

22

GAUTENG PROVINCE

Department: Roads and Transport
REPUBLIC OF SOUTH AFRICA

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Ref : 1/1/3/1/3 - 22458

2016 -02- 0 8

Department of Roads and Transport
Private Bag X83
MARSHALLTOWN
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Sir/Madam,

PROPOSED TOWNSHIP: JUKSKEI VIEW EXTENSION 128

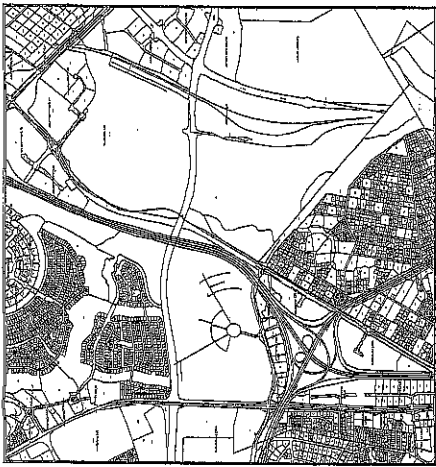
DISTRICT: CITY OF JOHANNESBURG

One copy of the lay-out plan of the above-mentioned township is enclosed for plotting and comments, if necessary.

Yours faithfully,

For: 
DEPUTY DIRECTOR: DEVELOPMENT FACILITATION
DIRECTORATE: TRANSPORT INFRASTRUCTURE PLANNING
DEPARTMENT OF ROADS AND TRANSPORT
DATE:

2016 -02- 0 8



TOWNSHIP DATA

LAND-USE	No. OF ERF'S	AREA (ha)	% OF TOTAL AREA
RESIDENTIAL-3	2	15.6724	90.69
PRIVATE OPEN SPACES	2	1.5579	9.01
ROADS	3	3.104	0.0316
TOTAL	4	17.2819	100.00

- NOTES
- All areas and dimensions are approximate, being subject to final survey.
 - Contours are in accordance with the standards laid down in regulation 18(2) of the Town Planning and Townships (Ordinance 15, 1986)
 - Datum plane - Mean Sea Level; interval 1m
 - Co-ordinate system: WGS 84 L.S. 29'
 - The figure lettered ABCD.....ABCA represents Part of the Remainder of Portion 1 of the farm, Waterval 5 IR, and Part of the Remainder of the farm Waterval 38 IR, being 17,281,919ha in extent
 - The figure lettered XYZW represents a 6 meter wide Electrical Servitude
 - The township falls under the jurisdiction of City of Johannesburg

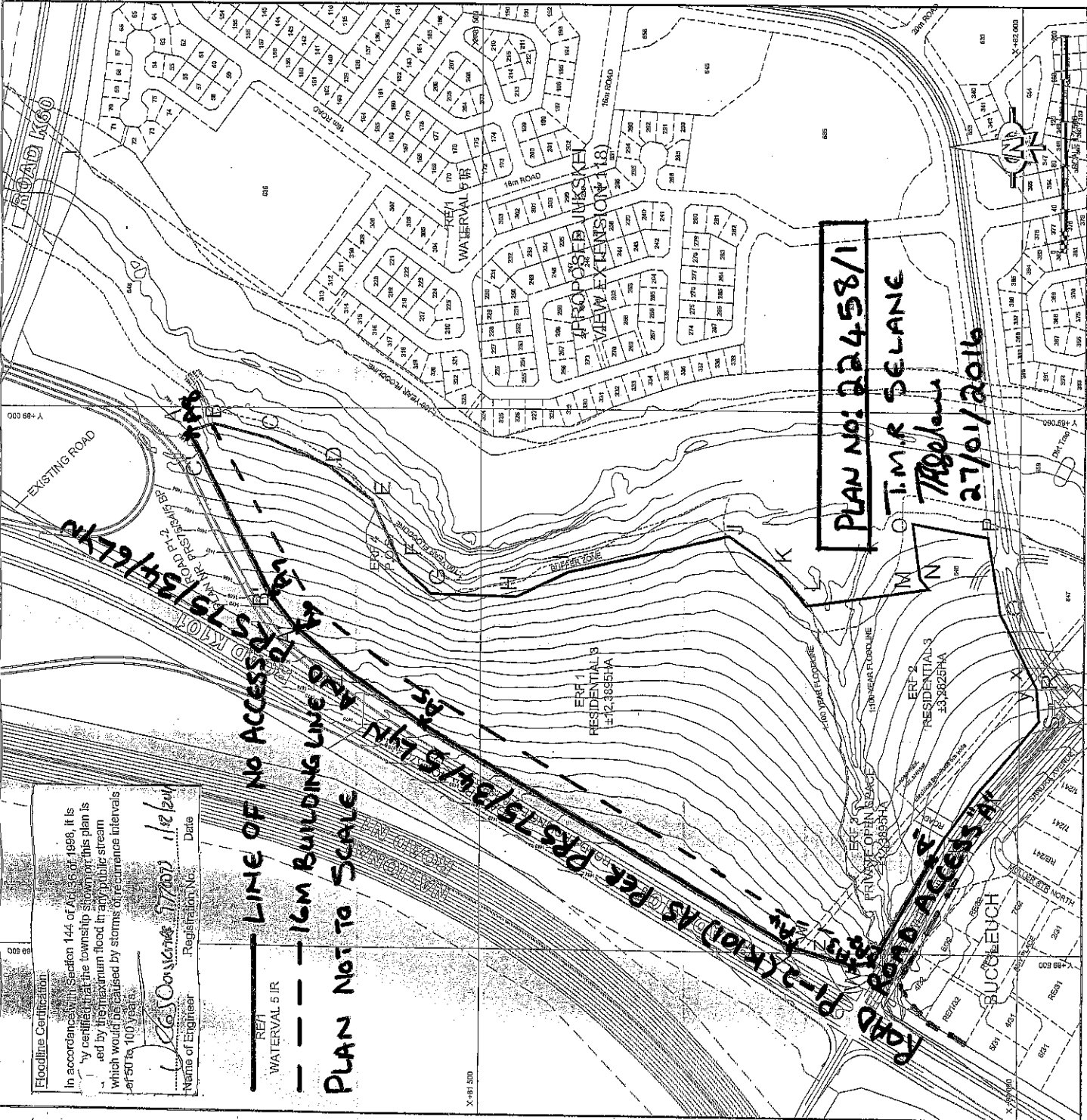
PROPOSED TOWNSHIP
JUKESKIEW
 EXTENSION 128

