

Appendix G: Specialist Reports

Appendix G1: Ecological Habitat Assessment

Ecological Habitat Assessment

Proposed East-West Link Road

Re-alignment,

City of Johannesburg Metropolitan

Municipality

Report Compiled by:

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For



STEYN CITY



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DECLARATION OF INDEPENDENCE

Specialist Name	Nico-Ronaldo Retief
Declaration of Independence	<p>I declare, as a specialist appointed in terms of the National Environmental Management Act (Act No 108 of 1998) and the associated 2014 Environmental Impact Assessment (EIA) Regulations, that I:</p> <ul style="list-style-type: none"> • 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 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	
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EXECUTIVE SUMMARY

Prism Environmental Management Services cc was requested to conduct an Ecological Assessment for the proposed East-West Link Road Re-alignment in the City of Johannesburg Metropolitan Municipality, Gauteng. The development site is located west of William Nicol drive and north of the existing Dainfern Estate at Steyn City. The site is situated west and adjacent to the Jukskei River.

- In the case of this study site, patches of grassland in fair condition remain.
- A watercourse occurs near the proposed footprint near the stables at the site. A riparian zone of the Jukskei River is present at the eastern end of the site. The proposed re-alignment does not cross these watercourses.
- Two plant species *Hypoxis hemerocallidea* and *Boophone disticha* that are not threatened, but listed as Declining are visibly frequent at the site and larger study area and could be conserved in the larger study area and relocated from the footprint, if the development is approved.
- Watercourses at the site are regarded as of medium-high sensitivity.
- Transformed and modified areas beyond reasonable restoration are regarded as of low ecological sensitivity.
- There appears to be no loss of any threatened species, if the site is developed.
- The site is part of the grassland vegetation type, Egoli Granite Grassland that is of high conservation priority and listed Endangered according to the National List of Threatened Ecosystems (2011). Measures are in place to conserve a substantial patch of this grassland type in as natural as possible form at the larger study area.
- Eradication of alien invasive species in the area is to be commended. Eradication of *Robinia pseudoacacia* at the site is imperative.
- Specific recommendations for to be followed during the Operational and Construction phases were made and should form part of the Environmental Authorisation and adhered to.

TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	PROJECT DESCRIPTION.....	1
1.2	PROPOSED EAST-WEST LINK ROAD RE-ALIGNMENT	1
1.3	STUDY AREA.....	6
1.4	SCOPE AND PURPOSE	9
1.5	OVERVIEW OF SPECIALISTS	9
2	REPORT OUTLINE	11
3	LEGISLATION AND GUIDELINES	13
3.1	THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA.....	13
3.2	NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA), ACT NO. 107 OF 1998	13
3.3	NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (NEM:BA), ACT NO. 10 OF 2004	13
4	METHODOLOGY	14
4.1	DESKTOP ASSESSMENT	14
4.2	LITERATURE REVIEW	14
4.3	SITE INVESTIGATION.....	14
4.4	IMPACT ASSESSMENT METHODOLOGY.....	17
4.5	CONSULTATION PROCESS	20
5	ASSUMPTIONS, GAPS AND LIMITATIONS	21
6	RESULTS AND FINDINGS.....	22
6.1	HABITAT AND VEGETATION CHARACTERISTICS.....	22
6.2	ASSESSMENT OF PLANT SPECIES OF CONSERVATION CONCERN	23
6.3	ASSESSMENT OF VERTEBRATE SPECIES OF CONSERVATION CONCERN	28
6.4	ASSESSMENT OF INVERTEBRATE SPECIES OF CONSERVATION CONCERN	35
6.5	PHOTOGRAPHIC RECORD	41
6.6	SITE SENSITIVITY.....	44
7	IMPACT ASSESSMENT	46
7.1	ANTICIPATED RISKS OR IMPACTS TO THE LOSS OF HABITAT	47
7.2	ANTICIPATED RISKS OR IMPACTS ON THE LOSS OF FAUNA	47
7.3	ANTICIPATED RISKS OR IMPACTS TO THE LOSS OF FLORA	48
7.4	ANTICIPATED RISKS OR IMPACTS TO THE DEGRADATION OF THE ECOLOGICAL SYSTEMS	49
7.5	ANTICIPATED RISKS OR IMPACTS ASSOCIATED WITH DISRUPTION OF NATURAL CORRIDORS.....	49
8	REASONED OPINION AND RECOMMENDATIONS	51

8.1	DESIGN AND CONSTRUCTION PHASE:	51
8.2	OPERATION PHASE:	52
9	REFERENCES.....	53
10	APPENDICES.....	58
10.1	CURRICULUM VITAE OF SPECIALISTS.....	59
10.2	APPENDIX B - LIST OF PLANT SPECIES RECORDED AT THE SITE.	64

LIST OF FIGURES

FIGURE 1-1: THE LOCALITY PLAN FOR THE EAST-WEST LINK ROAD RE-ALIGNMENT STUDY AREA.....	2
FIGURE 1-2: PREFERRED ALTERNATIVE (PROPOSAL) RE-ALIGNMENT POSITIONING	3
FIGURE 1-3: POSITIONING OF ALTERNATIVE 1.	5
FIGURE 1-4: VEGETATION UNIT (MUCINA & RUTHERFORD, 2006)	8
FIGURE 6-1: LEGEND TO SITE SENSITIVITY	44
FIGURE 6-2: SENSITIVITY MAP	45

LIST OF TABLES

TABLE 1-1: DETAILS OF SPECIALISTS	9
TABLE 2-1. SPECIALIST REPORT REQUIREMENTS.....	11
TABLE 4-1: SITE INVESTIGATION DETAILS.....	14
TABLE 4-2: NATURE AND TYPE OF IMPACT.....	17
TABLE 4-3: CONSEQUENCE OF THE IMPACT OCCURRING.....	18
TABLE 4-4: PROBABILITY AND CONFIDENCE OF IMPACT PREDICTION.....	18
TABLE 4-5: SIGNIFICANCE RATING OF THE IMPACT.	19
TABLE 4-6: LEVEL OF CONFIDENCE OF THE IMPACT PREDICTION.	19
TABLE 4-7: MITIGATION EFFICIENCY.....	20
TABLE 4-8: DEGREE OF REVERSIBILITY AND LOSS OF RESOURCES.....	20
TABLE 6-1:OUTLINE OF MAIN LANDSCAPE AND HABITAT CHARACTERISTICS OF THE SITE.	22
TABLE 6-2: THREATENED PLANT SPECIES OF THE GAUTENG PROVINCE THAT ARE LISTED IN THE CRITICALLY ENDANGERED CATEGORY. THE LIST HERE FOLLOWS THE MOST RECENT UPDATED RED LIST OF SOUTH AFRICAN PLANT SPECIES (RAIMONDO ET AL. 2009). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.	23
TABLE 6-3: THREATENED PLANT SPECIES OF THE GAUTENG PROVINCE THAT ARE LISTED IN THE ENDANGERED CATEGORY. THE LIST HERE FOLLOWS THE MOST RECENT UPDATED RED LIST OF SOUTH AFRICAN PLANT SPECIES (RAIMONDO ET AL. 2009). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.....	23
TABLE 6-4: THREATENED PLANT SPECIES OF THE GAUTENG PROVINCE THAT ARE LISTED IN THE VULNERABLE CATEGORY. THE LIST HERE FOLLOWS THE MOST RECENT UPDATED RED LIST OF SOUTH AFRICAN PLANT SPECIES (RAIMONDO ET AL. 2009). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.....	24
TABLE 6-5: NEAR THREATENED PLANT SPECIES OF THE GAUTENG PROVINCE. THE LIST HERE FOLLOWS THE MOST RECENT UPDATED RED LIST OF SOUTH AFRICAN PLANT SPECIES (RAIMONDO ET AL. 2009). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.	25
TABLE 6-6: LEAST CONCERN (= NOT THREATENED) PLANT SPECIES OF THE GAUTENG PROVINCE THAT ARE HOWEVER, OF PARTICULAR CONSERVATION CONCERN AND LISTED IN THE RARE CATEGORY. THE LIST HERE FOLLOWS THE MOST RECENT RED LIST OF SOUTH	

AFRICAN PLANT SPECIES (RAIMONDO ET AL.2009). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.	26
TABLE 6-7: NOT THREATENED PLANT SPECIES OF THE GAUTENG PROVINCE WHICH ARE HOWEVER OF CONSERVATION CONCERN AND LISTED IN THE DECLINING CATEGORY. THE LIST HERE FOLLOWS THE MOST RECENT RED LIST OF SOUTH AFRICAN PLANT SPECIES (RAIMONDO ET AL. 2009). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.	26
TABLE 6-8: PLANT SPECIES OF THE GAUTENG PROVINCE OF WHICH THE CONSERVATION STATUS IS UNCERTAIN OWING TO A LACK OF INFORMATION AND WHICH ARE LISTED IN THE DATA DEFICIENT CATEGORY. THE LIST HERE FOLLOWS THE MOST RECENT RED LIST OF SOUTH AFRICAN PLANT SPECIES (RAIMONDO ET AL. 2009). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.....	27
TABLE 6-9: LIST OF TREE SPECIES OF THE GAUTENG PROVINCE WHICH ARE NOT THREATENED, BUT LISTED AS PROTECTED SPECIES UNDER THE NATIONAL FORESTS ACT [NFA] NO. 84 OF 1998, SECTION 51(1). NO = PLANT SPECIES IS NOT A RESIDENT ON THE SITE; YES = PLANT SPECIES IS A RESIDENT AT THE SITE.	27
TABLE 6-10: THREATENED MAMMAL SPECIES OF THE GAUTENG PROVINCE. LITERATURE SOURCES: FRIEDMAN & DALY, (2004), SKINNER & CHIMIMBA (2005), WILSON & REEDER (2005). FURTHERMORE, GOLDEN MOLE SPECIES THAT ARE RARE AND BEING REPORTED FROM THE ADJACENT FREE STATE AND LIMPOPO PROVINCES HAVE ALSO BEEN INCLUDED.	28
TABLE 6-11: NEAR THREATENED MAMMAL SPECIES KNOWN TO OCCUR IN THE GAUTENG PROVINCE, FREE STATE PROVINCE AND NORTH-WEST PROVINCE. LITERATURE SOURCES: SKINNER & CHIMIMBA (2005).	29
TABLE 6-12: THREATENED BIRD SPECIES OF THE GAUTENG PROVINCE. LITERATURE SOURCES BARNES (2000), HOCKEY, DEAN & RYAN, P.G. (2005) AND CHITTENDEN (2007).	30
TABLE 6-13: NEAR THREATENED BIRD SPECIES OF THE GAUTENG PROVINCE. LITERATURE SOURCES BARNES (2000), HOCKEY, DEAN & RYAN, P.G. (2005) AND CHITTENDEN (2007).	32
TABLE 6-14: THREATENED REPTILE SPECIES IN GAUTENG PROVINCE. SOURCES: ALEXANDER & MARAIS (2007). NO = REPTILE SPECIES IS NOT A RESIDENT ON THE SITE; YES = REPTILE SPECIES IS FOUND TO BE RESIDENT ON THE SITE.	34
TABLE 6-15: NEAR THREATENED REPTILE SPECIES IN GAUTENG PROVINCE. SOURCES: ALEXANDER & MARAIS (2007). NO = REPTILE SPECIES IS NOT A RESIDENT ON THE SITE; YES = REPTILE SPECIES IS FOUND TO BE RESIDENT ON THE SITE.	35
TABLE 6-16: THREATENED: ENDANGERED BUTTERFLY SPECIES OF THE GAUTENG PROVINCE. SOURCES: MECENERO ET AL. (2013), HENNING, TERBLANCHE & BALL (2009).....	36
TABLE 6-17: RARE BUTTERFLY SPECIES OF THE GAUTENG PROVINCE. SOURCE: MECENERO ET AL. (2013).	37
TABLE 6-18: FRUIT CHAFER SPECIES (COLEOPTERA: SCARABAEIDAE: CETONINAE) IN THE GAUTENG PROVINCE WHICH ARE OF KNOWN HIGH CONSERVATION PRIORITY.	39
TABLE 6-19: BABOON SPIDER SPECIES (ARANEAE: TERAPHOSIDAE) SPECIES THAT ARE OF KNOWN HIGH CONSERVATION PRIORITY IN THE GAUTENG PROVINCE.....	40
TABLE 6-20: ROCK SCORPION SPECIES (SCORPIONES: ISCHNURIDAE) SPECIES THAT ARE OF KNOWN HIGH CONSERVATION PRIORITY IN THE GAUTENG PROVINCE AND GAUTENG PROVINCE.	40
TABLE 7-1: IMPACT TO LOSS OF HABITAT.....	47
TABLE 7-2: IMPACT ON THE LOSS OF FAUNA.....	47
TABLE 7-3: IMPACT ON THE LOSS OF FLORA.....	48
TABLE 7-4: IMPACT ON ECOLOGICAL SYSTEM DEGRADATION.....	49

TABLE 7-5: IMPACTS ASSOCIATED WITH DISRUPTION OF NATURAL CORRIDORS 49

TABLE 10-1: LIST OF PLANT SPECIES RECORDED ONSITE..... 64

LIST OF PHOTOS

PHOTOGRAPH 6-1: ALIEN INVASIVE ROBINIA PSEUDOACACIA (BLACK LOCUST TREE) AT THE SITE.....	41
PHOTOGRAPH 6-2: THE DECLINING BOOPHONIA DISTICHA AT THE STUDY AREA.	41
PHOTOGRAPH 6-3: THE DECLINING HYPOXIS HEMEROCALLIDEA AT THE STUDY AREA.	42
PHOTOGRAPH 6-4: FLOWERS OF ALOE DAVYANA, A WIDESPREAD ALOE IN THE CENTRAL INTERIOR AT THE NORTHERN PROVINCES OF SOUTH AFRICA AT THE SITE.	42
PHOTOGRAPH 6-5: MARSH OWL, ASIO CAPENSIS, WIDESPREAD IN THE NORTH-EASTERN PARTS OF SOUTH AFRICA, PHOTOGRAPHED AT THE SITE.	43
PHOTOGRAPH 6-6: SOUTHERN VIEW FROM THE PROPOSED EAST-WEST LINK ROAD RE-ALIGNMENT	43
PHOTOGRAPH 6-7: NORTHERN VIEW FROM THE PROPOSED EAST-WEST LINK ROAD RE-ALIGNMENT	44

1 INTRODUCTION

1.1 Project Description

The development of Porcupine Avenue from the border of Riverside View Extension 35 up to Runnymead Road was authorised by the Gauteng Department of Agriculture and Rural Development (GDARD) on 25 February 2016 (Gaut: 002/15-16/E0053). In addition to above 2016 Authorisation, sections of the road were also authorised as part of separate processes (Gaut: 002/12-13/E0070; Gaut: 006/13-14/E0091 and Gaut: 002/14-15/0022).

However, a small section of the authorised alignment (the intersection between 10th Road and Runnymead Road) impacts on the existing Equestrian Estate within Steyn City. It is therefore necessary to redesign this section. The proposed re-alignment involves the bending of the road so that it no longer impacts on Steyn City (Figure 1-2). The overall location of the proposed re-alignment is shown in Figure 1-1.

1.2 Proposed East-West Link Road Re-alignment

Two alternative re-alignment options will be assessed as part of the authorisation process. The preferred option occurs on the Remaining Extent of Farm Diepsloot 388-JR within Ward 96 of the City of Johannesburg Metropolitan Municipality. The property is owned by Johannesburg Property Company (JPC) and the area (Porcupine Park) is currently managed through a management agreement which is in place between City of Johannesburg and Steyn City Properties (Pty) Ltd (previously known as Golden Creek Investments (Pty) Ltd).

