA Red List Status http://redlist.sanbi.org / Gauteng C-Plan V3.3)	Likelihood of Occurring²
	<i>Holothrix micrantha</i>	Endangered	LOW Grassy cliffs.
	<i>Holothrix randii</i>	Near Threatened	LOW Grassy slopes and rock ledges.
	<i>Brachycorythis conica</i> subsp. <i>transvaalensis</i>	Vulnerable	LOW Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes on quartzite, 1 000 - 1 705 m.
	<i>Eulophia coddii</i>	Vulnerable	LOW Steep slopes, growing on sandstone-derived soils in grassland or bushveld.
HYPOXIDACEAE	<i>Hypoxis hemerocallidea</i>	Declining	MEDIUM Occurs in open grassland and woodland and is widespread. Decline is due to threatened habitat & widespread medicinal use of species
MESEMBRYANTHEM ACEAE	<i>Khadia beswickii</i>	Vulnerable	LOW Occurs on open shallow soil over rocks in grassland.
	<i>Lithops lesliei</i> subsp. <i>lesliei</i>	Near Threatened	LOW Occurs primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.
	<i>Lithops lesliei</i> subsp. <i>lesliei</i> var. <i>rubrobrunnea</i>	Endangered	LOW Known to occur about 5 km north west of Randfontein.
LEGUMINOSAE	<i>Melolobium</i> <i>subspicatum</i>	Vulnerable	LOW Only known from a few

FAMILY	Species Name	Threatened Status (RSA Red List Status http://redlist.sanbi.org / Gauteng C-Plan V3.3)	Likelihood of Occurring²
			localities in dolomitic grassland.
MYROTHAMNACEAE	<i>Myrothamnus flabellifolius</i>	Data Deficient	Unknown.
AMARYLLIDACEAE	<i>Nerine gracilis</i>	Near Threatened	LOW Undulating grasslands in damp areas.
	<i>Boophone disticha</i>	Declining	LOW Dry grassland and rocky areas.
	<i>Crinum macowanii</i>	Declining	LOW Mountain grassland and stony slopes in hard dry shale, gravely soil or sandy flats.
ROSACEAE	<i>Prunus africana</i>	Vulnerable	LOW Typical habitat includes evergreen forests.
ANACARDIACEAE	<i>Searsia gracillima</i> var. <i>gracillima</i>	Near Threatened	MEDIUM Restricted to a small area to the northeast of Pretoria. Rocky quartzitic outcrops in bushveld.
ASPHODELACEAE	<i>Kniphofia typhoides</i>	Near Threatened	LOW Low lying wetlands and seasonally wet areas in climax <i>Themeda triandra</i> grasslands on heavy black clay soils.
	<i>Trachyandra erythrorrhiza</i>	Near Threatened	MEDIUM Black turf marshes.
	<i>Aloe peglerae</i>	Endangered	LOW Magaliesberg Mountain Range.
SANTALACEAE	<i>Thesium boissierianum</i>	Data Deficient	Unknown
AQUIFOLIACEAE	<i>Ilex mitis</i> var. <i>mitis</i>	Declining	LOW Not observed on site.

3.1.5 Conservation Status and Biodiversity Targets

The Gauteng C-Plan V3.3 (GDARD, 2014) has delineated biodiversity priority areas called CBAs, ESAs and Protected Areas on a Critical Biodiversity Areas map. The CBAs are comprised of key areas that are required to meet national biodiversity pattern and process targets. In terms of the Gauteng C-Plan V3.3 (GDARD, 2014), the project site is not located within an important CBA (Figure 4) or within an ESA.

The site is however located within a threatened ecosystem, *i.e.* the Marikana Thornveld unit that is classed as Endangered and has a ³biodiversity target of 21 % (Table 2). The targets for defining threatened ecosystems follows the national guidelines (SANBI, 2014) and are based on the amount of each ecosystem (vegetation type) remaining relative to the biodiversity target, where:

Critically Endangered Ecosystems: where there is less ecosystem remaining than biodiversity target;
Endangered: where there is less remaining than the biodiversity target plus 15%; and

Vulnerable: where there is less than 60% remaining (60% is the ecological process target for all ecosystems). The ecosystem threat status of the project site is Vulnerable. Ecosystems with greater than 60% remaining habitat are not considered threatened at present.