TO BE ESTABLISHED ON PART OF THE REMAINDER OF PORTION 1 OF THE FARM WATerval 5 IR AND PART OF THE REMAINDER OF THE FARM WATerval 38 IR

TINE BEZUIDENHOUT AND ASSOCIATES
 Town Planning Consultants

Physical Address: Unit 50, Tenth Phase Office Park, Calderwood Road, Lone Hill
 Postal Address: P.O. Box 99558, Calderwood Park, 2152

Phone: (011) 467-1094 Telefax: (011) 467-1170 e-mail: tina@tineba.com
 DATE: 13 OCTOBER 2015 PLAN NO. 7533/LJ



Floodline Certification

In accordance with Section 144 of Act 103 of 1998, it is hereby certified that the township shown on this plan is not liable to be flooded by the maximum flood in any public stream which would be caused by storms of recurrence intervals of 50 to 100 years.

T.M.R. Delane
 Name of Engineer Registration No. 17700 Date 1/2/2016

— LINE OF NO ACCESS

--- 16M BUILDING LINE

PLAN NOT TO SCALE

PLAN NO: 22458/1

T.M.R. DELANE

Tabelan

27/01/2016

APPENDIX G: SPECIALIST REPORTS

APPENDIX G1: HERITAGE IMPACT ASSESSMENT

**PHASE 1 HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED JUKSKEI VIEW
EXTENSION 128 RESIDENTIAL DEVELOPMENT LOCATED IN MIDRAND, GAUTENG
PROVINCE**



Leonie Marais-Botes
Heritage Practitioner

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Cultural History (UP), Post Grad Dip Museology (UP), Cert
Conservation of Traditional Buildings (Univ of Canberra)
Post Grad Dip: Heritage (Wits)*

*Accredited member: SA Society for Cultural
History (CH002)*

For:

Bokamoso Environmental
PO Box 11375
MAROELANA
0161

June 2016

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Leonie Marais-Botes Heritage Practitioner.

The information contained in this report is the sole intellectual property of Leonie Marais-Botes Heritage Practitioner.

It may only be used for the purposes it was commissioned for by the client.

DISCLAIMER:

Although all possible care is taken to identify/find all sites of cultural importance during the initial survey of the study area, the nature of archaeological and historical sites are as such that it is always possible that hidden or sub-surface sites could be overlooked during the study. Leonie Marais-Botes Heritage Practitioner will not be held liable for such oversights or for the costs incurred as a result thereof.

ACKNOWLEDGEMENTS

Australia ICOMOS. The Burra Charter.

Bergh, J.S. Geskiedenis Atlas van Suid-Afrika. Die vier Noordelike Provinsies. Van Schaik Uitgewers, 1998.

Beyers C.J. (Editor-in-Chief). Dictionary of South African Biography (Vol I – V). Pretoria, 1987.

Carruthers, V. The Magaliesburg. Pretoria, 2000.

Coertze, P.J. & Coertze, R.D. Verklarende vakwoordeboek vir Antropologie en Argeologie. Pretoria, 1996.

Copley, I.B. Ambush at Kalkheuwel Pass 3 June 1900 in Military History Journal Vol. No. 9. 1993.

Huffman, T.N. A Handbook to the Iron Age: The Archaeology of Pre- Colonial Farming Societies in Southern Africa. University of KwaZulu-Natal Press, 2007

Human Tissues Act (Act 65 of 1983 as amended)

Government Printers. 1: 50 000

National Cultural History Museum, Unpublished Report. A Survey of Cultural Resources in the Midrand Municipal Area, Gauteng Province, March 1998.

National Heritage Resources Act (Act 25 of 1999)

National Environmental Management Act (Act 107 of 1998)

Ordinance on Exhumations (no 12 of 1980)

Potgieter, D.J. (editor-in-chief) Standard Encyclopaedia of Southern Africa. London 1971.

Rosenthal E. (Editor) Encyclopaedia of Southern Africa, 1973

The National Archives of South Africa databases.

<http://www.lanseria.co.za/history>

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ABOUT THIS REPORT

The heritage report must reflect that consideration has been given to the history and heritage significance of the study area and that the proposed work is sensitive towards the heritage resources and does not alter or destroy the heritage significance of the study area.

The heritage report must refer to the heritage resources currently in the study area.

The opinion of an independent heritage consultant is required to evaluate if the proposed work generally follows a good approach that will ensure the conservation of the heritage resources.

The National Heritage Resources Act (Act 25 of 1999), the National Environmental Management Act (Act 107 of 1998), Ordinance on Exhumations (no 12 of 1980) and the Human Tissues Act (Act 65 of 1983 as amended) are the guideline documents for a report of this nature.

Leonie Marais-Botes Heritage Practitioner was appointed by Bokamoso Environmental to carry out a Phase 1 Heritage Impact Assessment (HIA) for the proposed Jukskei View Extension 128 Residential Development located in Midrand, Gauteng Province. The site visit was conducted on 16 June 2016.

DEFINITION OF TERMS:

“alter” means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or other decoration or any other means.

“archaeological” means—

(a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;

(b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;

(c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; and

(d) features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

“conservation”, in relation to heritage resources, includes protection, maintenance, preservation and sustainable use of places or objects so as to safeguard their cultural significance.

“cultural significance” means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

“development” means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of a heritage authority in any way result in a change to the nature, appearance or physical nature of a place, or influence its stability and future well-being, including—

(a) construction, alteration, demolition, removal or change of use of a place or a structure at a place;

(b) carrying out any works on or over or under a place;

(c) subdivision or consolidation of land comprising, a place, including the structures or airspace of a place;

(d) constructing or putting up for display signs or hoardings;

(e) any change to the natural or existing condition or topography of land; and

(f) any removal or destruction of trees, or removal of vegetation or topsoil; object that is specifically designated by that state as being of importance.

“grave” means a place of interment and includes the contents, headstone or other marker of such a place, and any other structure on or associated with such place.

“heritage resource” means any place or object of cultural significance.

“heritage resources authority” means the South African Heritage Resources Agency, or in respect of a province, a provincial heritage resources authority.