The overall East-West Link Road is anticipated to carry high volumes of traffic and thus function as an important link in the greater road network. The aim of the road is to assist with the distribution and alleviation of traffic in this area of Johannesburg. The road has been planned as a Class 3 Arterial Road and will be managed by Johannesburg Roads Agency (JRA).

1.2.1 Alternatives

As mentioned above, two alternatives will be assessed in addition to the no-go alternative.

1.2.1.1 Proposal

The proposed section that will be re-aligned is the western section of the road which commences east of Runnymead Road and follows in a western direction towards the intersection with the R114 (P39-1/K52). As part of the preferred re-alignment (The Proposal), a small section of the road curve northwards so to miss the existing Steyn City Equestrian Estate. It will then curve southwards and joins up with the existing Runnymead Road and 10th Road intersection. From the intersection, it will follow the existing alignment again (Figure 1-2).

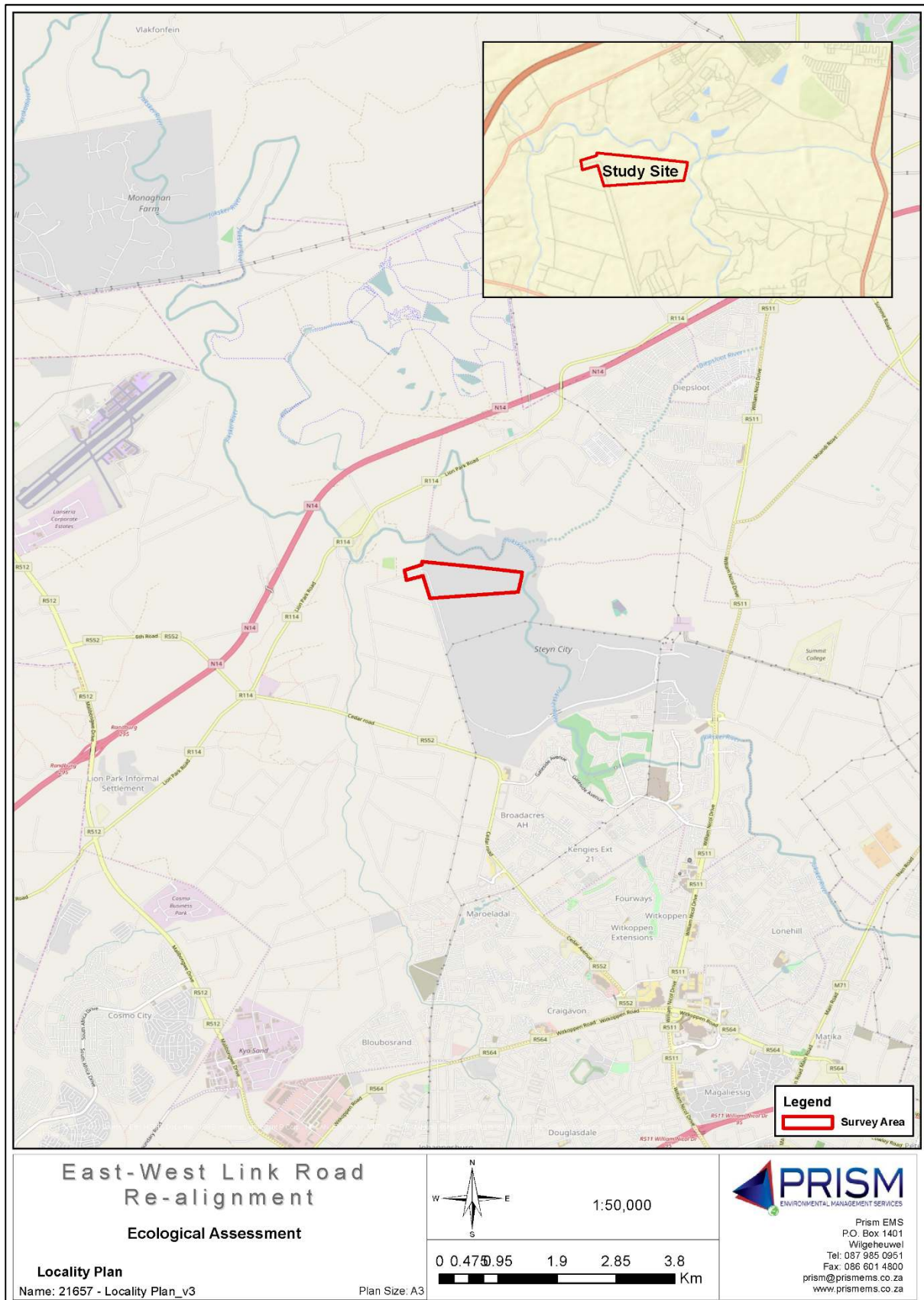


Figure 1-1: The locality plan for the East-West Link Road Re-alignment study area

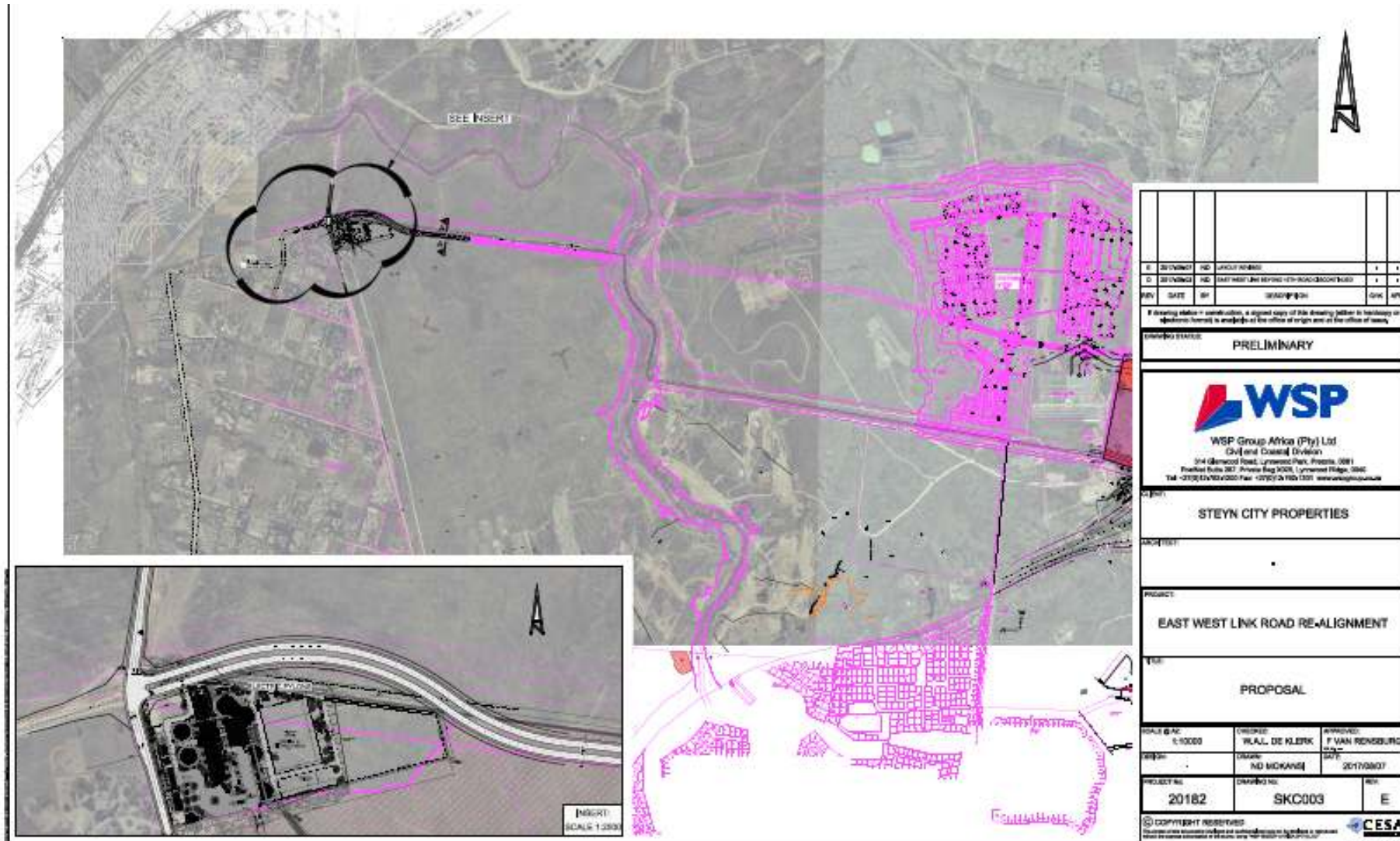


Figure 1-2: Preferred Alternative (Proposal) re-alignment positioning

The proposed re-aligned section is approximately 500m in length and has a 32m width road reserve.

The proposed re-alignment will have the following classification:

- Class 3 Minor Arterial;
- Dual carriageway road with a road reserve of 32m;
- Design speed of 80km/h;
- Carriageway surface width of 7.0m;
- Lane width of 3.5m; and
- Walkway width or 3.0m.

1.2.1.2 Alternative 1

Within Alternative 1, Porcupine Avenue will be re-aligned east of the Jukskei River on Portion 5 of Farm of Diepsloot 388-JR. It will then run adjacent to the Steyn City boundary (within the Remaining Extent of Farm Diepsloot 388-JR – i.e. Porcupine Park). It then will cross Runnymead Avenue slightly to the north of the existing Runnymead road and 10th road intersection. From the intersection, the road will curve to the south and then join the existing 10th road. This bend in the road will occur within Portion 25 of Farm Nietgedacht 535-JQ. Figure 1-3 shows the extent of the re-alignment in terms of Alternative 1. It should be noted that with Alternative 1, the full alignment of Porcupine Avenue will run within Porcupine Park and a much larger section of the road will have to be re-aligned.

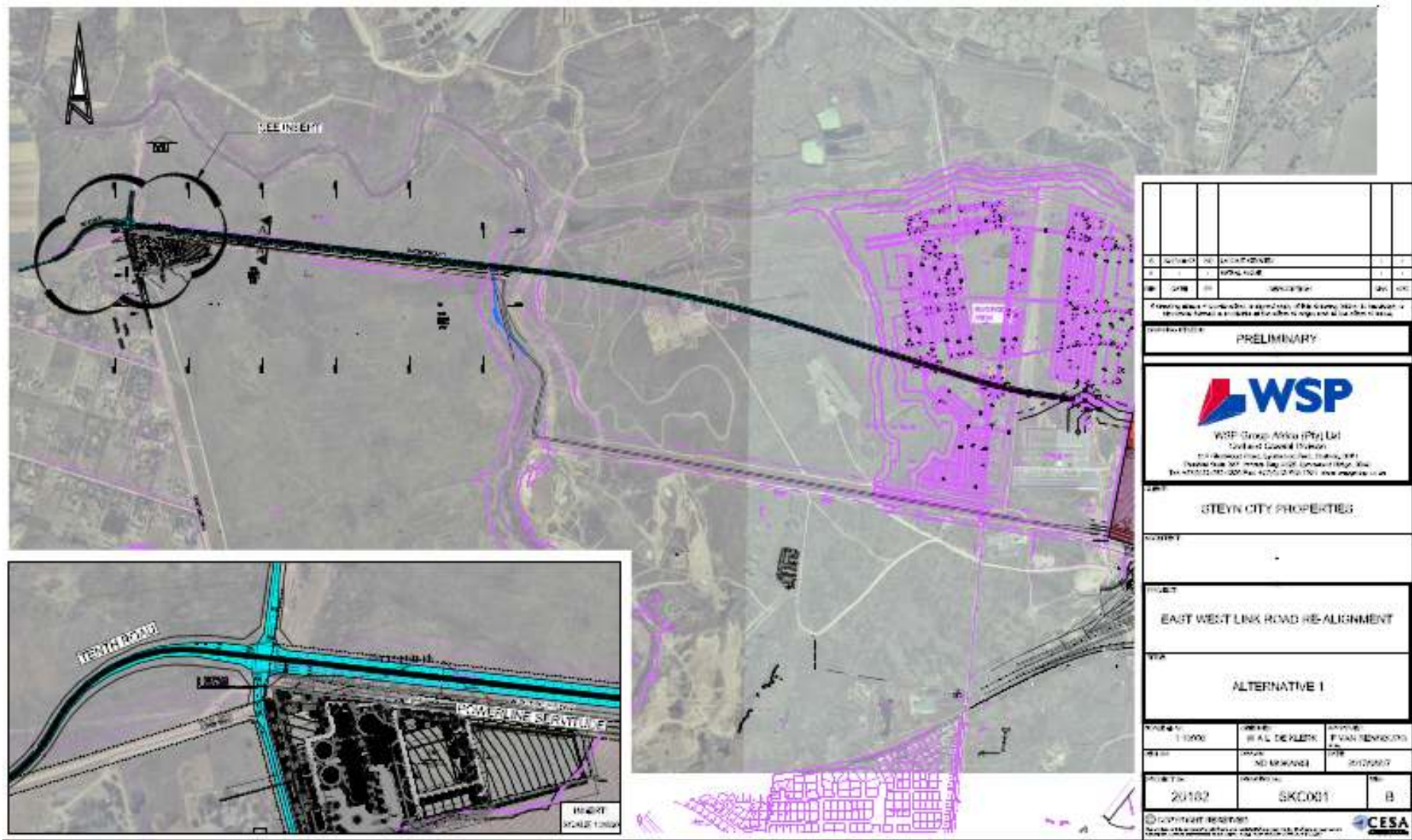


Figure 1-3: Positioning of Alternative 1.

1.3 Study Area

The development site is located west of William Nicol drive north of the existing Dainfern Estate at Steyn City. The site is situated west and adjacent to the Jukskei River. The site is situated in the Gauteng Province.

The study site is situated within the Grassland Biome (Mucina & Rutherford 2006). The Grassland Biome at the study site is represented by Egoli Granite Grassland (Mucina & Rutherford 2006) (Refer to Figure 1-4 **Error! Reference source not found.**).

Summary of Egoli Granite Grassland

Distribution: Egoli Granite Grassland is found in the Gauteng Province of South Africa. Egoli Granite Grassland is situated at the Johannesburg Dome and extends in the region between northern Johannesburg in the south, and from near Lanseria Airport and Centurion (south of Pretoria) to the north, westwards to about Muldersdrift and eastwards to Tembisa. Altitude is from 1280-1660 m (Mucina & Rutherford, 2006).

Vegetation & Landscape Features: Moderately undulating plains and low hills supporting tall, usually *Hypharrhenia hirta* dominated grassland, with some woody species on rocky outcrops or rock sheets. The rocky habitats show a high diversity of woody species, which occur in the form of scattered shrub groups or solitary small trees (Mucina & Rutherford, 2006).

Geology & Soils: Archaean granite and gneiss of the Halfway House Granite at the core of the Johannesburg Dome that support leached, shallow, coarsely grained, sandy soil poor in nutrients of Glenrosa form. Small area is built by ultramafics. Dominant land types Bb and Ba (Mucina & Rutherford, 2006).

Climate Strongly seasonal summer-rainfall region, with very dry winters. Mean annual precipitation (MAP) is 620-800 mm (overall average 680 mm). Incidence of frost is frequent, but higher in the south than the north.