Table 2 indicates that the *Marikana Thornveld* vegetation type occupies almost 90 000 hectares of land of which approximately 36 % remains as primary vegetation.

Table 2: Marikana Thornveld vegetation type and its targets included in Gauteng C-Plan V3.3

Vegetation Type (Habitat)	Total Vegetation (ha)	Remaining Primary Vegetation (ha)	Target (ha)	Target % of Total Vegetation
Marikana Thornveld	89 778	32 359	18 750	21

The NEMBA of 2004 National List of Ecosystems that are Threatened or in Need of Protection lists the Marikana Thornveld Vegetation Type as *Endangered* with a conservation target of 19 % (Government Gazette No. 34809, 9 December 2011). This vegetation type is considerably impacted with 48 % transformed, mainly cultivated and urban or built-up areas. Alien invasive plants occur localised in high densities, especially along the drainage lines.

³ For terrestrial ecosystems, biodiversity targets are set as a proportion of the original extent of an ecosystem that needs to be maintained in a natural state, and are the minimum proportion of ecosystem types required for the persistence of biodiversity. Targets provide a quantitative and a spatial interpretation of the Biodiversity Sector Plans' biodiversity conservation objectives.



Figure 4: Project site (blue square) is not located within a CBA or an ESA (Source: <http://bgisviewer.sanbi.org>)

3.2 FAUNA

Faunal habitat on the site has been reduced and is limited to trees and shrubs that occur predominantly on the broad edges of the site. Much of the site has been transformed by the establishment of sheds and other buildings, parking area and by dumping of waste (Plate 4). Fauna observed on site was primarily limited to insects and birds.