“heritage site” means a place declared to be a national heritage site by SAHRA or a place declared to be a provincial heritage site by a provincial heritage resources authority.

“improvement”, in relation to heritage resources, includes the repair, restoration and rehabilitation of a place protected in terms of Act 25 of 1999.

“living heritage” means the intangible aspects of inherited culture, and may include—

- (a) cultural tradition;
- (b) oral history;
- (c) performance;
- (d) ritual;
- (e) popular memory;
- (f) skills and techniques;
- (g) indigenous knowledge systems; and
- (h) the holistic approach to nature, society and social relationships.

“local authority” means a municipality as defined in section 10B of the Local Government Transition Act, 1993 (Act No. 209 of 1993).

“management”, in relation to heritage resources, includes the conservation, presentation and improvement of a place protected in terms of Act 25 of 1999.

“meteorite” means any naturally-occurring object of extraterrestrial origin.

“object” means any movable property of cultural significance which may be protected in terms of any provisions of Act 25 of 1999, including—

- (a) any archaeological artefact;
- (b) palaeontological and rare geological specimens;
- (c) meteorites; and
- (d) other objects.

“palaeontological” means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

“place” includes—

- (a) a site, area or region;
- (b) a building or other structure which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure;
- (c) a group of buildings or other structures which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures;
- (d) an open space, including a public square, street or park; and
- (e) in relation to the management of a place, includes the immediate surroundings of a place.

“presentation” includes—

- (a) the exhibition or display of;
- (b) the provision of access and guidance to;
- (c) the provision, publication or display of information in relation to; and
- (d) performances or oral presentations related to, heritage resources protected in terms of Act 25 of 1999.

“public monuments and memorials” means all monuments and memorials—

- (a) erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government; or
- (b) which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual.

“site” means any area of land, including land covered by water, and including any structures or objects thereon.

“structure” means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

“victims of conflict” means—

(a) certain persons who died in any area now included in the Republic as a direct result of any war or conflict as specified in the regulations, but excluding victims of conflict covered by the Commonwealth War Graves

Act, 1992 (Act No. 8 of 1992);

(b) members of the forces of Great Britain and the former British Empire who died in active service in any area now included in the Republic prior to 4 August 1914;

(c) persons who, during the Anglo-Boer War (1899-1902) were removed as prisoners of war from any place now included in the Republic to any place outside South Africa and who died there; and

(d) certain categories of persons who died in the “liberation struggle” as defined in the regulations, and in areas included in the Republic as well as outside the Republic.

EXECUTIVE SUMMARY

This project may impact on any types and ranges of heritage resources that are outlined in Section 3 of the National Heritage Resources Act (Act 25 of 1999). Consequently a Heritage Impact Assessment was commissioned by Bokamoso Environmental and conducted by Leonie Marais-Botes.

No heritage sites were identified on/near the site earmarked for development.

It is important to note that all graves and cemeteries are of high significance and are protected by various laws. Legislation with regard to graves includes the National Heritage Resources Act (Act 25 of 1999) whenever graves are 60 years and older. Other legislation with regard to graves includes those when graves are exhumed and relocated, namely the Ordinance on Exhumations (no 12 of 1980) and the Human Tissues Act (Act 65 of 1983 as amended).

1.1 INTRODUCTION

It is proposed that there will be 3 erven in the Township. Erven 1 and 2 are to be zoned “**Residential 3**” and Erf 3 to be zoned “**Private Open Space**”. Access to the site will be obtained from Maxwell Drive.