Important Taxa: Graminoids: *Aristida canescens*, *Aristida congesta*, *Cynodon dactylon*, *Digitaria monodactyla*, *Eragrostis capensis*, *Eragrostis chloromelas*, *Eragrostis curvula*, *Eragrostis racemosa*, *Heteropogon contortus*, *Hyparrhenia hirta*, *Melinis repens* subsp. *repens*, *Monocymbium ceresiiforme*, *Setaria sphacelata*, *Themeda triandra*, *Tristachya leucothrix*, *Andropogon eucomus*, *Aristida aequiglumis*, *Aristida diffusa*, *Aristida scabrivalvis* subsp. *borumensis*, *Bewisia biflora*, *Brachiaria serrata*, *Bulbostylis burchellii*, *Cymbopogon caesius*, *Digitaria tricholaenoides*, *Diheteropogon amplexans*, *Eragrostis gummiflua*, *Eragrostis sclerantha*, *Panicum natalense*, *Schizachyrium sanguineum*, *Setaria nigrirostris*, *Tristachya rehmannii*, *Ulrelytrum agropyroides*. Herbs: *Acalypha angustata*, *Acalypha peduncularis*, *Ocimum obovatum*, *Berkheya insignis*, *Crabbea hirsuta*, *Cyanotis speciosa*, *Dicoma anomala*, *Helichrysum rugulosum*, *Justicia anagalloides*, *Kohautia amatymbica*, *Nidorella hottentotica*, *Pentanisia prunelloides* subsp. *latifolia*, *Pseudognaphalium luteo-album*, *Senecio venosus*. Geophytic Herbs: *Cheilanthes deltoidea*, *Cheilanthes hirta*. Small Tree: *Vangueria*

infausta. Tall Shrub: *Searsia pyroides*. Low Shrubs: *Anthospermum hispidulum*, *Anthospermum rigidum* subsp. *pumilum*, *Gnidia capitata*, *Helichrysum kraussii*, *Ziziphus zeyheriana*. Succulent Shrub: *Lopholaena coriifolia*.

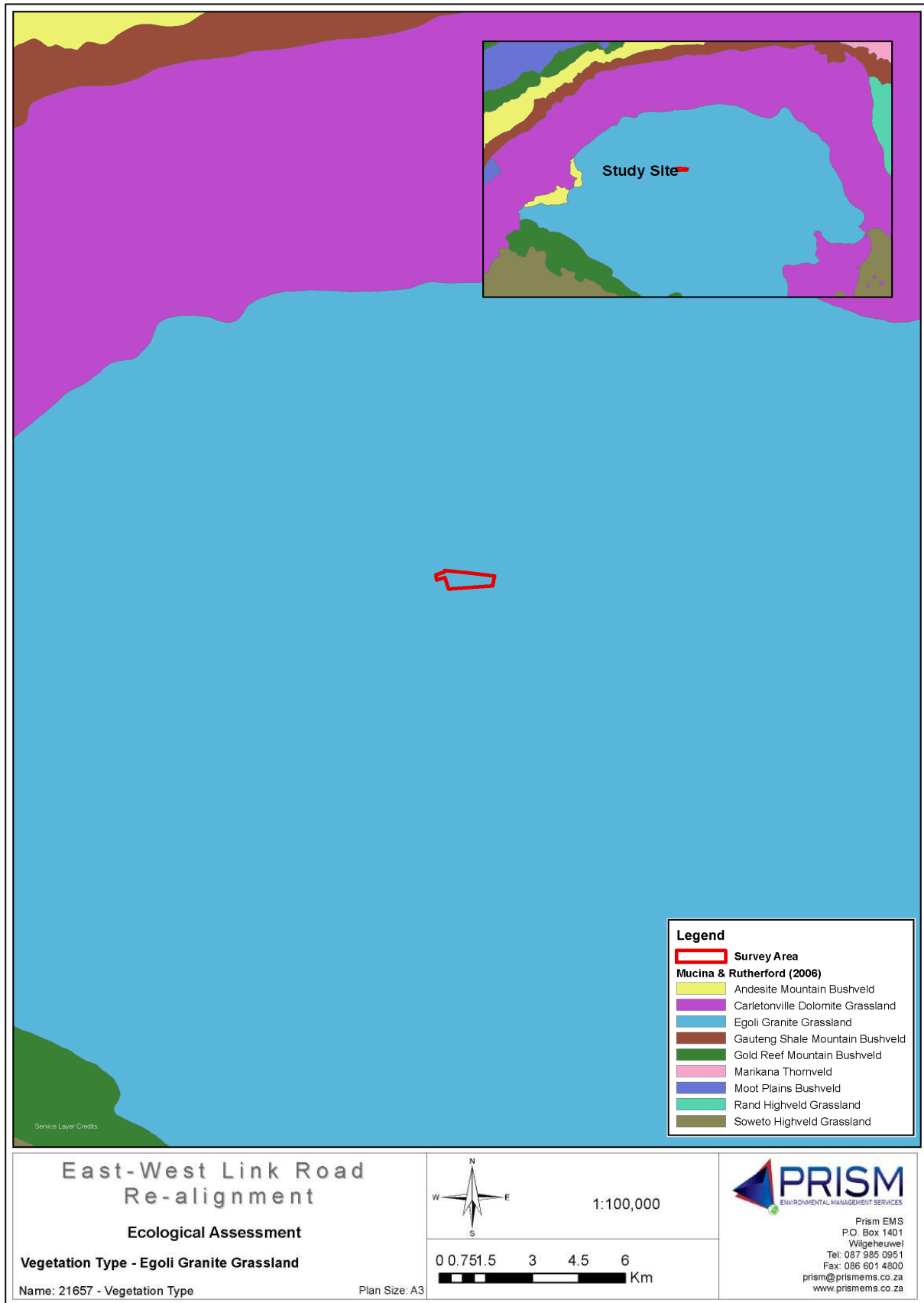


Figure 1-4: Vegetation Unit (Mucina & Rutherford, 2006)

1.4 Scope and Purpose

- A survey consisting of visits to investigate key elements of habitats on the site, relevant to the conservation of fauna and flora.
- Recording of any sightings and / or evidence of existing fauna and flora.
- The selective and careful collecting of voucher specimens of invertebrates where deemed necessary.
- An evaluation of the conservation importance and significance of the site with special emphasis on the status of threatened species.
- Recording of possible host plants or foodplants of fauna such as butterflies.
- Literature investigation of possible species that might occur on site.
- Integration of the literature investigation and field observations to identify potential ecological impacts that could occur because of the development.
- Integration of literature investigation and field observations to make recommendations to reduce or minimise impacts, should the development be approved.

1.5 Overview of Specialists

Mr. Renier Terblanche is a professional Ecologist with emphasis on Zoology. He is currently pursuing his Doctoral degree with focus on butterflies at the University of Stellenbosch. He is also registered with the South African Council for Natural Scientific Professions (SACNASP).

Mr. Nico-Ronaldo Retief is a professional water specialist and ecologist with emphasis on Zoology. He has undertaken numerous mining related, environmental and ecological assessments, wetland studies and water quality specialist studies. He is registered with the South African Council for Natural Scientific Professions (SACNASP). For more information, please refer to Table 1-1.

Table 1-1: Details of Specialists

Specialist 1	Renier Terblanche
Qualifications:	M.Sc. cum Laude, 1998 (Botany: Ecology) Ph.D. in progress (Department of Conservation Ecology and Entomology @ University of Stellenbosch)
Experience:	Flora and Fauna Habitat Surveys 20 years' Experience
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2 REPORT OUTLINE

Appendix 6 of GN 326 of 7 April 2017 provides the requirements for specialist reports undertaken as part of the environmental authorisation process. In line with this, Table 2-1 provides an overview of Appendix 6 together with information on how these requirements have been met.

Table 2-1. Specialist Report Requirements.

Requirement from Appendix 6 of GN 326 of 7 April 2017	Chapter
(a) Details of - (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Section 1 Section 10
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	<i>Declaration of Independence</i>
(c) Indication of the scope of, and the purpose for which, the report was prepared	Section 10
(cA) An indication of the quality and age of base data used for the specialist report	Section 3 & 4
(cB) A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	Section 4 & 7
(d) the Duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 4
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used.	Section 4
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives	Section 6
(g) Identification of any areas to be avoided, including buffers	Section 6
(h) Map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 6
(l) Description of any assumptions made and any uncertainties or gaps in knowledge	Section 5
(j) Description of the findings and potential implications of such findings on the impact of the proposed activity, or activities	Section 6 Section 7 Section 8
(k) Mitigation measures for inclusion in the EMPr	Section 8
(l) Conditions for inclusion in the environmental authorisation	Section 8

Requirement from Appendix 6 of GN 326 of 7 April 2017	Chapter
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8
(n) Reasoned opinion - (i) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 8
(o) Description of any consultation process that was undertaken during the course of preparing the specialist report	Section 4
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
(q) Any other information requested by the competent authority	N/A

3 LEGISLATION AND GUIDELINES

The following policies and legislation are relevant to the proposed development:

3.1 The Constitution of the Republic of South Africa

Section 24 states that everyone has the right: b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that.

- (i) Prevent pollution and ecological degradation;
- (ii) Promote conservation; and
- (iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

3.2 National Environmental Management Act (NEMA), Act No. 107 of 1998

NEMA defines the environment as the surroundings within which humans exist and that are made up of –

- (i) the land, water and atmosphere of the earth;
 - (ii) micro – organisms, plants and animal life;
 - (iii) any part or combination of (i) or (ii) and the interrelationship among and between them. 1.
- The principles set out in this section apply throughout the Republic to the actions of all organs of state that may significantly affect the environment.

3.3 National Environmental Management: Biodiversity Act (NEM:BA), Act No. 10 of 2004

Within the framework of NEMBA, Section 2(a) within the framework of NEMA, to provide for- (i) the management and conservation of biological diversity within the country.

4 METHODOLOGY

4.1 Desktop Assessment

The Gauteng Department of Agriculture and Rural Development (GDARD) was contacted to provide the Gauteng Conservation plan (C-plan) and information on red data species for the proposed development site.

The flow of genes and consequently the conservation of biodiversity is dependent on migratory corridors. Habitat fragmentation can impair the essential genetic movement in a community. It is therefore important to identify potential migratory corridors and the extent of the impact on the migratory corridors. Aerial photographs were also used to determine whether the proposed development site may fall within a migratory corridor.

4.2 Literature Review

The current literature was utilised to gain an understanding of the environmental influences presently affecting the proposed development site. General information on the veld type, climate, geology and soils and current activity on the site was acquired prior to the field assessment of the property.

A literature review on the habitat of red data listed plant, bird, mammal and butterfly species with a potential distribution on site was conducted prior to the field assessment to gain a thorough understanding of the habitat type occupied by these species.

4.3 Site Investigation

The details of the site investigation undertaken is provided in Table 4-1.

Table 4-1: Site Investigation Details

	Site Investigation
Date	<ul style="list-style-type: none">• January 2014; February 2014; March 2014• July 2015• April 2017
Season	<ul style="list-style-type: none">• Early Summer• Winter• Late Summer

A desktop study comprised not only an initial phase, but it was also used throughout the study to accommodate and integrate all the data that become available during the field observations.

Surveys were undertaken during July 2015 to note key elements of habitats on the site, relevant to the conservation of fauna and flora and revisited in April 2017. Earlier notes from surveys in the larger study area from visits during January 2014, February 2014 and March 2014 were also considered. The main

purpose of the site visits was ultimately to serve as a habitat survey that concentrated on the possible presence or not of threatened species and other species of high conservation priority.

The following sections highlight the materials and methods applicable to different aspects that were observed.

4.3.1 Habitat Characteristics and Vegetation

The habitat was investigated by noting habitat structure (rockiness, slope, plant structure/physiognomy) as well as floristic composition. Voucher specimens of plant species were only taken where the taxonomy was in doubt and where the plant specimens were of significant relevance for invertebrate conservation. Field guides such as those by Germishuizen (2003), Manning (2003), Manning (2009), Van Oudtshoorn (1999), Van Wyk (2000), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (1997) were used to confirm the taxonomy of the species. Works on specific plant groups (often genera) such as those by Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Ginkel, Glen, Gordon-Gray, Cilliers, Muasya & Van Deventer (2011), Van Jaarsveld (2006) and Van Wyk & Smith (2003) were also consulted to confirm the identification of species. In this case no plant specimens were needed to be collected as voucher specimens or to be send to an herbarium for identification. For the most recent treatise of scientific plant names and broad distributions, Germishuizen, Meyer & Steenkamp (2006) were followed to compile the lists of species.

4.3.2 Mammals

Mammals were noted as sight records by day. For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner & Chimimba (2005), Cillié, Oberprieler and Joubert (2004) and Apps (2000) are consulted. Sites have been walked, covering as many habitats as possible. Signs of the presence of mammal species, such as calls of animals, animal tracks (spoor), burrows, runways, nests and faeces were recorded. Walker (1996), Stuart & Stuart (2000) and Liebenberg (1990) were consulted for additional information and for the identification of spoor and signs. Trapping was not done since it proved not necessary in the case of this study.

Habitat characteristics were also surveyed to note potential occurrences of mammals. Many mammals can be identified from field sightings but, with a few exceptions bats, rodents and shrews can only be reliably identified in the hand, and even then, some species needs examination of skulls, or even chromosomes (Apps, 2000).

4.3.3 Avi-Fauna

Birds were noted as sight records, mainly with the aid of binoculars (10x30). Nearby bird calls of which the observer was sure of the identity were also recorded. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Ryan (2001) is followed. For information on identification, biogeography and ecology Barnes (2000), Hockey, Dean & Ryan, P.G. (2005), Cillié, Oberprieler & Joubert (2004), Tarboton & Erasmus (1998) and Chittenden (2007) were

consulted. Ringing of birds fell beyond the scope of this survey and was not deemed necessary. Sites have been walked, covering as many habitats as possible. Signs of the presence of bird species such as spoor and nests have additionally been recorded. Habitat characteristics were surveyed to note potential occurrences of birds.

4.3.4 Reptiles

Reptiles were noted as sight records in the field. Binoculars (10x30) can also be used for identifying reptiles of which some are wary. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques, Branch (1998), Marais (2004), Alexander & Marais (2007), Cillié, Oberprieler and Joubert (2004) and the Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland (Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers, 2014). Sites were walked, covering as many habitats as possible. Smaller reptiles are sometimes collected for identification, but this practice was not necessary in the case of this study. Habitat characteristics were surveyed to note potential occurrences of reptiles.

4.3.5 Amphibians

Frogs and toads are noted as sight records in the field or by their calls. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Carruthers (2001), Du Preez (1996), Conradie, Du Preez, Smith & Weldon (2006) and the recent complete guide by Du Preez & Carruthers (2009) are consulted. CD's with frog calls by Carruthers (2001) and Du Preez & Carruthers (2009) are used to identify species by their calls when applicable. Sites are walked, covering as many habitats as possible. Smaller frogs are often collected by pitfall traps put out for epigeal invertebrates (on the soil), but this practice falls beyond the scope of this survey. Habitat characteristics are also surveyed to note potential occurrences of amphibians.

4.3.6 Butterflies

Butterflies were noted as sight records or voucher specimens. Voucher specimens are mostly taken of those species of which the taxa warrant collecting due to taxonomic difficulties or in the cases where species can look similar in the veldt. Many butterflies use only one species or a limited number of plant species as host plants for their larvae. Myrmecophilous (ant-loving) butterflies such as the *Aloeides*, *Chrysoritis*, *Erikssonina*, *Lepidochrysops* and *Orachrysops* species (Lepidoptera: Lycaenidae), which live in association with a specific ant species, require a unique ecosystem for their survival (Deuschländer & Bredenkamp, 1999; Terblanche, Morgenthal & Cilliers, 2003; Edge, Cilliers & Terblanche, 2008; Gardiner & Terblanche, 2010). Known food plants of butterflies were therefore also recorded. After the visits to the site and the identification of the butterflies found there, a list was also compiled of butterflies that will most probably be found in the area in all the other seasons because of suitable habitat. The emphasis is on a habitat survey.