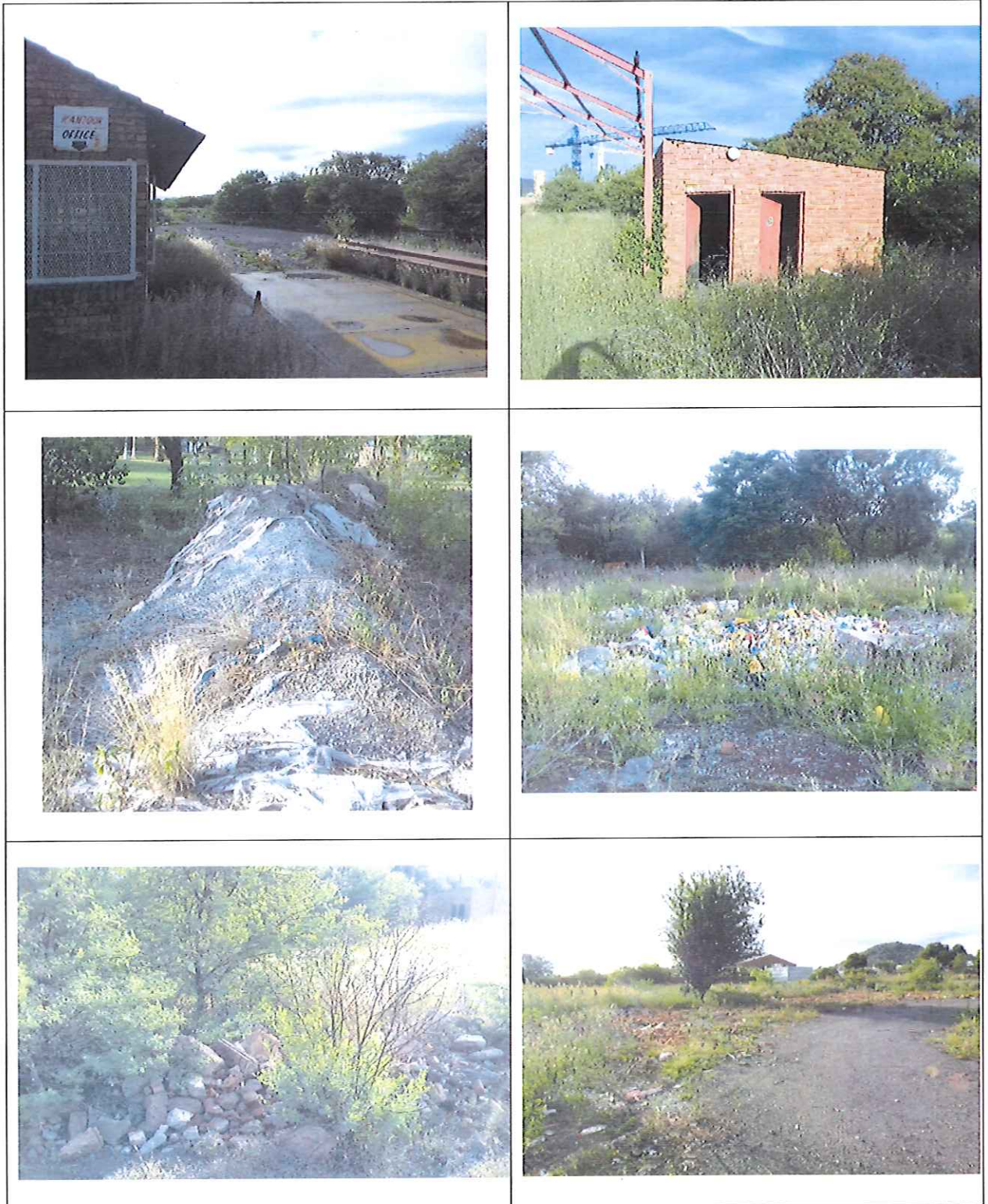


Plate 4: Transformed nature of site through establishment of infrastructure such as buildings and roads, extensive dumping of waste, thereby limiting available faunal habitat

3.2.1 Mammals

The project area is located in an urban area and is bordered by roads and institutions such as schools and it is unlikely that any large mammal species would occur on site. Ten mammal species, seven of which are bats, were prioritized for inclusion into the Gauteng C-Plan v3.3 (Table 3). The prioritization was based on threat status, with Endangered, Vulnerable and Near Threatened species being included. Species that have a MEDIUM probability of occurring in the project area have been highlighted. No signs of bat roosting areas were observed during the site visit.

Only a few small holes that would be used as burrow entrances by small rodents were noted (Plate 1) during the survey. No scats or droppings indicative of large mammal species were observed and this may be due to the urban nature of the site.

Table 3: Red List mammalian species that may occur in the project area

Common name	Scientific name	Status	Likelihood
Southern African Hedgehog	<i>Atelerix frontalis</i>	Rare	LOW Habitat includes grasslands.
Spotted-Necked Otter	<i>Lutra maculicollis</i>	Near Threatened	LOW Habitat includes clean water sources.
White Tailed Mouse	<i>Mystromys albicaudatus</i>	Endangered	LOW Habitat includes grasslands.
Juliana's Golden Mole	<i>Neamblysomus julianae</i>	Vulnerable	LOW Confined to sandy soils of the savanna (Apps, 2000).
Bats			
Scheiber's Long-Fingered Bat	<i>Miniopterus schreibersii</i>	Near Threatened	MEDIUM Roosts in caves, mines, hollow trees or rock crevices.
Temminck's Hairy Bat	<i>Myotis tricolor</i>	Near Threatened	MEDIUM Mostly in savanna woodland. Roosts in caves and mine adits.
Blasius's / Peak-Saddle Horseshoe Bat	<i>Rhinolophus blasii</i>	Vulnerable	LOW Roosts in caves.
Horseshoe Bat	<i>Rhinolophus clivosus</i>	Near Threatened	LOW Found in wide range of habitats. Roosts in caves, mines and rock cavities.
Darling's Horseshoe Bat	<i>Rhinolophus darlingi</i>	Near Threatened	LOW Roosts in caves.

Common name	Scientific name	Status	Likelihood
Hildebrandt's Horseshoe Bat	<i>Rhinolophus hildebrandtii</i>	Near Threatened	LOW Woodland. Roosts in caves, mines, cavities in rocks or large hollow trees.

3.2.2 Avifauna

A number of commonly occurring avifaunal species were observed on site including masked weavers, Swainson francolin, Cape and house sparrows, bulbuls, laughing dove, hadedaahs, Didericks cuckoo, etc. A number of weaver nests were noted on site (Plate 5).



Plate 5: Weaver nests observed in indigenous trees on site

Eleven threatened bird species were prioritized for inclusion into the Gauteng C-Plan v3.3 (Table 4), none of these species were observed during the site survey.