1.2 LOCATION AND STUDY AREA

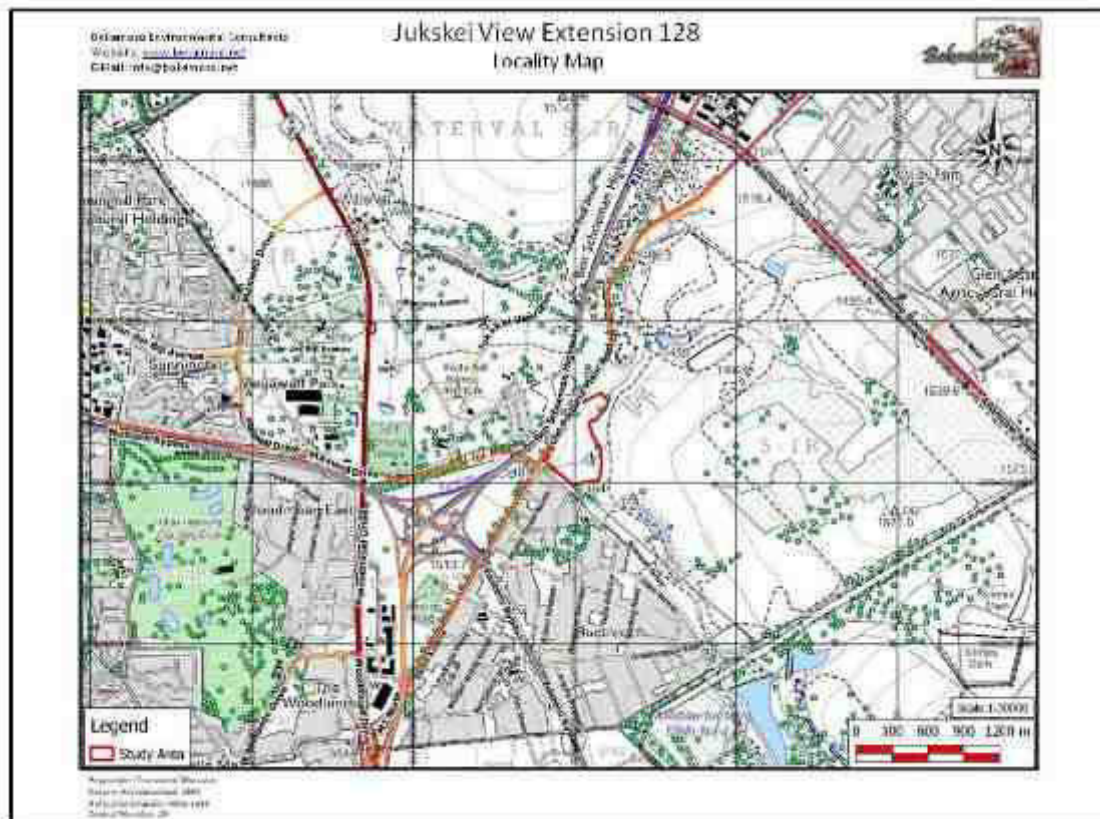


Figure 1: Locality Map

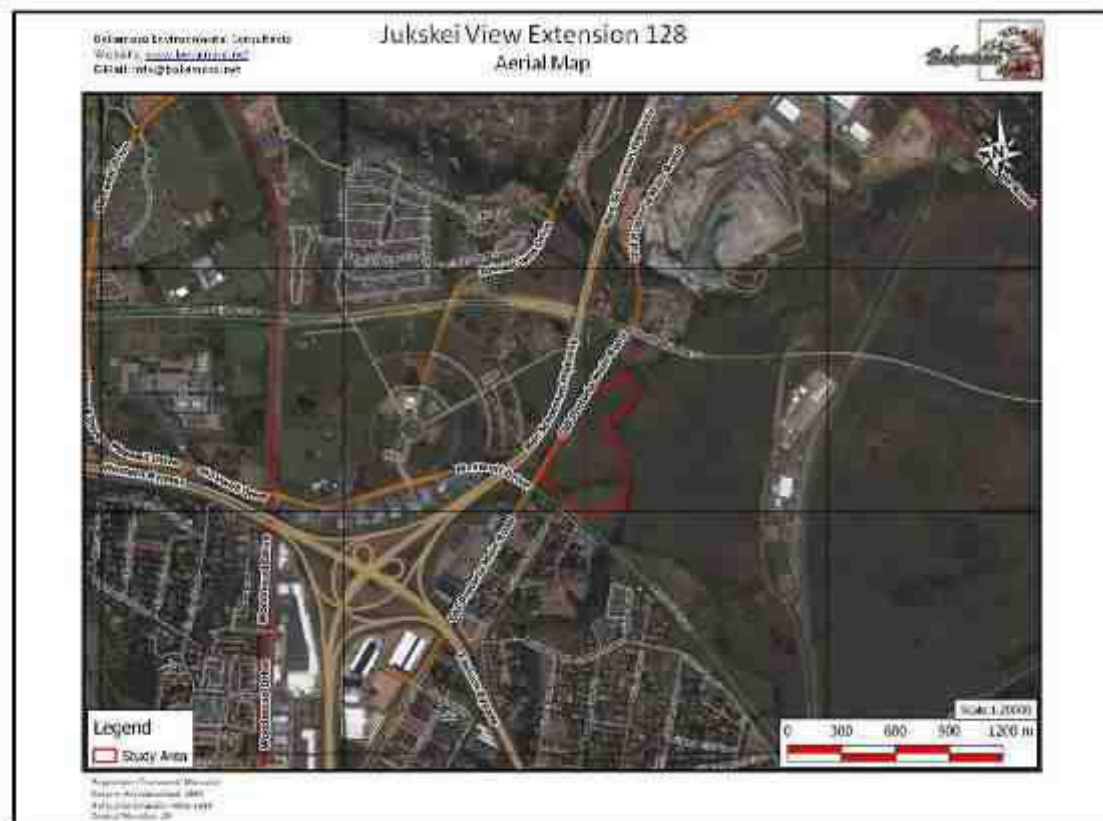


Figure 2: Aerial Map

1.3 METHOD

The objective of this Phase 1 Heritage Impact Assessment (HIA) was to gain an overall understanding of the heritage sensitivities of the area and indicate how they may be impacted on through development activities. The survey took place on 16 June 2016.

In order to establish heritage significance the following method was followed:

- Investigation of primary resources (archival information)
- Investigation of secondary resources (literature and maps)
- Physical evidence (site investigation)
- Determining Heritage Significance

1.4 BACKGROUND HISTORY OF THE GREATER STUDY AREA

The history of human occupation in the Midrand area, known thus far, goes back at least 150 000 years when groups of Early Stone Age people appeared periodically. The said Early Stone Age People appeared periodically and manufactured simple tools and weapons of stone, bone and wood, which they used for hunting and gathering of edible plants. No permanent settlement took place.

Following the Early Stone Age, Midrand was the scene of periodic occupation by Middle and probably also by Late Stone Age groups.

Occupation of Midrand by the first groups of Iron Age settlers began some 1600 years ago.

In the 1820's the first European people appeared on the scene, hunters, traders, missionaries and other travellers. Permanent occupation by whites began in the 1840's, when settler families established farms in the area.

Gradually the entire area was divided into farms until well into the 20th century, this was followed by sub-division into small holdings and later townships of various character¹.

1.5 PHOTOGRAPHIC RECORD OF AREA EARMARKED FOR DEVELOPMENT



Figure3: Site earmarked for development. Photograph taken to the east.

¹ National Cultural History Museum, Unpublished Report. A Survey of Cultural Resources in the Midrand Municipal Area, Gauteng Province, pp. 9-13



Figure 4: Site earmarked for development. Photograph taken to the south



Figure 5: Site earmarked for development. Photograph taken towards the west.



Figure 6: Site earmarked for development. Photograph taken towards the north.

2. FINDINGS

2.1 PRE-COLONIAL HERITAGE SITES

Possibilities: Greater study area taken into account.

Stone Age

The Stone Age is the period in human history when stone material was mainly used to produce tools². In South Africa the Stone Age can be divided in three periods³;

- Early Stone Age 2 000 000 – 150 000 years ago
- Middle Stone Age 150 000 – 30 000 years ago
- Late Stone Age 40 000 years ago - +/- 1850 AD

Iron Age

The Iron Age is the period in human history when metal was mainly used to produce artefacts⁴. In South Africa the Iron Age can be divided in three periods;

- Early Iron Age 250-900 AD
- Middle Iron Age 900-1300 AD
- Late Iron Age 1300-1840 AD⁵

There are no pre-colonial heritage sites evident in the study area.

2.2 HISTORICAL PERIOD HERITAGE SITES

Possibilities: Greater study area taken into account.

- Pioneer sites;
- Sites associated with early mining;
- Structures older than 60 years;
- Graves (Graves younger than 60 years, graves older than 60 years, but younger than 100 years, graves older than 100 years, graves of victims of conflict or of individuals of royal descent).

There are no historical period sites situated on the site earmarked for development.

2.3 ORIGINAL LANDSCAPE

Previous farming and other infra-structure development activities have altered the original landscape in most of the greater study area considerably.