4.3.7 Fruit Chafer Beetles

Different habitat types in the areas were explored for any sensitive or special fruit chafer species. Selection of methods to find fruit chafers depends on the different types of habitat present and the species that may be present. Fruit bait traps would probably not be successful for capturing *Ichneustoma* species in a grassland patch (Holm & Marais 1992). Possible chafer beetles of high conservation priority were noted as sight records accompanied by the collecting of voucher specimens with grass nets or containers where deemed necessary.

4.3.8 Mygalomorph Spiders and Rock Scorpions

Relatively homogenous habitat / vegetation areas were identified and explored to identify any sensitive or special species. Selected stones that were lifted to search for Arachnids were put back very carefully resulting in the least disturbance possible. The area was searched for possible signs of trap door spiders or other mygalomorph spiders (for example traces of wafer-lids, cork-lids or silk-lined burrows). Investigations by brushing the soil surface with a small broom/paint brush, scraping or digging into the soil with a spade, were made. All the above actions were accompanied by the least disturbance possible.

4.4 Impact Assessment Methodology

As standardized impact assessment methodology was utilized to determine the impacts associated with the proposed development. A summary of this methodology is provided below.

The **significance** of an impact is defined as the combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The nature and type of impact may be direct or indirect and may also be positive or negative, refer to Table 4-2: below for the specific definitions.

Table 4-2: Nature and type of impact.

Nature and Type of Impact:			
IMPACT	Direct	Impacts that are caused directly by the activity and generally occur at the same time and place as the activity	✓/✗
	Indirect	Indirect or induced changes that may occur because of the activity. These include all impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity	✓/✗
	Cumulative	Those impacts associated with the activity which add to, or interact synergistically with existing impacts of past or existing activities, and include direct or indirect impacts which accumulate over time and space	✓/✗
	Positive	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will benefit significantly, and includes neutral impacts (those that are not considered to be negative)	✓
	Negative	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will be comprised	✗

Table 4-3: presents the defined criteria used to determine the **consequence** of the impact occurring which incorporates the extent, duration and intensity (severity) of the impact.

Table 4-3: Consequence of the Impact occurring.

Extent of Impact:			
CONSEQUENCE	Site	Impact is limited to the site and immediate surroundings, within the study site boundary or property (immobile impacts)	1
	Neighbouring	Impact extends across the site boundary to adjacent properties (mobile impacts)	2
	Local	Impact occurs within a 5km radius of the site	5
	Regional	Impact occurs within a provincial boundary	8
	National	Impact occurs across one or more provincial boundaries	10
	Duration of Impact:		
	Incidental	The impact will cease almost immediately (within weeks) if the activity is stopped, or may occur during isolated or sporadic incidences	1
	Short-term	The impact is limited to the construction phase, or the impact will cease within 1 - 2 years if the activity is stopped	2
	Medium-term	The impact will cease within 5 years if the activity is stopped	5
	Long-term	The impact will cease after the operational life of the activity, either by natural processes or by human intervention	8
	Permanent	Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient	10
	Intensity or Severity of Impact:		
	Low	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are not affected	1
	Low-Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are modified insignificantly	2
	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are altered	5
Medium-High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes are severely altered	8	
High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will permanently cease	10	

The probability of the impact occurring is the likelihood of the impacts occurring, and is determined based on the classification provided in Table 4-4.

Table 4-4: Probability and confidence of impact prediction.

Probability of Potential Impact Occurrence:			
PROBABILITY	Improbable	The possibility of the impact materialising is very low either because of design or historic experience	5
	Possible	The possibility of the impact materialising is low either because of design or historic experience	10
	Likely	There is a possibility that the impact will occur	15
	Highly Likely	There is a distinct possibility that the impact will occur	25
	Definite	The impact will occur regardless of any prevention measures	30

The **significance** of the impact is determined by considering the consequence and probability without considering any mitigation or management measures and is then ranked according to the ratings listed in Table 4-5.

Table 4-5: Significance rating of the impact.

Significance Ratings:		
SIGNIFICANCE	Low	Neither environmental nor social and cultural receptors will be adversely affected by the impact. Management measures are usually not provided for low impacts
	Low-Medium	Management measures are usually encouraged to ensure that the impacts remain of Low-Medium significance. Management measures may be proposed to ensure that the significance ranking remains low-medium
	Medium	Natural, cultural and/or social functions and processes are altered by the activities, and management measures must be provided to reduce the significance rating
	Medium-High	Natural, cultural and/or social functions and processes are altered significantly by the activities, although management measures may still be feasible
	High	Natural, cultural, and/or social functions and processes are adversely affected by the activities. The precautionary approach will be adopted for all high significant impacts and all possible measures must be taken to reduce the impact

The level of confidence associated with the impact prediction is also considered as low, medium or high (Table 4-6:).

Table 4-6: Level of confidence of the impact prediction.

Level of Confidence in the Impact Prediction:			
CONFIDENCE	Low	Less than 40% sure of impact prediction due to gaps in specialist knowledge and/or availability of information	10
	Medium	Between 40 and 70% sure of impact prediction due to limited specialist knowledge and/or availability of information	50
	High	Greater than 70% sure of impact prediction due to outcome of specialist knowledge and/or availability of information	100

Once significance rating has been determined for each impact, management and mitigation measures must be determined for all impacts that have a significance ranking of Medium and higher to attempt to reduce the level of significance that the impact may reflect.

The EIA Regulations, 2014 specifically require a description is provided of the degree to which these impacts:

- can be reversed;
- may cause irreplaceable loss of resources; and
- can be avoided, managed or mitigated.

Based on the proposed mitigation measures, the mitigation efficiency is also determined (Table 4-7:) whereby the initial significance is re-evaluated and ranked again to affect a significance that incorporates the mitigation based on its effectiveness. The overall significance is then re-ranked and a final significance rating is determined.

Table 4-7: Mitigation efficiency.

MITIGATION EFFICIENCY	Mitigation Efficiency		
	None	Not applicable	0%
	Very Low	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact. Positive impacts will remain the same	20%
	Low	Where the significance rating reduces by one level, after mitigation	40%
	Medium	Where the significance rating reduces by two levels, after mitigation	60%
	High	Where the significance rating reduces by three levels, after mitigation	80%
	Very High	Where the significance rating reduces by more than three levels, after mitigation	100%

The reversibility is directly proportional the “Loss of Resource” where no loss of resource is experienced, the impact is completely reversible; where a substantial “Loss of resource” is experienced there is a medium degree of reversibility; and an irreversible impact relates to a complete loss of resources, i.e. irreplaceable (Table 4-8:).

Table 4-8: Degree of reversibility and loss of resources.

DEGREE REVERSABILITY & LOSS OF RESOURCES	Loss of Resources:		
	No Loss	No loss of social, cultural and/or ecological resource(s) are experienced. Positive impacts will not experience resource loss	0
	Partial	The activity results in an insignificant or partial loss of social, cultural and/or ecological resource(s)	30
	Substantial	The activity results in a significant loss of social, cultural and/or ecological resource(s)	60
	Irreplaceable	The activity results in the complete and irreplaceable social, cultural and/or ecological loss of resource(s)	80
	Reversibility:		
	Irreversible	Impacts on natural, cultural and/or social functions and processes are irreversible to the pre-impacted state in such a way that the application of resources will not cause any degree of reversibility	20
	Medium Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if less than 50% resources are applied	40
	High Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if more than 50% resources are applied	70
	Reversible	Impacts on natural, cultural and/or social functions and processes are fully reversible to the pre-impacted state if adequate resources are applied	100

4.5 Consultation Process

Consultation as part of the overall environmental authorization process is being undertaken by Prism EMS. However, in addition to this, as part of the Ecological Specialist Study, discussions took place with GDARD to provide information on red data species that have been recorded in the surrounding environment.

5 ASSUMPTIONS, GAPS AND LIMITATIONS

The study was limited to a snapshot view. Site visits were undertaken during July 2015 and revisited in April 2017. Notes from earlier habitat surveys in the larger study area during January 2014, February 2014 and March 2014 were also considered. For each site visited, it should be emphasized that surveys can by no means result in an exhaustive list of the plants and animals present on the site, because of the time constraint.

The site surveys were conducted in July 2015 and revisited in April 2017, which compromises a sub-optimal time of the year to do the surveys. Notes from earlier visits to the larger study area during January 2014, February 2014 and March 2014 have also been considered. Weather conditions during the survey were favourable for recording fauna and flora. The focus of the survey remains a habitat survey that concentrates on the possibility that species of conservation priority occur on the site or not. It is unlikely that more surveys would alter the outcome of this study.

6 RESULTS AND FINDINGS

6.1 Habitat and Vegetation Characteristics

An outline of the main landscape and habitat characteristics of the site is provided in Table 6-1.

Table 6-1: Outline of main landscape and habitat characteristics of the site.

HABITAT FEATURE	DESCRIPTION
Topography	Gentle to moderate slopes are present at the site.
Rockiness	No rocky ridges are present at the site. Some gravelly rock surfaces at some patches on a slope.
Presence of wetlands	A watercourse crosses the narrow-proposed footprint near the stables at the site. A riparian zone of the Jukskei river is present at the eastern end of the site.
Overview of vegetation	<p>Grassland with a diversity of grass species and forbs are present at the site. Conspicuous grass species include <i>Eragrostis chloromelas</i> (also <i>E. curvula</i>), <i>Schizachyrium sanguineum</i> (Red Autumn Grass), <i>Heteropogon contortus</i> (Spear Grass), <i>Hyparrhenia hirta</i> (Common Thatching Grass), <i>Eragrostis gummiflua</i> (Gum Grass), <i>Melinis repens</i> (Natal Red-top), <i>Themeda triandra</i> (Red Grass) and <i>Elionurus muticus</i> (Wire Grass). Very few trees occur at the grassland at the site. Several herbaceous species include <i>Hilliardiella oligocephala</i>, <i>Helichrysum nudifolium</i>, <i>Cleome monophylla</i>, <i>Pentanisia angustifolia</i> and <i>Maclodium zeyheri</i>. Two geophytes that are visibly frequent at the site and adjacent areas are <i>Boophone disticha</i> and <i>Hypoxis hemerocallidea</i>.</p> <p>A gully with noticeable concentration of <i>Robinia pseudoacacia</i> (Black Locust), an alien invasive tree, is found at the eastern end of the site.</p>
Signs of disturbances	Stables are present at the western end of the site. Some tracks and scraped areas are present as well as powerlines. Alien invasive tree species such as <i>Robinia pseudoacacia</i> are present in some areas. Signs of illegal dumping was also prevalent onsite on as indicated under low sensitivity (refer to Figure 6-2).
Connectivity of natural vegetation at the site and between the site and surrounding areas	Watercourse that crosses the narrow-proposed footprint is a corridor of considerable conservation importance in the local area as well as the buffer zone of Jukskei River that enters the eastern parts of the site. This is however, not relevant to the proposed re-alignment (The Proposal) as it does not cross this corridor and also one of the reasons why The Proposal is the proposal (preferred) alignment.

6.2 Assessment of Plant Species of Conservation Concern

Extinct, threatened, near threatened and other plant species of high conservation priority in Gauteng Province are listed in Table 6-2 to

In Table 6-9 a list of tree species within Gauteng not threatened but protected under NFA, 1998 are indicated. None of these tree species were however, recorded onsite.

Table 6-9. The presence or absence of all the species listed in the tables were investigated during the survey. No threatened or near threatened plant species appear to be present at the site. There are two plant species that are not threatened but listed as Declining that are present at the site. These declining plant species at the site are *Boophone disticha* and *Hypoxis hemerocallidea*.

In Table 6-2 below the threatened plant species in the Gauteng Province is shown. No residents of the species were recorded onsite.

Table 6-2: Threatened plant species of the Gauteng Province that are listed in the Critically Endangered category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Encephalartos middelburgensis</i>	Critically Endangered	Critically Endangered Pop. Trend: Decreasing	No

In Table 6-3 below the threatened plant species of Gauteng Province are listed in the Endangered category. None of these species were recorded onsite.

Table 6-3: Threatened plant species of the Gauteng Province that are listed in the Endangered category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Aloe peglerae</i>	Endangered	Needs updating Pop. Trend: decreasing	No
<i>Brachystelma discoideum</i>	Endangered	Not mentioned in IUCN	No
<i>Delosperma purpureum</i>	Endangered	Not mentioned in IUCN	No

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Frithia humilis</i>	Endangered	Not mentioned in IUCN	No
<i>Habenaria mossii</i>	Endangered	Needs updating Pop. Trend: decreasing	No
<i>Holothrix micrantha</i>	Endangered	Not mentioned in IUCN	No

In Table 6-4 below the threatened plant species of Gauteng Province listed in the vulnerable category is included. None of the species were recorded onsite.

Table 6-4: Threatened plant species of the Gauteng Province that are listed in the Vulnerable category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	Vulnerable	Not under Red list	No
<i>Brachycorythis conica</i> subsp. <i>transvaalensis</i>	Vulnerable	Not under Red list	No
<i>Ceropegia decidua</i> subsp. <i>pretoriensis</i>	Vulnerable	Low Risk / Least concern Needs updating	No
<i>Cheilanthes deltoidea</i> subsp. nov.	Vulnerable	Not under Red list	No
<i>Cineraria longipes</i>	Vulnerable	Endangered B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v); C1+2a(i) ver 3.1 (needs updating) Pop trend: decreasing	No
<i>Cucumis humifructus</i>	Vulnerable	Not under Red list	No
<i>Delosperma gautengense</i>	Vulnerable	Endangered A3cde+4cde; B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v) ver 3.1 (needs updating) Pop trend: decreasing	No
<i>Dicliptera magaliesbergensis</i>	Vulnerable	Not under Red list	No
<i>Dioscorea sylvatica</i>	Vulnerable	Not under Red list	No
<i>Encephalartos lanatus</i>	Vulnerable	Near Threatened Pop trend: stable	No

<i>Eulophia coddii</i>	Vulnerable	Endangered B2ab(ii,iii,iv,v) ver 3.1 (needs updating) Pop. trend: decreasing	No
<i>Khadia beswickii</i>	Vulnerable	Status: Critically Endangered C1+2a(i,ii) ver 3.1 (needs updating) Pop. trend: decreasing	No
<i>Melolobium subspicatum</i>	Vulnerable	Status: Least Concern ver 3.1 Pop. trend: stable	No
<i>Prunus africana</i>	Vulnerable	Status: Vulnerable A1cd ver 2.3 (needs updating)	No

In Table 6-5 the near threatened plant species of Gauteng is provided. None of these species were recorded onsite.