Table 4: Red List Avifaunal species that may occur in the project area (C-Plan V3.3)

Common name	Scientific name	Status	Likelihood
White-backed Night Heron	<i>Gorsachius leuconotus</i>	Vulnerable	LOW Occurs near quiet rivers and dams.
Secretary Bird	<i>Sagittarius serpentarius</i>	Near Threatened	LOW Site has no suitable habitat.
African Marsh Harrier	<i>Circus ranivorus</i>	Vulnerable	LOW No suitable marshland habitat for foraging.
Blue Crane	<i>Anthropoides paradiseus</i>	Vulnerable	LOW Limited suitable habitat

Common name	Scientific name	Status	Likelihood
			habitat for foraging.
Blue Crane	<i>Anthropoides paradiseus</i>	Vulnerable	LOW Limited suitable habitat (50 ha/ bird is required).
African Grass Owl	<i>Tyto capensis</i>	Vulnerable	LOW Moist grassland habitat (requires ~ 130 ha / bird as a minimum).
Half-collared kingfisher	<i>Alcedo semitorquata</i>	Near Threatened	LOW Habitat includes small, heavily wooded inland waters and well-wooded estuaries.
Melodious Lark	<i>Mirafr cheniana</i>	Near Threatened	LOW Habitat includes dry grassland dominated by <i>Themeda triandra</i> .
African Finfoot	<i>Podica senegalensis</i>	Vulnerable	LOW Preferred habitat includes quiet wooded watercourses bordered by dense riparian vegetation, largely avoiding fast-flowing and stagnant rivers.
Blue Korhaan	<i>Eupodotis caerulescens</i>	Near Threatened	LOW Shy birds, habitat includes Highveld grassland.
White-bellied Korhaan	<i>Eupodotis senegalensis</i>	Vulnerable	LOW Unsuitable habitat - requires tall grassland. Requires 120 ha per pair.

3.2.3 Herpetofauna

One snake was included in the Gauteng C-Plan V3.3 based on its Near Threatened status (Table 5). This species is unlikely to occur in the project area as it is an urban area and no ant heaps (common type of habitat that this snake is found in) were seen on the site.

The Giant Bullfrog (*Pyxicephalus adspersus*) relies on temporary wetlands and dams and is listed as Near Threatened (Table 5). While the destruction, degradation and fragmentation of grasslands and wetlands

contribute the most to the decline of the Giant Bullfrog, the high mortality of these frogs on roads (usually at night after heavy thunder showers) is also of concern.

Table 5: Red List Herpetofauna species that may occur in the project area

Common name	Scientific name	Status	Likelihood
Striped Harlequin Snake	<i>Homoroselaps dorsalis</i>	Near Threatened	LOW Grassland
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Near Threatened	LOW Temporary wetlands and dams

3.3 SENSITIVE AREAS

Sensitive areas are identified as a sensitive species habitat or a unique ecological system that it supports. This usually includes ridges, aquatic habitat such as rivers and wetlands as well as the habitat of Red Data, protected or endemic species. The project site is located near a sensitive area, *i.e.* the Onderstepoort Nature Reserve that includes the Pyramid Hills. The nearby Bon Accord Dam may also be considered as a sensitive area.

4 ECOLOGICAL IMPACT ASSESSMENT

This section describes and evaluates the potential impact that the proposed EPG Gas project may have on the ecology on the project area during the construction phase. It then goes on to predict the potential impacts that the project could have on the biodiversity of the project site if it is approved (operational phase).

4.1 METHODOLOGY

The significance of the impacts on the ecology in the study area was assessed using a standard impact assessment rating matrix. This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale / extent of impact	Magnitude (severity) of impact

To assess each of these factors for each impact, the following four ranking scales are used:

Probability	Duration
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long term
3 - Medium probability	3 - Medium term (8-15 years)
2 - Low probability	2 - Short term (0 – 7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 - Immediate
0 - None	
Scale	Magnitude
5 - International	10 – Very High / Don't know
4 – National	8 – High
3 – Regional	6 - Moderate
2 - Local	4 –Low
1 – Site Only	2 - Minor
0 – None	