² P. J. Coertze & R.D. Coertze, Verklarende vakwoordeboek vir Antropologie en Argeologie.

³ S.A. Korsman & A. Meyer, Die Steentydperk en rotskuns in J.S. Bergh (red) Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies.

⁴ P.J. Coertze & R.D. Coertze, Verklarende vakwoordeboek vir Antropologie en Argeologie.

⁵ M.M. van der Ryst & A Meyer. Die Ystertydperk in J.S. Bergh (red) Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies and T.N Huffman, A Handbook to the Iron Age: The Archaeology of Pre-Colonial Farming Societies in Southern Africa.

2.4 INTANGIBLE HERITAGE

The intangible heritage of the greater study area can be found in the stories of past and present inhabitants.

3 CATEGORIES OF HERITAGE VALUE (ACT 25 OF 1999)

The National Heritage Resources Act (Act 25 of 1999) identifies the following categories of value under section 3(1) and (2) of the Act under the heading "National Estate":

- “3 (1) For the purpose of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.
- (2) Without limiting the generality of subsection (1), the national estate may include-
- (a) places, buildings, structures and equipment of cultural significance;
 - (b) places which oral traditions are attached or which are associated with living heritage;
 - (c) historical settlements and townscapes;
 - (d) landscapes and natural features of cultural significance;
 - (e) geological sites of scientific or cultural importance;
 - (f) archaeological and palaeontological sites;
 - (g) graves and burial grounds, including-
 - (i) ancestral graves;
 - (ii) royal graves and graves of traditional leaders;
 - (iii) graves of victims of conflict;
 - (iv) graves of individuals designated by the Minister by notice in the Gazette
 - (v) historical graves and cemeteries; and
 - (vi) other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
 - (h) sites of significance relating to the history in South Africa;
 - (i) movable objects, including-
 - (i) objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
 - (ii) objects to which oral traditions are attached or which are associated with living heritage;
 - (iii) ethnographic art and objects;
 - (iv) military objects
 - (v) objects of decorative or fine art;
 - (vi) objects of scientific or technological interests; and
 - (vii) books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section I (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).
- (3) Without limiting the generality of the subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of-
- (a) Its importance in the community, or pattern of South Africa's history;
 - (b) Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

- (c) Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- (d) Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural objects;
- (e) Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- (f) Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- (g) Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- (h) Its strong or special association with the life and work of a person, group or organisation of importance in the history of South Africa; and
- (i) Sites of significance relating to the history of slavery in South Africa.”

3.1 HERITAGE VALUE OF WEIGHED AGAINST CULTURAL SIGNIFICANCE CATEGORIES

3.1.1 Spiritual value

During the site visit/field work no indication of any spiritual activity was observed on/near the proposed site. Thus no sites of spiritual value will be impacted on by the proposed project.

3.1.2 Scientific value

No sites of scientific value was observed on or near the site earmarked for development.

3.1.3 Historical value

No historical value associated with the proposed site could be found in primary and secondary sources.⁶

3.1.4 Aesthetic value

No heritage item with exceptional aesthetic (architectural) value was identified in the study area.

3.1.5 Social value

Social value is attributed to sites that are used by the community for recreation and formal and informal meetings regarding matters that are important to the community. These sites include parks, community halls, sport fields etc. Visually none of the above is evident in the study area.

⁶ Standard Encyclopaedia of Southern Africa and the Transvaalse Argiefbewaarplek (TAB) database at the National Archives, Pretoria;
 J.S. Bergh (red), Geskiedenisatlas van Suid-Afrika: Die Vier Noordelike Provinsies.

3.2 SPECIFIC CATEGORIES INVESTIGATED AS PER SECTION 3 (1) AND (2) OF THE NATIONAL HERITAGE LEGISLATION (ACT 25 OF 1999)

3.2.1 Does the site/s provide the context for a wider number of places, buildings, structures and equipment of cultural significance?

The study area does not provide context for a wider number of places, buildings, structures and equipment of cultural significance. The reason is the low density of heritage structures/sites in the study area, near or on the proposed site.

3.2.2 Does the site/s contain places to which oral traditions are attached or which are associated with living heritage?

Places to which oral traditions are attached or associated with living heritage are usually found in conjunction with traditional settlements and villages which still practise age old traditions. None of these are evident near or on the proposed site.

3.2.3 Does the site/s contain historical settlements?

No historical settlements are located on or near the proposed site.

3.2.4 Does the site/s contain landscapes and natural features of cultural significance?

Due to previous infra-structure development activities the original character of the landscape have been altered significantly in the greater study area.

3.2.5 Does the site/s contain geological sites of cultural importance?

Geological sites of cultural importance include meteorite sites (Tswaing Crater and Vredefort Dome), fossil sites (Karoo and Krugersdorp area), important mountain ranges or ridges (Magaliesburg, Drakensberg etc.). Although in the Krugersdorp area, the site is located outside the paleontological buffer zone.

3.2.6 Does the site/s contain a wide range of archaeological sites?

The proposed site does not contain any surface archaeological deposits.

The possibility of sub-surface findings always exists and should be taken into consideration in the Environmental Management Plan.

If sub-surface archaeological material is discovered work must stop and a heritage practitioner preferably an archaeologist contacted to assess the find and make recommendations.

3.2.7 Does the site/s contain any marked graves and burial grounds?

The site does not contain marked graves. The possibility of graves not visible to the human eye always exists and this should be taken into consideration in the Environmental Management Programme.

It is important to note that all graves and cemeteries are of high significance and are protected by various laws. Legislation with regard to graves includes the National Heritage Resources Act (Act 25 of 1999) whenever graves are 60 years and older. Other legislation with regard to graves includes those when graves are exhumed and relocated, namely the Ordinance on Exhumations (no 12 of 1980) and the Human Tissues Act (Act 65 of 1983 as amended).

If sub-surface graves are discovered work should stop and a professional preferably an archaeologist contacted to assess the age of the grave/graves and to advice on the way forward.

3.2.8 Does the site/s contain aspects that relate to the history of slavery?

This is not an area associated with the history of slavery like the Western Cape Province.

3.2.9 Can the place be considered as a place that is important to the community or in the pattern of South African history?

In primary and secondary sources the proposed site is not described as important to the community or in the pattern of South African history.⁷

3.2.10 Does the site/s embody the quality of a place possessing uncommon or rare endangered aspects of South Africa's natural and cultural heritage?