Table 6-5: Near Threatened plant species of the Gauteng Province. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Alepidea attenuata</i>	Near Threatened	Not on Red list	No
<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	Near Threatened	Not on Red list	No
<i>Argyrobium campicola</i>	Near Threatened	Not on Red list	No
<i>Argyrobium megarrhizum</i>	Near Threatened	Not on Red list	No
<i>Ceropegia turricula</i>	Near Threatened	Not on Red list	No
<i>Cineraria austrotransvaalensis</i>	Near Threatened	Not on Red list	No
<i>Cleome conrathii</i>	Near Threatened	Not on Red list	No
<i>Delosperma leendertziae</i>	Near Threatened	Not on Red list	No
<i>Drimia sanguinea</i>	Near Threatened	Not on Red list	No
<i>Gladiolus robertsoniae</i>	Near Threatened	Not on Red list	No
<i>Habenaria barbertoni</i>	Near Threatened	Not on Red list	No
<i>Habenaria bicolor</i>	Near Threatened	Not of Red list	No
<i>Habenaria kraenzliniana</i>	Near Threatened	Not on Red list	No
<i>Holothrix randii</i>	Near Threatened	Not on Red list	No
<i>Kniphofia typhoides</i>	Near Threatened	Not on Red list	No
<i>Lithops leslei</i> subsp. <i>leslei</i>	Near Threatened	Not on Red list	No
<i>Nerine gracilis</i>	Near Threatened	Not on Red list	No
<i>Searsia gracillima</i> var. <i>gracillima</i>	Near Threatened	Not on Red list	No

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Stenostelma umbelluliferum</i>	Near Threatened	Not on Red list	No
<i>Trachyandra erythrorrhiza</i>	Near Threatened	Status: Vulnerable A3ce+4ce; B2ab(ii,iii,iv,v); C1+2a(i); D2 ver 3.1 (needs updating) Pop. trend: decreasing	No

In Table 6-6 the species of least concern within Gauteng that are of particular conservation concern and listed in the rare category is shown. None of these species were recorded onsite.

Table 6-6: Least Concern (= not threatened) plant species of the Gauteng Province that are however, of particular conservation concern and listed in the Rare category. The list here follows the most recent red list of South African plant species (Raimondo *et al.*2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Blepharis uniflora</i>	Rare	Not on Red list	No
<i>Frithia pulchra</i>	Rare	Status: Vulnerable D2 ver 3.1 (needs updating) Pop. trend: stable	No
<i>Gladiolus pole-evansii</i>	Rare	Not on Red list	No
<i>Gnaphalium nelsonii</i>	Rare	Not on Red list	No

In Table 6-7 the not threatened plant species within Gauteng with conservation concern and listed as declining are indicated. Two species from the list were recorded on the site.

Table 6-7: Not threatened plant species of the Gauteng Province which are however of conservation concern and listed in the Declining category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Boophone disticha</i>	Declining	Not on Red list	Yes
<i>Callilepis leptophylla</i>	Declining	Not on Red list	No
<i>Crinum bulbispermum</i>	Declining	Not on Red list	No

<i>Crinum macowanii</i>	Declining	Not on Red list	No
<i>Drimia altissima</i>	Declining	Not on Red list	No
<i>Eucomis autumnalis</i>	Declining	Not on Red list	No
<i>Gunnera perpensa</i>	Declining	Not on Red list	No
<i>Hypoxis hemerocallidea</i>	Declining	Not on Red list	Yes
<i>Ilex mitis</i>	Declining	Not on Red list	No

In Table 6-8 the plant species within Gauteng where the conservation status is uncertain is shown. None of these species were recorded onsite.

Table 6-8: Plant species of the Gauteng Province of which the conservation status is uncertain owing to a lack of information and which are listed in the Data Deficient category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Status: Global status or national status indicated	IUCN 2017 Status	Resident at the site
<i>Lepidium mossii</i>	Data Deficient	Not on Red list	No

In Table 6-9 a list of tree species within Gauteng not threatened but protected under NFA, 1998 are indicated. None of these tree species were however, recorded onsite.

Table 6-9: List of tree species of the Gauteng Province which are not threatened, but listed as Protected Species under the National Forests Act [NFA] No. 84 of 1998, Section 51(1). No = Plant species is not a resident on the site; Yes = Plant species is a resident at the site.

Species	Conservation status	IUCN 2017 Status	Resident at the site
<i>Acacia erioloba</i>	Protected	Not on Red list	No
<i>Boscia albitrunca</i>	Protected	Not on Red list	No
<i>Combretum imberbe</i>	Protected	Not on Red list	No
<i>Sclerocarya birrea</i>	Protected	Not on Red list	No

6.3 Assessment of Vertebrate Species of Conservation Concern

In Table 6-10 and

In Table 6-11 near threatened mammal species are indicated for the Gauteng Province, however none of these species were recorded onsite.

Table 6-11 the possible presence or absence of threatened mammal species and near threatened mammal species at the site are provided. Literature sources that were used are Friedman & Daly (2004), Skinner & Chimimba (2005) and Wilson & Reeder (2005). Because the site falls outside reserves, threatened species such as the black rhinoceros (*Diceros bicornis*) and the African wild dog (*Lycaon pictus*) are obviously not present. No smaller mammals of high conservation significance are likely to be found on the site as well.

6.3.1 Mammals of high conservation priority

In Table 6-10 threatened mammal species within Gauteng Province is shown. None of these species were observed onsite.

Table 6-10: Threatened mammal species of the Gauteng Province. Literature sources: Friedman & Daly, (2004), Skinner & Chimimba (2005), Wilson & Reeder (2005). Furthermore, golden mole species that are rare and being reported from the adjacent Free State and Limpopo Provinces have also been included.

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
<i>Chrysospalax villosus</i> Rough-haired golden mole	Vulnerable	No	No	Not of Red list
<i>Cloeotis percivali</i> Short-eared Trident Bat	Vulnerable/ Near-threatened	No	No	Least Concern ver 3.1 Pop. trend: unknown
<i>Diceros bicornis</i> Black rhinoceros	Critically Endangered	No	No	Critically Endangered A2abcd ver 3.1 Pop. trend: increasing
<i>Lycaon pictus</i> African wild dog	Endangered	No	No	Endangered C2a(i) ver 3.1 Pop. trend: decreasing
<i>Loxodonta africana</i> African elephant	Vulnerable	No	No	Vulnerable A2a ver 3.1

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
				Pop. trend: increasing
<i>Mystromys albicaudatus</i> White-tailed mouse	Endangered	No	No	Endangered A3c ver 3.1 Pop. trend: decreasing
<i>Neamblysomus juliana</i> Juliana's Golden Mole	Critically Endangered	No	No	Endangered B2ab(iii) ver 3.1 Pop. trend: unknown
<i>Panthera leo</i> Lion	Vulnerable	No	No	Vulnerable A2abcd ver 3.1 Pop. trend: decreasing
<i>Rhinolophus blasii</i> Blasi's Horseshoe Bat	Vulnerable	No	No	Least Concern ver 3.1 Pop. trend: decreasing

In Table 6-11 near threatened mammal species are indicated for the Gauteng Province, however none of these species were recorded onsite.

Table 6-11: Near threatened mammal species known to occur in the Gauteng Province, Free State Province and North-West Province. Literature sources: Skinner & Chimimba (2005).

Species	Red Listed Status	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
<i>Ceratotherium simum</i> White Rhinoceros	Near-threatened	No	No	Near Threatened ver 3.1 Pop. trend: increasing
<i>Manis temminckii</i> Ground Pangolin	Lower risk/ Near threatened	No	No	IUCN: <i>Smutsia temminckii</i> Vulnerable A4d ver 3.1 Pop. trend: decreasing

6.3.2 Birds of high conservation priority

Table 6-12 and

In Table 6-13 the near threatened bird species of Gauteng are shown. None of these species were however, recorded.

Table 6-13 list the possible presence or absence of threatened bird species and near threatened bird species at the site. Literature sources that were mainly consulted are Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). The site does not appear to form part of any habitat of importance for any threatened bird species or any bird species of particular conservation importance.

According to Table 6-12 none of the threatened bird species for Gauteng were recorded onsite. *Tyto capensis* is listed as regionally vulnerable in South Africa (Hockey, Dean & Ryan 2005). *Tyto capensis* (African Grass-owl) is often found as a resident in treeless areas with damp substrata, mainly marshes and vleis (Hockey, Dean & Ryan 2005). This owl favours patches of tall, rank grass, sedges or weeds (Armstrong, 1991). **Only the more widespread marsh owl, *Asio capensis*, appears to persist in small numbers at the site (Photograph 6-5).** However, no *Tyto capensis* was recorded on the site, as no suitable habitat for this owl species has been found at the site, and it is unlikely that the African grass-owl will be found at present.

Table 6-12: Threatened bird species of the Gauteng Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007).

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based on being dependant on site	IUCN Status 2017
<i>Aegypius tracheliotos</i>	Lappet-faced Vulture	Vulnerable	No	No	Not on Red list
<i>Anthropoides paradiseus</i>	Blue Crane	Vulnerable	No	No	Vulnerable A3cde ver 3.1 Pop. trend: stable
<i>Aquila rapax</i>	Tawny Eagle	Vulnerable	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Ardeotis kori</i>	Kori Bustard	Vulnerable	No	No	Near Threatened ver 3.1 Pop. trend: decreasing
<i>Botaurus stellaris</i>	Eurasian Bittern	Critically Endangered	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Buphagus africanus</i>	Yellow-billed Oxpecker	Vulnerable	No	No	Least Concern ver 3.1

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based on being dependant on site	IUCN Status 2017
					Pop. trend: decreasing
<i>Circus ranivorus</i>	African Marsh-Harrier	Vulnerable	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Crex crex</i>	Corn Crake	Vulnerable	No	No	Least Concern ver 3.1 Pop. trend: stable
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	Vulnerable	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Gorsachius leuconotus</i>	White-backed Night-heron	Vulnerable	No	No	IUCN: <i>Calherodius leuconotus</i> Least Concern ver 3.1 Pop. trend: stable
<i>Gyps africanus</i>	White-backed Vulture	Vulnerable	No	No	Critically Endangered A2bcd+3bcd ver 3.1 Pop. trend: decreasing
<i>Gyps coprotheres</i>	Cape Vulture	Vulnerable	No	No	Endangered A2acde+3cde ver 3.1 Pop. trend: decreasing
<i>Neophron percnopterus</i>	Egyptian Vulture	Regionally almost extinct	No	No	Endangered A2bcde+3bcde ver 3.1 Pop. trend: decreasing
<i>Neotis denhami</i>	Denham's Bustard	Vulnerable	No	No	Near Threatened ver 3.1 Pop. trend: decreasing
<i>Pelecanus rufescens</i>	Pink-backed Pelican	Vulnerable	No	No	Least Concern ver 3.1 Pop. trend: stable
<i>Polemaetus bellicosus</i>	Martial Eagle	Vulnerable	No	No	Vulnerable A2acde+3cde ver 3.1 Pop. trend: decreasing

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based on being dependant on site	IUCN Status 2017
<i>Rhynchops flavirostris</i>	African Skimmer	Endangered	No	No	Near Threatened ver 3.1 Pop. trend: decreasing
<i>Sarothrura ayresi</i>	White-winged Flufftail	Critically Endangered	No	No	Critically Endangered C2a(i) ver 3.1 Pop. trend: decreasing
<i>Terathopius ecaudatus</i>	Bateleur	Vulnerable (in South Africa)	No	No	IUCN: <i>Terathopius ecaudatus</i> Near Threatened ver 3.1 Pop. trend: decreasing
<i>Tyto capensis</i>	African Grass-Owl	Vulnerable	No	No	Least Concern ver 3.1 Pop. trend: decreasing

In Table 6-13 the near threatened bird species of Gauteng are shown. None of these species were however, recorded.

Table 6-13: Near threatened bird species of the Gauteng Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007).

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based or being dependant on site	IUCN Status 2017
<i>Alcedo semitorquata</i>	Half-collared Kingfisher	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Anastomus lamelligerus</i>	African Openbill	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Aquila ayresii</i>	Ayres's Hawk-Eagle	Near threatened	No	No	IUCN: <i>Hieraaetus ayresii</i> Least Concern ver 3.1 Pop. trend: stable
<i>Buphagus erythrorhynchus</i>	Red-Billed Oxpecker	Near threatened	o	No	Least Concern ver 3.1

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based or being dependant on site	IUCN Status 2017
					Pop. trend: decreasing
<i>Charadrius pallidus</i>	Chestnut-banded Plover	Near threatened	No	No	Near Threatened ver 3.1 Pop. trend: stable
<i>Ciconia nigra</i>	Black Stork	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: unknown
<i>Circus macrourus</i>	Pallid Harrier	Near threatened	No	No	Near Threatened ver 3.1 Pop. trend: decreasing
<i>Falco biarmicus</i>	Lanner Falcon	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: increasing
<i>Falco peregrinus</i>	Peregrine Falcon	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: stable
<i>Glareola nordmanni</i>	Black-winged Pratincole	Near threatened	No	No	Near Threatened ver 3.1 Pop. trend: decreasing
<i>Leptoptilos crumeniferus</i>	Marabou Stork	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: increasing
<i>Mirafra cheniana</i>	Melodious lark	Near threatened	No	No	Near Threatened ver 3.1 Pop. trend: unknown
<i>Mycteria ibis</i>	Yellow-billed Stork	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Pelecanus onocrotalus</i>	Great White Pelican	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: unknown
<i>Phoenicopterus minor</i>	Lesser Flamingo	Near threatened	No	No	IUCN: <i>Phoeniconaias minor</i> Near Threatened ver 3.1

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be found breeding on site based or being dependant on site	IUCN Status 2017
					Pop. trend: decreasing
<i>Phoenicopterus ruber</i>	Greater Flamingo	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: increasing
<i>Pterocles gutturalis</i>	Yellow-throated Sandgrouse	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Rostratula benghalensis</i>	Greater Painted-snipe	Near threatened	No	No	Least Concern ver 3.1 Pop. trend: decreasing
<i>Sagittarius serpentarius</i>	Secretarybird	Near threatened	No	No	Vulnerable A4acd ver 3.1 Pop. trend: decreasing
<i>Sterna caspia</i>	Caspian Tern	Near threatened	No	No	IUCN: <i>Hydroprogne caspia</i> Least Concern ver 3.1 Pop. trend: increasing

6.3.3 Reptiles of high conservation priority

Table 6-14 and Table 6-15 list the possible presence or absence of near threatened reptile species on the site. The Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland were used to compile the list for the assessment (Bates, Branch, Bauer, Burger, Marais, Alexander & De Villiers, 2014). There appears to be no threat to any reptile species of high conservation importance if the site is developed. In Table 6-14 the threatened reptile species in Gauteng are provided. None of these listed species were recorded onsite.

Table 6-14: Threatened reptile species in Gauteng Province. Sources: Alexander & Marais (2007). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
<i>Python natalensis</i>	Vulnerable*	No	No	No	Not on Red List

Southern African Python					
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* Note that *Python natalensis* is not listed as threatened anymore (see Bates et al., 2014)

In Table 6-15 the near threatened reptile species within Gauteng are provided, however none of the listed species were recorded onsite.

Table 6-15: Near threatened reptile species in Gauteng Province. Sources: Alexander & Marais (2007). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
<i>Homoroselaps dorsalis</i>	Near threatened	No	No	No	Near Threatened ver 3.1
Striped Harlequin Snake					Pop. trend: decreasing

6.3.4 Amphibians of importance

No frog species that occur in the Gauteng are red listed as threatened species or near threatened species at present. There appears to be no threat to any amphibian species of high conservation importance if the site is developed. The Giant Bullfrog was hitherto listed as a Near Threatened species. Currently the Giant Bullfrog is listed according to the IUCN categories and criteria as Least Concern. No amphibians of conservation concern appear to be present at the site and there appears to be no threat to any amphibian species of particular high conservation importance if the site is developed.