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:

$$\text{SP (significance points)} = (\text{magnitude} + \text{duration} + \text{scale}) \times \text{probability}$$

The maximum value is 100 significance points (SP). The impact significance will then be rated as follows:

SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 -75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP < 30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive Impact	An impact that constitutes an improvement over pre-project conditions

4.2 IMPACT ASSESSMENT DURING CONSTRUCTION PHASE

The predicted impacts associated with the establishment of the EGP Gas facility, which is a major hazardous installation (MHI), includes the following:

General disturbance to fauna and flora

The increased people presence (construction workers) resulting in noise, poaching and disturbing fauna and flora. Site clearing that is required for the establishment of a MHI remove remaining faunal habitat. Activities associated with the construction phase include vehicle movement (noise and movement disturbance, compaction of soil), stockpiling of materials and cement, temporary ablution facilities and clearing of vegetation. This will impact fauna and flora species and habitat.

Natural Vegetation

The project site is located within an Endangered vegetation unit. Site clearing activities will destroy habitat of both faunal and floral Red List species that may occur in the project area (GDARD, C-Plan V3.3). The impact on the natural vegetation in the proposed project area footprint will be a negative, definite, permanent impact as the natural vegetation will be cleared in the entire site. The magnitude of this impact is rated as Moderate as the proposed development is located in the *Marikana Thornveld* vegetation type, which is rated as *Endangered* (Mucina and Rutherford, 2006). In terms of the GDARD C-Plan, V3.3, this vegetation type has a biodiversity conservation target of 21 %.

This impact is rated as being of Moderate significance (Table 6) and with the application of mitigation remains as Moderate. This is owing to the Endangered status of the vegetation unit. While large sections of the site (roughly three quarters) is transformed by dumping of various forms of waste and by the establishment of infrastructure, a number of large indigenous trees, shrubs and understory forbs (many being geophytes or bulbs) and grasses occur within the project site.

Reduction in faunal habitat and species

The urban nature of the site and the transformed habitat of much of the area has led to displacement of indigenous faunal species with the overall result being a reduction in the faunal species diversity and numbers. The removal of the remaining indigenous vegetation in the relatively small project footprint areas will definitely result in a further reduction of faunal habitat and food resources for faunal species that may typically include small mammals, reptiles and birds (Table 6).

The impact of vegetation clearing activities on the fauna in the project areas is a definite impact that is of permanent duration and local in extent (site). This impact is of Moderate magnitude and is of Moderate significance. The significance of the impact with the application of mitigation measures is Low (Table 6).

Increase in the spread of declared weeds and alien invader plants

The site is characterised by large tracts of weedy vegetation. The clearing of vegetation for construction activities is unlikely to promote the establishment of alien species as most the vegetation will remain cleared. The impact is a direct negative impact that has a high probability of occurring, is of short-term duration, local in extent and of Moderate magnitude. The significance of the impact with mitigation measures is Low (Table 6).

4.3 IMPACT ASSESSMENT DURING OPERATIONAL PHASE

Floral and Faunal habitat diversity

The overall impact on indigenous flora and fauna during the operational phase will be a negative, permanent impact of high magnitude and local (limited to the project site) in extent. The significance remains Moderate even with the application of appropriate management measures (Table 7) as this development will result in a reduction in the extent of this Endangered vegetation unit. Despite this rating, certain management measures are recommended that may be considered as significance offsets.

Table 6: Construction Phase impacts on local ecosystem (Fauna and Flora)

Project Aspect / activity	Impact Type	Duration (d)	Scale (Extent) (s)	Probability of Occurrence (p)	Magnitude (m)	Significance Points Rating (m+d+s)*p=SP	Impact Significance (without mitigation)	Impact Significance with mitigation
Loss of Vulnerable Marikana Thornveld vegetation type Vegetation within the project footprint will be cleared resulting in a reduction in the overall extent of <i>Vulnerable</i> Marikana Thornveld. Consequences may include: <ul style="list-style-type: none"> Increased vulnerability of remaining vegetation type portions to future disturbance. Reduction of habitat for sensitive species and existing large trees. General reduction in biodiversity. 	Direct, negative	Permanent (5)	Site (1)	Definite (5) (will occur)	Moderate (6)	(6+5+1)*5=60	Moderate	Moderate
Loss of habitat for threatened and / or protected faunal species The removal of the vegetation in the small project footprint areas will definitely result in a reduction of faunal habitat and food resources for faunal species that may include small mammals, reptiles and birds. Consequence may include: <ul style="list-style-type: none"> A change in the conservation status of the species. A reduction in occupancy area of the species. 	Direct, negative	Permanent (5)	Site (1)	Definite (5) – (will occur)	Moderate (6)	(6+5+1)*5=60	Moderate	Low