The proposed site does not possess uncommon, rare or endangered aspects of South Africa's natural and cultural heritage. These sites are usually regarded as Grade 1 or World Heritage Sites.

3.2.11 Does the site/s demonstrate the principal characteristics of South Africa's natural or cultural places?

The proposed site does not demonstrate the principal characteristics of South Africa's natural or cultural places. These characteristics are usually associated with aesthetic significance.

3.2.12 Does the site/s exhibit particular aesthetic characteristics valued by the community or cultural groups?

This part of the greater study area does not exhibit particular aesthetic characteristics valued by the community or cultural groups. The reason being the low density of heritage buildings and structures located in the greater study area.

⁷ Standard Encyclopaedia of Southern Africa and the Transvaalse Argiefbewaarplek (TAB) database at the National Archives, Pretoria.

J.S. Bergh (red), Geskiedenisatlas van Suid-Afrika. Die Vier Noordelike Provinsies.

3.2.13 Does the site/s contain elements, which are important in demonstrating a high degree of creative technical achievement?

The site does not contain elements which are important in demonstrating a high degree of creative technical achievement. Reason being none of the above evident on site.

3.2.14 Does the site/s have strong and special associations with particular communities and cultural groups for social, cultural and spiritual reasons?

The proposed site does not have a strong or special association with particular communities and cultural groups for social, cultural and spiritual reasons, the reason being that the particular site is located on mainly developed land and it is evident that the site is not utilised for social, cultural or spiritual reasons.

3.2.15 Does the site/s have a strong and special association with the life or work of a person, group or organisation?

The site does not have a strong and special association with the life or work of a person, group or organisation.

4. OPPORTUNITIES, RESTRICTIONS, IMPACTS

- There are no visible restrictions or negative impacts in terms of heritage associated with the site. In terms of heritage this project can proceed.
- 3.2.6 and 3.2.7 must be taken into account in the Environmental Management Plan.

5. THE WAY FORWARD

- **Submit this report as a Section 38 application to the Gauteng Heritage Resources Authority (PHRAG) for comment/approval.**

APPENDIX G2: FLORA ASSESSMENT

Flora Assessment for remainder of portion 1 of the farm Waterval 5-IR and part of the remainder of the Farm Waterval 38-IR, Midrand



April 2016



Landscape Architects &

Environmental Consultants: Specialist Division

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sampie@bokamoso.net | www.bokamoso.biz.

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Report Author: S.E. van Rooyen

Reviewed by: Dr. J.V. van Greuning (Pr. Sci. Nat. reg. no. 400168/08)

Specialists

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Declaration of independence:

The specialist investigators responsible for conducting this particular specialist vegetation study declare that:

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report we did not have any interest, hidden or otherwise, in the proposed development, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, we will not be affected in any manner by the outcome of any environmental process of which this report may form a part;
- I declare that there are no circumstances that may compromise our objectivity in performing this specialist investigation. We do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I have the necessary qualifications and guidance from professional experts (registered Pr. Nat. Sci.) in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
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S.E. van Rooyen

VERIFICATION STATEMENT

This communication serves to verify that the flora report compiled by S. E. van Rooyen has been prepared under my supervision, and I have verified the contents thereof.

Declaration of independence: I, Dr. J.V. van Greuning (Pr. Sci. Nat. reg. no. 400168/08) declare that I:

- am committed to biodiversity conservation but concomitantly recognise the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them.
- abide by the Code of Ethics of the S.A. Council of Natural Scientific Professions
- act as an independent specialist consultant in the field of Botany
- am subcontracted as specialist consultant by Bokamoso Environmental Consultants for the proposed Mixed Use development on the remainder of the remainder of portion 1 of the farm Waterval 5-IR, Midrand described in this report.
- have no financial interest in the proposed development other than remuneration for work performed
- have or will not have any vested or conflicting interests in the proposed development
- undertake to disclose to Bokamoso Environmental Consultants and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2014.



Dr. J. V. van Greuning

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1. INTRODUCTION

Bokamoso Environmental: Specialist Division was commissioned to conduct a flora assessment for the proposed residential development on the remainder of Portion 1 of the Farm Waterval 5 IR and part of the remainder of the Farm Waterval 38 IR, Midrand. The objective was to conduct a floristic species survey to determine which species occur in the site of the proposed development. Special attention was given to possible habitats for Red and Orange List plant species that may occur in the area. Furthermore, the ecological integrity and sensitive habitats of the site were investigated.

2. OBJECTIVES OF THE STUDY

- To assess the habitat component and current ecological status of the area;
- To identify and list the plant species occurring on the site and indicate whether they are Red and Orange List species;
- Make recommendations if any Red and Orange List species are found;
- To indicate the sensitive habitats of the area;
- To highlight the current impacts on the flora of the site; and
- Provide recommendations to mitigate negative impacts and enhance positive impacts on the current flora should the proposed development be approved.

3. SCOPE OF STUDY

This report:

- Lists all plant species, including alien species, recorded during the flora survey;
- Provide recommendations on Red and Orange List plant species;
- Indicate medicinal plant species recorded;
- Comments on ecological sensitive areas;
- Comments on current impacts affecting the flora of the site;
- Evaluates the conservation importance and significance of the area in and adjacent to the proposed development, with special emphasis on the current status of threatened species; and
- Provides recommendations to mitigate or reduce negative impacts, should the proposed development be approved.

4. STUDY AREA

4.1 Regional vegetation

The study site lies within the Quarter Degree Square (QDS) 2628AA, which according to Mucina and Rutherford (2006), forms part of the Egoli Granite Grassland, declared as Endangered (Government Gazette no. 34809, 2011).

Less than 3 % of the targeted 24 % of the Egoli Granite Grassland is conserved in several nature reserves. The authors described the landscape of the Egoli Granite Grassland as low hills and moderately undulating plains, which support tall grass species such as *Hyparrhenia hirta*, dominating the area. Scattered rocky outcrops and rock sheets form suitable habitats for woody species (Mucina and Rutherford, 2006).

This grassland is regarded as degraded, as over utilisation created a species poor vegetation unit (Mucina and Rutherford, 2006). It often resembles secondary grassland as previously cultivated lands were rehabilitated to form a natural vegetation layer.