6.4 Assessment of Invertebrate Species of Conservation Concern

6.4.1 Butterflies of conservation priority

Studies about the vegetation and habitat of threatened butterfly species in South Africa showed that ecosystems with a unique combination of features are selected by these often localised threatened butterfly species (Deutschländer and Bredenkamp 1999; Edge 2002, 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003; Edge, Cilliers & Terblanche, 2008). Threatened butterfly species in South Africa can then be regarded as bio-indicators of rare ecosystems.

Because invertebrates are often less well known the expected presence or not of threatened butterfly species in the Endangered category (Table 6-16) and other high conservation priority species such as

Rare butterfly species (In Table 6-17 rare butterfly species of Gauteng are provided, however none mentioned in the table were recorded onsite.

Table 6-17) follows.

In Table 6-16 the threatened: endangered butterfly species within Gauteng are shown. None of these species were recorded onsite, however.

Table 6-16: Threatened: Endangered butterfly species of the Gauteng Province. Sources: Mecenero *et al.* (2013), Henning, Terblanche & Ball (2009).

Species	Red List Status (Global status)	Recorded at site During survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely	IUCN Status 2017
<i>Aloeides dentatis dentatis</i> Roodepoort Copper	Endangered	No	Highly unlikely	Vulnerable D2 ver 2.3 (needs updating)
<i>Chrysochrysis aureus</i> Golden Opal/ Heidelberg Opal	Endangered	No	Highly unlikely	Not on Red list
<i>Lepidochrysis praeterita</i> Highveld Blue	Endangered	No	Highly unlikely	Not on Red list
<i>Orachrysis mijburghi</i> Mijburgh's Blue	Endangered	No	Highly unlikely	Not on Red list

6.4.1.1 Assessment of threatened butterfly species (Endangered) in the Gauteng Province

6.4.1.1.1 *Aloeides dentatis dentatis* (Roodepoort Copper)

The proposed global red list status for *Aloeides dentatis dentatis* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.* 2013). *Aloeides dentatis dentatis* colonies are found where one of its host plants *Hermannia depressa* or *Lotononis eriantha* is present. Larval ant association is with *Lepisiota capensis* (S.F. Henning 1983; S.F. Henning & G.A. Henning 1989). The habitat requirements of *Aloeides dentatis dentatis* are complex and not fully understood yet. See Deutschländer and Bredenkamp (1999) for the description of the vegetation and habitat characteristics of one locality of *Aloeides dentatis* subsp. *dentatis* at Ruimsig, Roodepoort, Gauteng Province. There is not an ideal habitat of *Aloeides dentatis* subsp. *dentatis* on the site and it is unlikely that the butterfly is present at the site.

6.4.1.1.2 *Chrysochrysis aureus* (Golden Opal/ Heidelberg Copper)

The proposed global red list status for *Chrysochrysis aureus* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.* 2013) *Chrysochrysis aureus* (Golden Opal / Heidelberg Copper) is a resident where the larval host plant, *Clusia pulchella* is present. However, the distribution

of the butterfly is much more restricted than that of the larval host plant (S.F. Henning 1983; Terblanche, Morgenthal & Cilliers 2003). One of the reasons for the localised distribution of *Chrysothrix aureus* is that a specific host ant *Crematogaster liengmei* must also be present at the habitat. Fire appears to be an essential factor for the maintenance of suitable habitat (Terblanche, Morgenthal & Cilliers 2003). Research revealed that *Chrysothrix aureus* (Golden Opal/ Heidelberg Copper) has very specific habitat requirements, which include rocky ridges with a steep slope and a southern aspect (Terblanche, Morgenthal & Cilliers 2003). Owing to a lack of habitat requirements and ideal habitat the presence of the taxon is highly unlikely.

6.4.1.1.3 *Lepidochrysops praeterita* (Highveld Blue)

The proposed global red list status for *Lepidochrysops praeterita* according to the most recent IUCN criteria and categories is Endangered (G.A. Henning, Terblanche & Ball, 2009; Mecenero *et al.* 2013). *Lepidochrysops praeterita* is a butterfly that occurs where the larval host plant *Ocimum obovatum* (= *Becium obovatum*) is present (Pringle, G.A. Henning & Ball, 1994), but the distribution of the butterfly is much more restricted than the distribution of the host plant. *Lepidochrysops praeterita* is found on selected rocky ridges and rocky hillsides in parts of Gauteng, the extreme northern Free State and the south-eastern North-West Province. Presence of *Lepidochrysops praeterita* at the site is highly unlikely.

6.4.1.1.4 *Orachrysops mijburghii* (Mijburgh's Blue)

The proposed global red status for *Orachrysops mijburghii* according to the most recent IUCN criteria and categories is Endangered (Mecenero *et al.* 2013). *Orachrysops mijburghii* favours grassland depressions where specific *Indigofera* plant species occur (Terblanche & Edge 2007). The Heilbron population of *Orachrysops mijburghii* in the Free State uses *Indigofera evansiana* as a larval host plant (Edge, 2005) while the Suikerbosrand population in Gauteng uses *Indigofera dimidiata* as a larval host plant (Terblanche & Edge 2007). There is no suitable habitat for *Orachrysops mijburghii* on the site and it is unlikely that *Orachrysops mijburghii* would be present on the site.

6.4.1.2 Conclusion on threatened butterfly species

There appears to be no threat to any red listed butterfly species if the route re-alignment be approved.

In Table 6-17 rare butterfly species of Gauteng are provided, however none mentioned in the table were recorded onsite.

Table 6-17: Rare butterfly species of the Gauteng Province. Source: Mecenero *et al.* (2013).

Species	Red List Status	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely	IUCN Status 2017
<i>Colotis celimene amina</i> Lilac Tip	Rare (Low density)	No	Highly unlikely	Not on Red list

Species	Red List Status	Recorded at site during survey	Residential status at the site: Confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely	IUCN Status 2017
<i>Lepidochrysops procera</i> Grassland Blue	Rare (Habitat specialist)	No	Highly unlikely	Not on Red list
<i>Metisella meninx</i> Marsh Sylph	Rare (Habitat specialist)	No	Highly unlikely	Not on Red list
<i>Platylesches dolomitica</i> (Hilltop hopper)	Rare (Low density)	No	Highly unlikely	Not on Red list

6.4.1.1 **Butterfly species that are not threatened but also of high conservation priority**

6.4.1.1.1 *Colotis celimene amina* (Lilac tip)

Colotis celimene amina is listed as Rare (Low density) by Mecenero *et al.* (2013). In South Africa *Colotis celimene amina* is present from Pietermaritzburg in the south and northwards into parts of Kwa-Zulu Natal, Gauteng, Limpopo, Mpumalanga and the North-West Provinces (Mecenero *et al.* 2013). Reasons for its rarity are poorly understood. It is highly unlikely that *Colotis celimene amina* would be present at the site.

6.4.1.1.2 *Lepidochrysops procera* (Savanna Blue)

Lepidochrysops procera is listed as Rare (Habitat specialist) by Mecenero *et al.* (2013). *Lepidochrysops procera* is endemic to South Africa and found in Gauteng, KwaZulu-Natal, Mpumalanga and North West (Mecenero *et al.* 2013). Presence of *Lepidochrysops procera* at the site is highly unlikely.

6.4.1.1.3 *Metisella meninx* (Marsh Sylph)

Henning and Henning (1989) in the first South African Red Data Book of butterflies listed *Metisella meninx* as threatened under the former IUCN category Indeterminate. Even earlier in the 20th century Swanepoel (1953) raised concern about vanishing wetlands leading to habitat loss and loss of populations of *Metisella meninx*. According to the second South African Red Data Book of butterflies (Henning, Terblanche & Ball, 2009) the proposed global red list status of *Metisella meninx* has been Vulnerable. During a recent large scale atlassing project the Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas (Mecenero *et al.* 2013) it was found that more *Metisella meninx* populations are present than thought before. Based on this valid new information, the conservation status of *Metisella meninx* is now regarded as Rare (Habitat specialist) (Mecenero *et al.* 2013). Though *Metisella meninx* is more widespread and less threatened than perceived before, it should be regarded as a localised rare habitat specialist of conservation priority, which is dependent on wetlands with suitable patches of grass at wetlands (Terblanche in prep.). Another important factor to keep in mind for the conservation of *Metisella meninx* is that based on very recent discoveries of new

taxa in the group the present *Metisella meninx* is a species complex consisting of at least three taxa (Terblanche in prep., Terblanche & Henning In prep.). The ideal habitat of *Metisella meninx* is treeless marshy areas where *Leersia hexandra* (rice grass) is abundant (Terblanche in prep.). The larval host plant of *Metisella meninx* is wild rice grass, *Leersia hexandra* (G.A. Henning & Roos, 2001). *Metisella meninx* has not been found at the site and presence of the species at the site is unlikely.

6.4.1.1.4 *Platylesches dolomitica* (Hilltop Hopper)

Platylesches dolomitica is listed as Rare (Low density) by Mecenero et al. (2013). Historically the conservation status of *Platylesches dolomitica* was proposed to be Vulnerable (Henning, Terblanche & Ball 2009). However, this butterfly which is easily overlooked has a wider distribution than perceived before. *Platylesches dolomitica* has a patchy distribution and is found on rocky ledges where *Parinari capensis* occurs, between 1300 m and 1800m (Mecenero et al. 2013, Dobson Pers comm.). Presence of *Platylesches dolomitica* is highly unlikely.

6.4.2 Beetles of conservation priority

Table 6-18 lists the fruit chafer beetle species (Coleoptera: Scarabaeidae: Cetoninae) that are of known high conservation priority in the Gauteng Province. No *Ichnestoma stobbiai* or *Trichocephala brincki* were found during the surveys. There appears to be no suitable habitat for *Ichnestoma stobbiai* or *Trichocephala brincki* at the site. There appears to be no threat to any of the fruit chafer beetles of high conservation priority if the site is developed.

Table 6-18: Fruit chafer species (Coleoptera: Scarabaeidae: Cetoninae) in the Gauteng Province which are of known high conservation priority.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
<i>Ichnestoma stobbiai</i>	Uncertain (Probably endangered)	No	No	No	Not on Red list
<i>Trichocephala brincki</i>	Uncertain	No	No	No	Not on Red list

6.4.3 Mygalomorph spiders of conservation priority

Table 6-19 lists the baboon spider species (Araneae: Teraphosidae) that are of known high conservation priority in the Gauteng Province. The assessment of the conservation status of baboon spiders in South Africa is in process but as a pre-caution the species listed in Table 6-18 has been included. None of the above baboon spider species were found on the site, or are likely to be resident

at the site. There appears to be no threat to the baboon spider species of high conservation significance if the study site is developed.

Table 6-19: Baboon spider species (Araneae: Teraphosidae) species that are of known high conservation priority in the Gauteng Province.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
<i>Brachionopus pretoriae</i>	Uncertain	No	No	No	Not on Red list

6.4.4 Scorpions of conservation priority

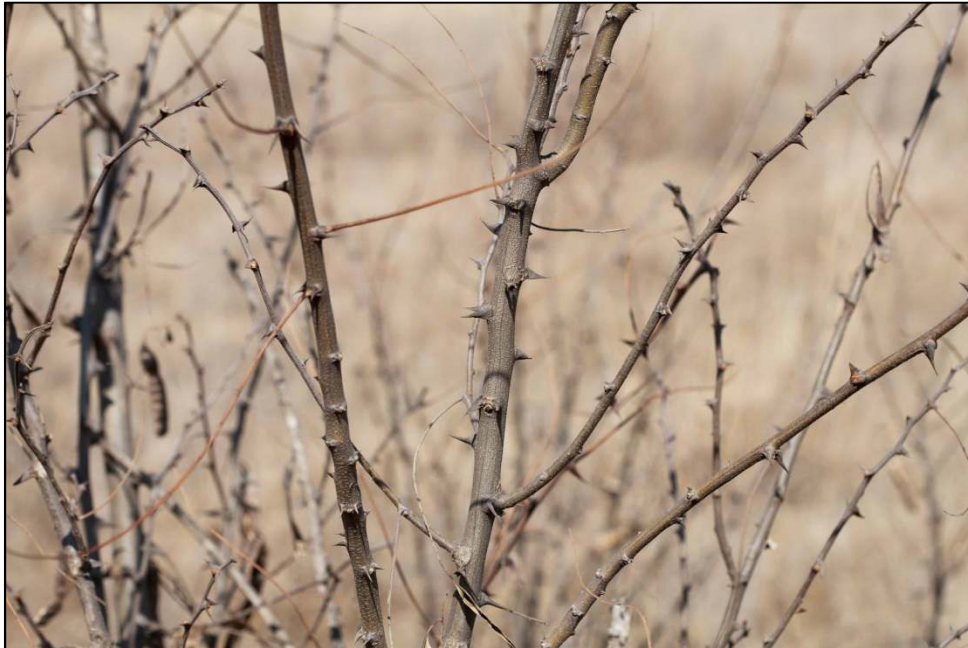
Table 6-20 lists the rock scorpion species (Scorpiones: Ischnuridae) that are of known high conservation priority in the Gauteng Province. There appears to be no threat to the rock scorpion species of high conservation priority if the study site is developed.

Table 6-20: Rock scorpion species (Scorpiones: Ischnuridae) species that are of known high conservation priority in the Gauteng Province and Gauteng Province.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment	IUCN Status 2017
<i>Hadogenes gracilis</i>	Uncertain	No	No	No	Not on Red list
<i>Hadogenes gunningi</i>	Uncertain	No	No	No	Not on Red list

6.5 Photographic Record

This section introduces the reader to views of the proposed East-West Link Road Re-alignment and identified flora and fauna. Please refer Photograph 6-1 to Photograph 6-7 below for more information.



Photograph 6-1: Alien invasive *Robinia pseudoacacia* (Black Locust Tree) at the site.

Photo: July 2015, R.F. Terblanche.



Photograph 6-2: The Declining *Boophone disticha* at the study area.

Photo: February 2014, R.F. Terblanche.



Photograph 6-3: The Declining *Hypoxis hemerocallidea* at the study area.

Photo: February 2014, R.F. Terblanche.



Photograph 6-4: Flowers of *Aloe davyana*, a widespread aloe in the central interior at the northern provinces of South Africa at the site.

Photo: July 2015, R.F. Terblanche.



Photograph 6-5: Marsh owl, *Asio capensis*, widespread in the north-eastern parts of South Africa, photographed at the site.

Photo: July 2015, R.F. Terblanche



Photograph 6-6: Southern view from the proposed East-West Link Road Re-alignment

Photo: April 2017, NR Retief

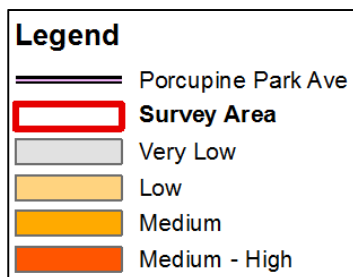


Photograph 6-7: Northern view from the proposed East-West Link Road Re-alignment

Photo: April 2017, NR Retief

6.6 Site Sensitivity

Based on the findings above, the following map depicts the sensitivities on the study site. Same must be utilised for forward planning of the development and or Applicant (Refer to Figure 6-1 and Figure 6-2).



Grid references and altitudes were taken at site with a GPS Garmin E-trex 20 ® instrument. Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2014, licenced software bought by the author).