Project Aspect / activity	Impact Type	Duration (d)	Scale (Extent) (s)	Probability of Occurrence (p)	Magnitude (m)	Significance Points Rating (m+d+s)*p=SP	Impact Significance (without mitigation)	Impact Significance with mitigation
Establishment and spread of declared weeds and alien invader species <ul style="list-style-type: none"> Clearing of vegetation for construction activities may lead to a temporary spread of alien invasive species. Such species are often more prominent near infrastructural disturbances relative to less disturbed areas. The project site is already characterised by high levels of alien and invasive species. 	Direct, negative	Short term (2)	Site (1)	Highly Probable (4)	Moderate (6)	(6+2+1)*5=45	Moderate	Low

Table 7: Operational Phase Impacts on local Ecosystem

Project Aspect / activity	Impact Type	Duration (d)	Scale (Extent) (s)	Probability of Occurrence (p)	Magnitude (m)	Rating Significance Points Rating (m+d+s)*p=SP	Impact Significance (without mitigation)	Impact Significance with mitigation
Reduction in extent of vegetation unit The development will permanently reduce the footprint of this Endangered vegetation unit.	Direct, negative	Permanent (5)	Site (1)	Definite (5) – (will occur)	High (8)	(8+5+1)*5=70	Moderate	Moderate

5 CONCLUSIONS AND RECOMMENDATIONS

It is acknowledged that the project site falls within the Marikana Thornveld ecosystem listed as Endangered in terms of the NEMBA National List of Ecosystems that are threatened or in need of protection. However, the proposed site is located within an urban area that is characterised by similar light industrial developments and much of the site, roughly three quarters, is transformed and in a degraded state (Plate 4). The remaining quarter is characterised by small stands of relatively undisturbed indigenous vegetation (trees and shrubs with a dense forb and grass understorey). The proposed EPG Gas development will result in the removal of much waste and litter that is found on the site.

It is therefore recommended that the application be approved pending certain conditions. The conditions should include the following, amongst others:

- The applicant is to undertake an alien vegetation eradication programme and clear all alien vegetation species from the site. The plan must be implemented from the start of construction as it takes at least three years to break the cycle of regeneration.
- Construction-related activities must be limited to the extent of the site to limit disturbances to surrounding areas, which shall be designated as no-go areas. The Contractor is to communicate all no-go areas to his employees prior to construction commencing.
- A plant rescue operation must be undertaken prior to construction commencing to remove all geophytes and replant them in a similar area such as the protected Onderstepoort Nature Reserve. Geophytes to be rescued include *Hypoxis rigidula*, *Scadoxus punicea*, *Ledebouria revoluta*, *Crinum bulbispermum* (Plate 2) and *Aloe greatheadii* var. *daveyana*. The translocation should be undertaken by a suitably qualified person such as a botanist or a GDARD representative. Monitoring to ensure the plants survive must be undertaken for at least 6 months to a year following the transplanting.
- No fauna species encountered may be harmed, trapped or captured. No poaching is allowed.
- As far as possible and practical, the removal of large indigenous trees, shrubs and understorey vegetation should be minimised. It is recommended that small stands of indigenous trees be retained as illustrated in Plate 6.
- In the event that any rare/endangered/protected species are found in the footprint area, such species should be relocated to a similar location/habitat not more than 300 metres from its original location. As described above, a suitably qualified professional (botanist) or an institution, e.g. GDARD, should be contacted to advise and assist the applicant to ensure that the threatened species relocation process is undertaken appropriately and does not result in the death of the species being moved.
- An Environmental Control Officer (ECO) shall be appointed during the construction phase to ensure mitigation measures are applied as per the Environmental Management Plan (EMP).



Plate 6: Areas with stands of trees (green boundary) to be retained if practical

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