4.2 The study site

The site for the proposed residential development on the remainder of Portion 1 of the Farm Waterval 5 IR and part of the remainder of the Farm Waterval 38 IR, Midrand is situated east of Pretoria Main Road and north of Sandra Ave in Midrand (**Figure 1**). The study site is about 16 ha in size.

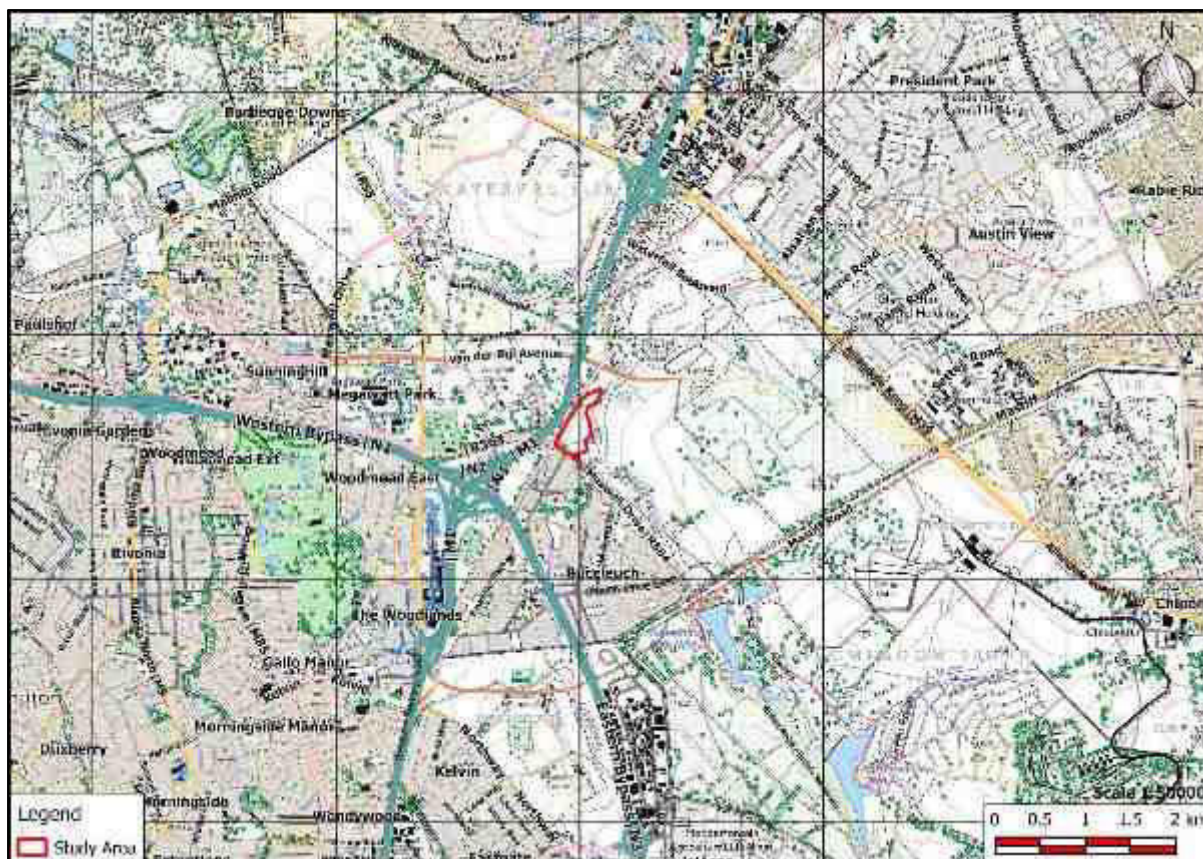


Figure 1 Locality map of the study site.

5. METHODS

The study site was visited on the 7th of April 2016. For each study unit identified, a species list was compiled for all plants recorded, using the adequate number of sampling plots (100 m by 25 m). Field guides such as those by Germishuizen and Meyer (2003), Koekemoer *et al.* (2014), Pooley (1998), van Ginkel *et al.* (2011), van Oudtshoorn *et al.* (2014), van Wyk and Malan (1998) and van Wyk (2013) were used to identify the species. The herbarium of the University of Pretoria (H. G. W. J. Schweickerdt Herbarium, University of Pretoria) was also visited to confirm the correct identification of species.

The survey also included information about the occurrence of Red and Orange List plant species obtained from GDARD (Pfab, 2002; Pfab and Victor, 2002) (**Annexure A**). The Red List Plant Species Guidelines and Requirements for Biodiversity Assessments v3. issued by GDARD (2014) was consulted. A desktop study was done to identify suitable habitats for the Red and Orange List plant species known to occur in the QDS 2628AA. The plant species list for this QDS obtained from SANBI (Plants of Southern Africa: an online checklist) was consulted to verify the record of occurrence of the plant species recorded at the site. The

Gauteng Conservation Plan (C-plan v3.3) was also consulted to evaluate ecologically sensitive areas.

Each study unit was further assessed for the occurrence of alien plant species (Bromilow, 2010) and any form of disturbance. Alien species are included in the species lists (indicated in bold in the relevant tables) as they suggest the particular state of each study unit. For each alien species the Category is indicated according to the *Alien and Invasive species lists* (2014) amended in NEMBA (National Environmental Management: Biodiversity Act (ACT NO, 10 OF 2004).

For each plant species, the medicinal properties were assessed (van Wyk *et al.*, 2013). Medicinal plants are marked with an asterisk (*) in the respective tables (**Tables 4 & 6**). Harvesting of medicinal plants causes a decline of the particular species and, therefore, threatens the conservation of these species.

6. RESULTS

6.1 Study Units

Two study units were identified in the study site (**Figure 2**):

1. Grassland
2. Drainage Line

The plant species found in each study unit are listed in **Tables 4 & 6**.