Figure 6-1: Legend to site sensitivity

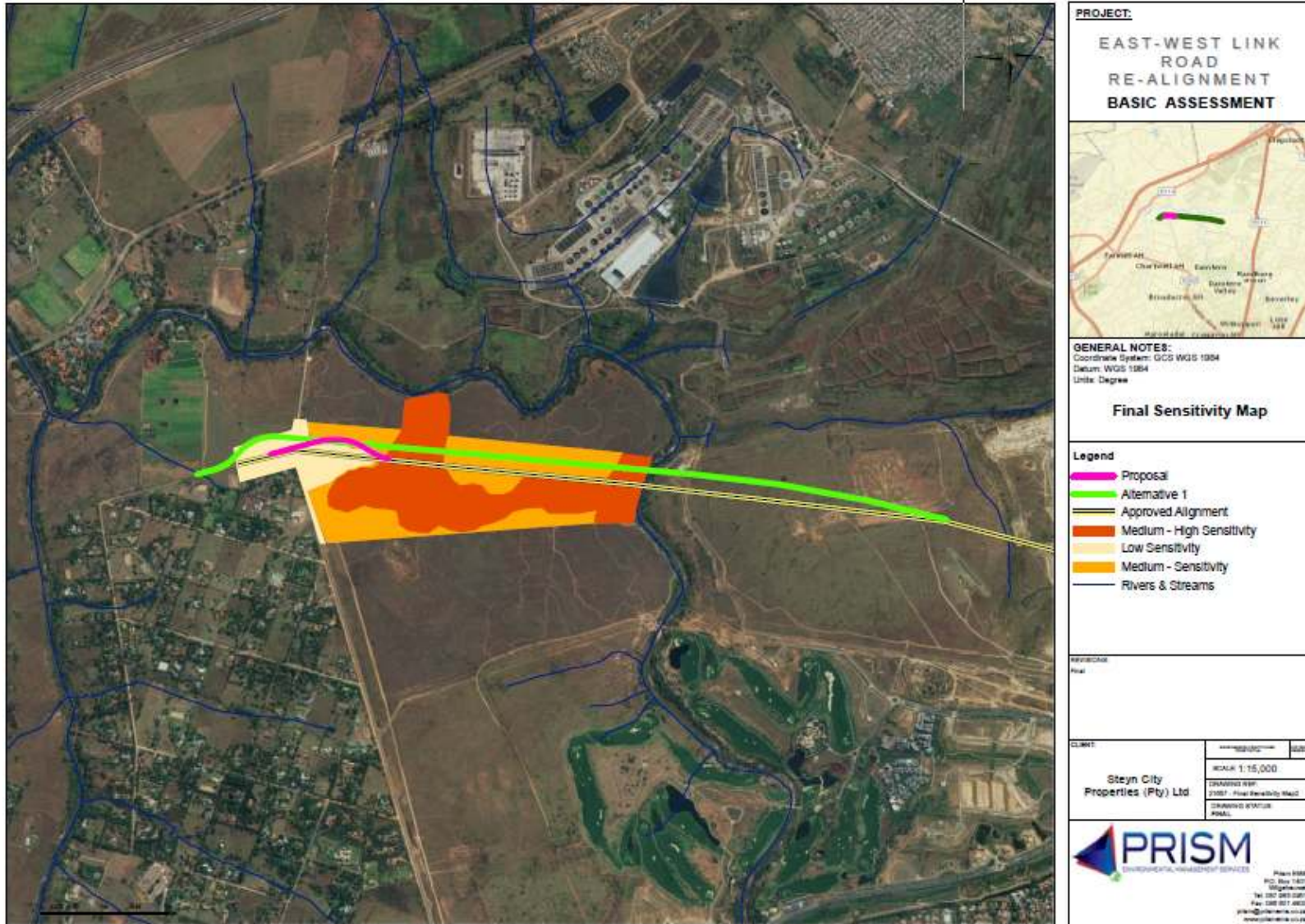


Figure 6-2: Sensitivity Map

7 IMPACT ASSESSMENT

Habitats of threatened plants are in danger most often due to urban developments such as is the case for the Gauteng Province (Pfab & Victor, 2002). Habitat conservation is the key to the conservation of invertebrates such as threatened butterflies (Deutschländer and Bredenkamp 1999; Edge 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003; Edge, Cilliers & Terblanche, 2008). Furthermore, corridors and linkages may play a significant role in insect conservation (Pryke & Samways, 2003, Samways, 2005).

Urbanisation is a major additional influence on the loss of natural areas (Rutherford & Westfall 1994). In the Gauteng Province, the pressure to develop areas are high since its infrastructure allows for improvement of human well-being in some way. Urban nature conservation issues in South Africa are overshadowed by the goal to improve human well-being, which focuses on aspects such as poverty, equity, redistribution of wealth and wealth creation (Cilliers, Müller & Drewes 2004). Nevertheless, the conservation of habitats is the key to invertebrate conservation, especially for those red listed species that are very habitat specific. This is also true for any detailed planning of corridors and buffer zones for invertebrates. Though proper management plans for habitats are not in place, setting aside special ecosystems is in line with the recent Biodiversity Act (2004) of the Republic of South Africa.

Corridors are important to link ecosystems of high conservation priority. Such corridors or linkages are there to improve the chances of survival of otherwise isolated populations (Samways, 2005). How wide should corridors be? The answer to this question depends on the conservation goal and the focal species (Samways, 2005). For an African butterfly assemblage, this is about 250m when the corridor is for movement as well as being a habitat source (Pryke and Samways 2003). Hill (1995) found a figure of 200m for dung beetles in tropical Australian forest. In the agricultural context, and at least for some common insects, even small corridors can play a valuable role (Samways, 2005). Much more research remains to be done to find refined answers to the width of grassland corridors in South Africa. The width of corridors will also depend on the type of development, for instance the effects of the shade of multiple story buildings will be quite different from that of small houses.

To summarise: In practice, as far as residential developments are concerned, the key would be to prioritise and plan according to sensitive species and special ecosystems.

In the case of this study site, patches of grassland in fair condition remain. There appears to be no loss of any unique ecosystems, if the site is developed. A riparian zone of the Jukskei River is present at the eastern end of the site. Two plant species *Hypoxis hemerocallidea* and *Boophone disticha* that are not threatened but listed as Declining are visibly frequent at the site and larger study area and could be conserved in the larger study area and relocated from the footprint, if the development is approved. There appears to be no loss of any threatened species, if the site is developed.

The following impacts and mitigation measures with a view to the proposed developments apply:

7.1 Anticipated Risks or Impacts to the Loss of Habitat

The following impacts on the loss of habitat apply at the site.

Potential impacts on the available habitat will be of local extent, of permanent duration, of low intensity and high probability. The significance of loss of habitat is expected to be low without mitigation and low with mitigation.

Impact summary matrix:

Table 7-1: Impact to loss of habitat

IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	Degree	
TYPE	DESCRIPTION	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
Negative	Loss of habitat	No	Direct	Low-Medium	High	High	Low	Partial	High Degree

7.1.1 Mitigation measures:

- A programme to replace exotic and invasive plant species with indigenous plant species is to be commended and to be continued.
- All areas not earmarked for construction activities should be clearly demarcated to prevent vehicle access.
- Consultation in conjunction with an Environmental Control Officer (ECO) should be undertaken where bushes, trees and plants are required to be removed for the Proposal.
- Corridors for surrounding natural areas should be maintained and protected and demarcated as no-go areas and be undertaken in consultation with the ECO.
- The proposal alternative i.e. “The Proposal” is the preferred option as it will have the lowest impact on the loss of natural habitat.

7.2 Anticipated Risks or Impacts on the Loss of Fauna

Impacts in terms of fauna during the construction phase includes the possible risks of loss of habitat for nesting or breeding sites. Other factors are illustrated in Table 7-2. Possible road kills during the operational phase can be reduced by the installation of a fence to prevent these possible kills.

Table 7-2: Impact on the loss of Fauna

IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	Degree	
TYPE	DESCRIPTION	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
Negative	Loss of fauna	No	Direct	Low	Medium	High	Low	No Loss	Reversible

7.2.1 Mitigation Measures:

- Feeding or leaving of food for stray or wild animals in the area is forbidden.
- No animals should be hunted, trapped or disturbed.
- Nesting and breeding sites for birds and mammals should be avoided
- Should fauna be encountered during site clearance or during construction activities, earthworks shall cease immediately, until such fauna have been safely relocated.
- No animal shall be killed, unless an immediate threat to human health is perceived or in conjunction with the ECO or specialist advise.
- Culverts to be installed in the embankments be large enough permit movement of small mammal and herpetofaunal species, if required.
- It is suggested that a fence be erected around the proposed road development site, as this may reduce accidental deaths of animals and casual access by humans during the operational phase of road.

7.3 Anticipated Risks or Impacts to the Loss of Flora

Sensitive species are regarded here as those listed in section 5 and constitutes the fauna and flora species that are threatened or of known high conservation importance. Sensitive species are regarded here as those listed in section 6 and constitutes the fauna and flora species that are threatened or of known particular high conservation importance. Presence of any threatened or near threatened plant species or animal species at the footprint proposed for the development is highly unlikely. Mitigation measures of sensitive species apply for two plant species that are listed as Declining *Boophone disticha* and *Hypoxis hemerocallidea*.

Table 7-3: Impact on the loss of Flora

IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	Degree	
TYPE	DESCRIPTION	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
Negative	Loss of flora	Yes	Direct	Low-Medium	Medium	High	Low	No Loss	Reversible

7.3.1 Mitigation measures:

- Individuals of the Declining plant species *Boophone disticha* and *Hypoxis hemerocallidea* need to be relocated where applicable, to a suitable site nearby before the construction work of the development, if approved, is initiated.
- Prior to construction, woody vegetation matter shall be stripped, collected and disposed of
- Alien, invasive species eradicated as far as possible to minimise the spread of alien vegetation.
- No trees / vegetation outside the construction area should be removed or damaged, therefore demarcate the construction footprint by tape or bollards.
- Removal of plant material for medicinal purposes is prohibited.
- Planting of exotic grasses during rehabilitation should not occur, instead, non-invasive indigenous flora should be used where required during the rehabilitation phase.

- Cleared wood / or vegetation should not to be used for any purpose of fire or heating purposes.
- Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas.
- Movement of construction workers through sensitive areas should be minimised.

7.4 Anticipated Risks or Impacts to the Degradation of the Ecological Systems

Potential impacts on connectivity will be of local extent, of permanent duration, of low intensity and low probability. The significance of the impacts on loss of connectivity is expected to be moderate without mitigation and low with mitigation.

Table 7-4: Impact on Ecological System Degradation

IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	Degree	
TYPE	DESCRIPTION	CUMULATIVE	NATURE					LOSS RESOURCE	REVER-SABILITY
Negative	Degradation of ecological systems	Yes	Direct	Low	Medium	High	Low	No Loss	Reversible

7.4.1 Mitigation measures:

- Present exotic and invasive plant species should be eradicated where appropriate, if the development is approved.
- The proposal alternative “The Proposal” limits the impacts on the ecological systems, i.e. habitat connectivity and does not cross the watercourse.
- Corridors surrounding natural areas must be maintained and protected, and demarcated as no-go areas.
- Areas earmarked for construction of structures i.e. construction site offices etc. need to be cleared from bushes, trees, and plants, under supervision of the ECO.

7.5 Anticipated Risks or Impacts Associated with Disruption of Natural Corridors

Overall construction activities associated with the development will be site based, of medium to long-term duration, of low intensity and high probability. During the construction phase, the significance of the impacts associated with the construction phase is likely to be Low-Medium without and Low with mitigation.

Table 7-5: Impacts associated with Disruption of Natural Corridors

IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	Degree	
TYPE	DESCRIPTION	CUMULATIVE	NATURE					LOSS RESOURCE	REVER-SABILITY
Negative	Disruption of natural corridors	No	Direct	Low	Medium	High	Low	No Loss	Reversible

7.5.1 Mitigation measures:

- Should the proposed development be granted authorisation, contractors must ensure that no mammalian species are disturbed, trapped, hunted or killed during the construction phase.
- “The Proposal” the proposal is selected as it will minimise impacts on habitat, connectivity and impacts on the Natural Corridors. It will also not cross any watercourses.
- Corridors must be maintained and protected, and demarcated as no-go areas.
- If the development is approved care must be taken that no pollutants such as any hydrocarbons (fuels, oil) are spilled on soil.
- Erect a fence around the site to prevent casual access and accidental deaths of humans and animals or fauna.

8 REASONED OPINION AND RECOMMENDATIONS

Based on the ecological assessment of the study site undertaken as part of this Ecological Habitat Assessment, the following can be noted:

- In the case of this study site, patches of grassland in fair condition remain.
- There appears to be moderate loss of unique ecosystems, if the site is developed.
- A watercourse crosses the narrow-proposed footprint near the stables at the site. A riparian zone of the Jukskei River is present at the eastern end of the site. The proposed alternative (The Proposal) does not cross either watercourse and is thus preferred.
- Two plant species *Hypoxis hemerocallidea* and *Boophone disticha* that are not threatened but listed as Declining are visibly frequent at the site and larger study area and could be conserved in the larger study area and relocated from the footprint, if the development is approved.
- Watercourses at the site are regarded as of medium-high sensitivity.
- Transformed and modified areas beyond reasonable restoration are regarded as of low ecological sensitivity.
- Site is part of the grassland vegetation type, Egoli Granite Grassland that is of high conservation priority and listed Endangered according to the National List of Threatened Ecosystems (2011). Measures are in place to conserve a substantial patch of this grassland type in as natural as possible form at the larger study area.
- Eradication of alien invasive species in the area is to be commended. Eradication of *Robinia pseudoacacia* at the site is imperative.

Based on the reasoned opinion points listed above as well as the following recommended mitigation measures, it is of the specialists' opinion that the proposed re-alignment "The Proposal" can proceed. The preferred re-alignment (The Proposal) is supported and should be implemented as this will limit the impact to the sensitive Porcupine Park area, with watercourses, no-go sensitive areas and impacts on natural corridors.

The following mitigation measures must be included in the Environmental Management Programme (EMPr) for the development and strictly implemented.

8.1 Design and Construction Phase:

The following mitigation and management measures should be implemented during the construction phase to minimise potential environmental impacts:

- Construction activities should be limited to between 08:00 and 17h30 or in conjunction with the ECO.

- Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas, thereby limiting the removal of natural vegetation to the minimum.
- The removal of natural vegetation should be limited to the bare minimum and should not be undertaken without proper planning and delineation or consultation with the appointed ECO.
- Any soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation.
- The suggested “The Proposal” should be encouraged, as it may have the least impact on the natural environment and habitat.

8.2 Operation Phase:

The following mitigation and management measures should be implemented during the operation phase to minimise potential environmental impacts:

- Waste should be managed as not to be aesthetically appealing or attract pests or rodents.
- Control of alien invasive plant with pesticides.
- Rehabilitation and landscaping within the development should be encouraged.
- To reduce accidental deaths of fauna, it is suggested that a fence be erected to prevent these from occurring.

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10 APPENDICES

10.1 Curriculum Vitae of Specialists

Curriculum vitae: Mr Nico-Ronaldo Retief

Name : Nico-Ronaldo Retief
Date of Birth : 07 February 1982
Profession/Specialisation : Senior Environmental Assessment Practitioner
Nationality : South African
Years' experience : 10

Career summary

I have 10 years' experience in the environmental consulting industry. My key interest falls within the water and mining industry. I completed my Masters in Zoology in February 2007 and since August 2010 I have been registered as a Professional Natural Scientist. I have considerable experience in the writing of EIA reports and have managed a variety of small- to large-scale EIA projects ranging from electrical powerlines to housing developments. I have completed over 60 EIA projects, more than 25 Water Use License Applications, more than 15 mining related applications and more than 20 specialist input assessments.

I have vast experience as an Environmental Assessment Practitioner with expertise in: Water Quality Management, GIS mapping (in particular, PlanetGIS and ArcGIS software packages) and Surface Water Management.

I have valuable practical experience in the following EIA fields: bulk service infrastructure, water pipelines, sewage pipelines, road projects and upgrades; residential developments; renewable energy, mining applications and water use license applications. I am also proficient in conducting wetland and ecological assessments.

I believe that I am a valuable asset in any environmental industry owing to my experience, knowledge and expertise. I have the ability to lead, train and inspire staff to be enthusiastic and goal-orientated. I am self-motivated and maintain an organised efficient work habit.

Education & Key qualifications

DEGREE	INSTITUTION	YEAR
B.Sc.	Rand Afrikaans University	2001-2003
B.Sc.	Honours Rand Afrikaans University	2004
M.Sc.	University of Johannesburg	2005-2007

Career enhancing courses

Basic Wetlands	GDARD.	14, 15 April 2008
Lexis Nexis	Sandton	12 October 2009
Risk Management of Aquifers	FETWater by Dept. Water Affairs	08 March 2010.
NEMA Legislation 2010	Strategic Environmental Focus	13 August 2010.
Section 21 c and i	Dept. Water Affairs	08, 09 September 2010.
Microsoft Project Professional	ProjectLink	20 & 21 June 2011.
Engen Permit to Work	Prowalco	6-8 June 2014.

Other:

Date : Course Name, Institution
2014 : Health and Safety (Level 1 & 2 First Aid)
2014 : Firefighting
2004 : Advanced 4 x 4 driving course

Employment record

May 2015 – To date	PRISM Environmental Management Services, Position
September 2014 – April 2015	DMT-Kai Batla
June 2014 – August 2014	Kantey and Templer
September 2013 – May 2014	GladAfrica Environmental Management
August 2012 – April 2013	African Innovative Solutions and Projects

May 2011 – July 2012
March 2010 – April 2011
May 2009 – February 2010
April 2007 – April 2009

Lidwala Consulting Engineers
Strategic Environmental Focus
Savannah Environmental
Nemai Consulting

SYNOPTIC CV: REINIER. F. TERBLANCHE



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Noordbrug
2522
South Africa

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E-mail: reinierf.terblanche@gmail.com

SUMMARY

Career as natural scientist

Reinier is a landscape ecologist and habitat specialist with an exceptional combination of botanical and zoological expertise which he keeps fostering, updating and improving. He practices as an ecological consultant and has owned Anthene Ecological CC since 2008. He has been registered as a Professional Natural Scientist by SACNASP since 2005: Reg. No. 400244/05.

His experience in consultation includes: Flora and fauna habitat surveys, especially focusing on the possible presence or not of threatened species, Riparian vegetation index surveys, Ecological condition surveys, Compilation of Ecological Management Plans, Biodiversity Action Plans and Contributions to Environmental Management Frameworks, Wetland Assessments, Management of Rare Wetland Species.

Reinier is busy with a Ph.D for which he registered at the Department of Conservation Ecology and Entomology at the University of Stellenbosch in 2013. Reinier's experience includes being a lecturer (ecology, zoology) at the School of Environmental Sciences and Management at North West University, Potchefstroom Campus (1998-2008). He specializes in conservation biology and threatened butterfly species. These studies include detailed habitat, vegetation and ant assemblage studies. He has published extensively in the fields of taxonomy, biogeography and ecology in popular journals, peer-reviewed scientific journals and as co-author and co-editor of books (see attached list of publications). Reinier presented several oral papers locally and internationally. Reinier's passion for ecology and taxonomy originated with his hobby of collecting butterflies at the age of four, and he has sustained this passion including his discovery of a number of new butterfly species. His multidisciplinary background in botany and zoology as well as his considerable experience in the veld and wilderness facilitate informed decision making in environmental management and biodiversity conservation.

Other activities

In his school days and in particular at university as Vice-President of the Student Council NWU (pre-1994) Reinier made an effort to contribute pro-actively to a non-racist dispensation of the then to arrive, new South Africa. He participated in many sport- and cultural activities during school and university years, some to provincial level. Reinier was a teacher (biology and science) from 1994-1998 at secondary school. He also ran a few ultra-marathons, including four Two Oceans marathons and three Comrades marathons. He is interested in African and contemporary music and art, and finished a semester course in art history. Reinier is a keen macro-photographer and contributed many photographic images to popular and scientific publications.

REINIER F. TERBLANCHE

SYNOPSIS OF EXPERIENCE IN ECOLOGY, BIOGEOGRAPHY, TAXONOMY AND
CONSERVATION BIOLOGY

QUALIFICATIONS

Qualification	Main subject matter	Institution
M.Sc <i>Cum Laude</i> , 1998: Botany: Ecology	Quantitative study of invertebrate assemblages of rangelands at an experimental farm in the Grassland Biome (North-West University, Potchefstroom).	North-West University, Potchefstroom
B.Sc Honns <i>Cum Laude</i> , 1992 Taxonomy	Distinctions in all subjects: Botany: Plant Anatomy 75, Taxonomy 84, Modern Systematics 82, System Modelling 75, Plant Ecology 75, Taxonomy Project 77, Statistics Attendance Course	North-West University, Potchefstroom
B.Sc Zoology	Botany, Main subjects: Botany, Zoology. Other subjects: Chemistry (2 nd year) Physics (First year)	North-West University, Potchefstroom
Higher Education Diploma , 1990	Numerous subjects aimed at holistic training of teachers	North-West University, Potchefstroom

Current studies:

Ph.D: Currently busy with a Ph.D that focuses on landscape ecology of butterfly species in South Africa based on model case studies. Thesis includes extensive habitat, vegetation and ant assemblage studies. A large body of data has already been gathered so that Reinier registered in 2013 for Ph.D at the Department of Conservation Ecology and Entomology, University of Stellenbosch, Western Cape, South Africa.

Recent courses:

Tools for Wetland Assessment – *Rhodes* (September, 2012)

Integrated Land Management: Rehabilitation and Monitoring - *CEM, NWU* (July, 2012)

Recent workshops:

Prioritising southern African butterfly species for conservation action – Walter Sisulu National Botanical Gardens, Johannesburg: SANBI, University of Pretoria (31 May 2013)

10.2 Appendix B - List of Plant Species Recorded at the Site.

Plant species are listed alphabetically under life forms that are generally recognizable.

Plant species marked with an asterisk (*) are exotic.

Table 10-1: List of Plant Species Recorded onsite

PLANT GROUPS AND SPECIES	COMMON NAME	PLANT FAMILY
GRASSES/ GRAMINOIDS		
<i>Aristida canescens</i>		POACEAE Grass family
<i>Aristida congesta</i>	Tassel Three-awn	POACEAE Grass family
<i>Brachiaria serrata</i>		POACEAE Grass family
<i>Cyperus esculentus</i>	Yellow nutsedge	CYPERACEAE Sedge family
<i>Chloris virgata</i>	Feather-top Chloris	POACEAE Grass family
<i>Cymbopogon pospischilii</i> (= <i>Cymbopogon plurinodis</i>)	Narrow-leaved Turpentine Grass	POACEAE Grass family
<i>Cynodon dactylon</i>	Couch Grass	POACEAE Grass family
<i>Digitaria eriantha</i>	Common Finger Grass	POACEAE Grass family
<i>Eleusine coracana</i> subsp. <i>africana</i>	Goose Grass Jongosgras (A)	POACEAE Grass family
<i>Elionurus muticus</i>	Wire Grass	POACEAE Grass family
<i>Eragrostis chloromelas</i>	Narrow Curly Leaf	POACEAE Grass family
<i>Eragrostis curvula</i>	Weeping Love Grass	POACEAE Grass family
<i>Eragrostis gummiiflua</i>	Gum Grass	POACEAE Grass family
<i>Eragrostis racemosa</i>		POACEAE Grass family
<i>Eragrostis superba</i>	Saw-toothed Love Grass	POACEAE Grass family
<i>Heteropogon contortus</i>	Spear Grass	POACEAE Grass family
<i>Hyparrhenia hirta</i>	Common Thatching Grass	POACEAE Grass family
<i>Imperata cylindrica</i>	Cotton Wool Grass	POACEAE Grass family
<i>Melinis repens</i>	Natal Red Top	POACEAE Grass family
<i>Panicum maximum</i>	Guinea Grass	POACEAE Grass family
<i>Paspalum distichum</i>	Water Couch	POACEAE Grass family
<i>Pogonarthria squarrosa</i>	Herringbone Grass	POACEAE Grass family
<i>Schizachyrium sanguineum</i>	Red Autumn Grass	POACEAE Grass family
* <i>Sorghum halepense</i>	Johnson Grass	POACEAE Grass family

PLANT GROUPS AND SPECIES	COMMON NAME	PLANT FAMILY
<i>Sporobolus africanus</i>	Ratstail Dropseed	POACEAE Grass family
<i>Themeda triandra</i>	Red Grass	POACEAE Grass family
<i>Urochloa mosambicensis</i>	Bushveld Signal Grass	POACEAE Grass family
HERBS AND GEOPHYTES		
<i>Albuca setosa</i>	Small White Albuca	HYACINTHACEAE
* <i>Amaranthus hybridus</i>	Pigweed	AMARANTHACEAE
* <i>Argemone ochroleuca</i>	White-flowered Mexican Poppy	PAPAVERACEAE
* <i>Bidens bipinnata</i>	Spanish blackjack	ASTERACEAE
* <i>Bidens pilosa</i>	Common blackjack	ASTERACEAE
<i>Boophone disticha</i>	Poison Bulb	AMARYLLIDACEAE
<i>Bulbine narcissifolia</i>		ASPHODELACEAE
* <i>Campuloclinium macrocephalum</i>	Pompom Weed	ASTERACEAE
* <i>Capsella bursa-pastoris</i>		BRASSICACEAE
<i>Chamaecrista mimosoides</i>	Fishbone Cassia	CAESALPINIACEAE
* <i>Chenopodium album</i>	White Goosefoot	CHENOPODIACEAE
* <i>Chenopodium carinatum</i>	Green Goosefoot	CHENOPODIACEAE
* <i>Cichorium intybus</i>	Chicory	ASTERACEAE
* <i>Cirsium vulgare</i>	Scotch Thistle	ASTERACEAE
* <i>Conyza bonariensis</i>	Flax-leaf Fleabane	ASTERACEAE
* <i>Conyza canadensis</i>	Fleabane	ASTERACEAE
<i>Conyza podocephala</i>		ASTERACEAE
* <i>Cosmos bipinnatus</i>	Cosmos	ASTERACEAE
<i>Cyanotis speciosa</i>		COMMELINACEAE
* <i>Datura ferox</i>	Large thorn-apple	SOLANACEAE
* <i>Datura stramonium</i>	Common thorn-apple	SOLANACEAE
<i>Dicoma anomala</i>		ASTERACEAE
<i>Felicia muricata</i>		ASTERACEAE
<i>Gazania krebsiana</i>		ASTERACEAE
<i>Gnidia kraussiana</i>		THYMELAEACEAE

PLANT GROUPS AND SPECIES	COMMON NAME	PLANT FAMILY
* <i>Gomphrena celosioides</i>	Bachelor's Button	AMARANTHACEAE
* <i>Guilleminea densa</i>	Carrot weed	AMARANTHACEAE
<i>Helichrysum nudifolium</i>	Hottentot's tea	ASTERACEAE
<i>Helichrysum rugulosum</i>		ASTERACEAE
<i>Hibiscus pusillus</i>		MALVACEAE
* <i>Hibiscus trionum</i>	Bladder hibiscus	MALVACEAE
<i>Hilliardiella oligocephala</i>		ASTERACEAE
<i>Hypoxis hemerocallidea</i>	Star Flower	HYPOXIDACEAE
<i>Hypoxis rigidula</i>		HYPOXIDACEAE
* <i>Lactuca serriola</i>	Wild Letuce Wildeslaai (A)	ASTERACEAE
* <i>Medicago sativa</i>	Lucerne	FABACEAE
* <i>Melilotus alba</i>	Bokhara Clover	FABACEAE
<i>Monopsis decipiens</i>		LOBELIACEAE
<i>Nidorella anomala</i>		ASTERACEAE
<i>Nidorella hottentotica</i>		ASTERACEAE
* <i>Oenothera indecora</i>	Small Evening Primrose	ONAGRACEAE
* <i>Oenothera rosea</i>	Rose Evening Primrose	ONAGRACEAE
* <i>Oenothera stricta</i>	Yellow Evening Primrose	ONAGRACEAE
* <i>Oenothera tetraptera</i>	White Evening Primrose	ONAGRACEAE
* <i>Oxalis corniculata</i>	Creeping Sorrel	OXALIDACEAE
<i>Papaver aculeatum</i>	Orange Poppy	PAPAVERACEAE Poppy family
<i>Pentanisia angustifolia</i>		RUBIACEAE
* <i>Physalis viscosa</i>	Sticky gooseberry	SOLANACEAE
* <i>Plantago lanceolata</i>	Narrow-leaved plantain	PLANTAGINACEAE
* <i>Portulaca oleracea</i>	Purslane	PORTULACACEAE

PLANT GROUPS AND SPECIES	COMMON NAME	PLANT FAMILY
* <i>Schkuhria pinnata</i>	Dwarf Marigold	ASTERACEAE
<i>Senecio consanguineus</i>	Starvation Senecio	ASTERACEAE
<i>Sida rhombifolia</i>	Arrowleaf Sida	MALVACEAE
<i>Solanum panduriforme</i>	Poison Apple	SOLANACEAE
<i>Solanum retroflexum</i>	Black Nightshade	SOLANACEAE
* <i>Sonchus dregeanus</i>	Sow Thistle	ASTERACEAE
* <i>Sonchus oleraceus</i>	Sow Thistle	ASTERACEAE
<i>Striga asiatica</i>	Witchweed	SCROPHULARIACEAE Snapdragon family
* <i>Tagetes minuta</i>	Khakiweed	ASTERACEAE
* <i>Taraxacum officinale</i>	Common Dandelion	ASTERACEAE
* <i>Tragopogon dubius</i>	Yellow Goat's Beard	ASTERACEAE
<i>Tribulus terrestris</i>	Devil's Thorn	ZYGOPHYLLACEAE
<i>Tripteris aghillana</i>		ASTERACEAE
* <i>Verbena aristigera</i>	Fine-leaved Verbena	VERBENACEAE
* <i>Verbena bonariensis</i>	Purple top	VERBENACEAE
* <i>Verbena brasiliensis</i>		VERBENACEAE
SHRUBS		
<i>Asparagus larycinus</i>		ASPARAGACEAE
<i>Gomphocarpus fruticosus</i>	Milkweed	APOCYNACEAE

PLANT GROUPS AND SPECIES	COMMON NAME	PLANT FAMILY
CLIMBERS		
<i>Clematis brachiat</i>	Traveller's Joy	RANUNCULACEAE
<i>Ipomoea purpurea</i>	Morning Glory	CONVOLVULACEAE
TREES		
* <i>Acacia decurrens</i>	Green Wattle	FABACEAE
<i>Acacia karroo</i>	Sweet Thorn	FABACEAE
<i>Celtis africana</i>	White Stinkwood	CELTIDACEAE
<i>Combretum erythrophyllum</i>	River Bushwillow	COMBRETACEAE
* <i>Gleditsia triacanthos</i>	Honey Locust	FABACEAE
* <i>Melia azedarach</i>	Seringa	MELIACEAE
* <i>Robinia pseudoacacia</i>	Common Mulberry	FABACEAE
<i>Searsia pyroides</i>	Common Wild Currant	ANACARDIACEAE