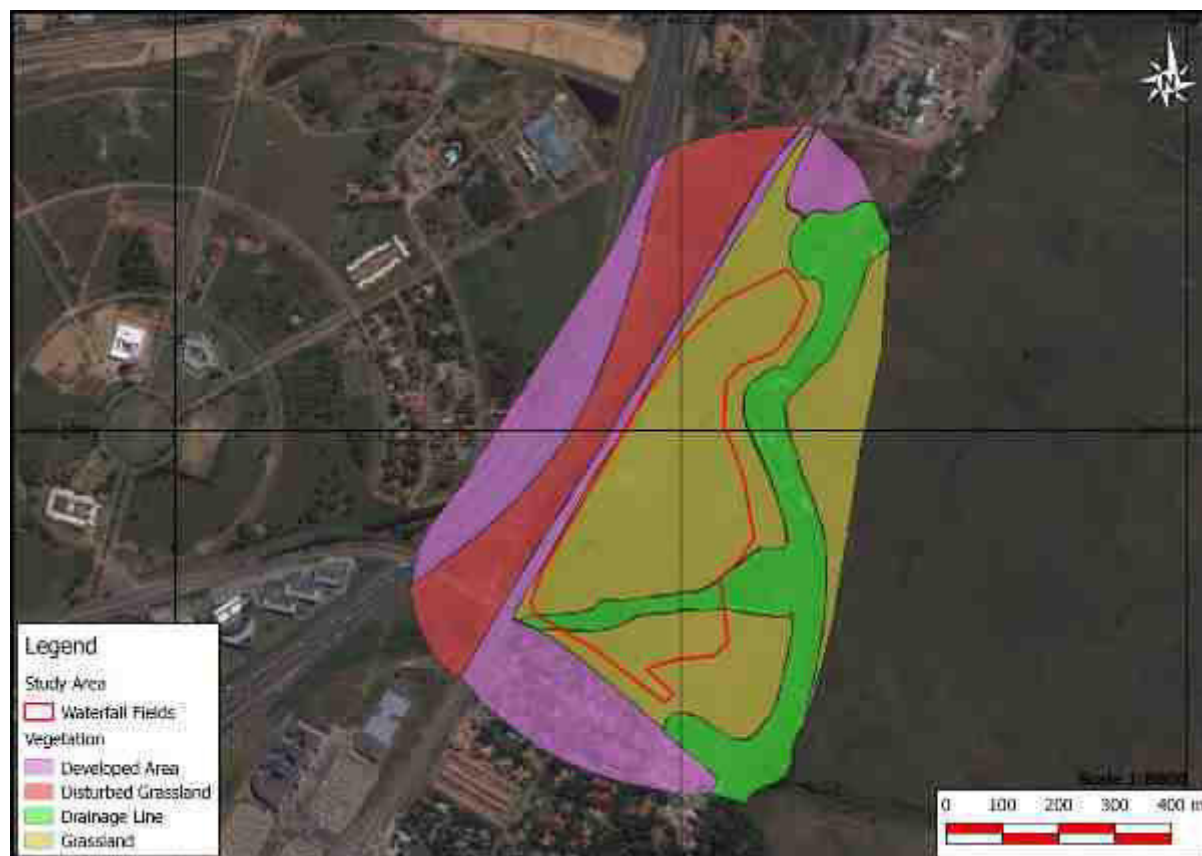


Figure 2 Vegetation map indicating different study units identified in the study site.

6.2 Red and Orange List species

Fifteen Red and Orange List species are known to occur in the QDS 2628AA (**Annexure A**). One Orange List plant species (*Hypoxis hemerocallidea*) was found on the study site. The Red List species *Boweia volubilis* subsp. *volubilis* occur within a 5km radius from the study site (**Annexure A**). The chance of finding this species on the study site is very low, as the study site doesn't fulfil in this particular species habitat requirements.

6.3 Medicinal & Alien species

The number of medicinal plant species for each study unit is indicated in **Table 1** and in representative species lists (**Table 4 & 6**). The species are indicated with a (*). Seven medicinal species were listed in the study site.

Table 1 The number of plant species recorded per study unit, including the total number of medicinal and alien plant species.

Study unit	Total number of species	No. of medicinal species	No. of alien species
Grassland	76	6	11
Drainage Line	43	4	12

The number of alien plant species for each study unit is indicated in **Table 1 & 2**, and in species lists (**Table 4 & 6**). The species are indicated in bold. The Grassland study unit has a high species richness with some alien species invading into this unit (**Table 1**). The Drainage Line on the other hand, has a relative high number of alien species as they occur in abundance on the site (**Table 2**).

Table 2 Number of alien plant species per study unit and numbers in different categories.

Study unit	Total number of alien species	CAT 1b	CAT 2	CAT 3	Not declared
Grassland	11	6		1	4
Drainage Line	12	6	1	1	4

All Category 2 exotics should likewise be removed, unless a permit is obtained to control it in a demarcated area or a biological control reserve. Category 3 Declared Invader plants may not occur on any land, or inland water surface other than in a biological control reserve. If Category 3 Declared Invader plants exist on the study site, a land user must take all responsible steps to stop the spreading of propagating material belonging to these plants.

6.4 Grassland

6.4.1 Composition & Connectivity

This study unit is dominated by the graminoid layer (**Table 3**), which include species such as *Eragrostis* spp., *Schizachyrium sanguineum*, *Heteropogon contortus* and *Hyparrhenia hirta* (**Figure 3**). The ecological status of this Grassland is good with fairly high species richness. Most of the species are forbs and include species such as *Bidens* spp., *Chlorophytum transvaalense*, *Cucumis zeyheri*, *Commelina* spp., *Hermannia depressa* and *Ledebouria* spp. Several trees and shrubs were also recorded, which includes dominant species such as *Searsia pyroides* and *Robinia pseudoacacia*.

Table 3 Number of species recorded in each growth form

GROWTH FORM	TOTAL NUMBER OF SPECIES
Shrub/Tree	12
Graminoid	20
Forb	44

Limited connectivity with homogenous vegetation exists to the east. This adjacent Grassland unit to the east is small, which makes sustainable biodiversity dynamics not achievable in this area.

6.4.2 Red & Orange List species

This study unit provides possible suitable habitats for the Red List species *Callilepis leptophylla*, *Cineraria longipes* and *Habenaria bicolor* (**Annexure A**). One Orange List species, *Hypoxis hemerocallidea* was found in abundance.

6.4.3. Medicinal & Alien species

Several alien plant species occur on the study unit, but is still dominated by indigenous vegetation (**Table 4**). Most of these species are category 1b invaders and should be removed from the study unit (**Table 2**).

Six medicinal species were observed in this study unit (**Table 1**), which needs to be protected from harvesting.

6.4.4 Sensitivity

This study unit is regarded as moderate sensitive, on account of its fairly high indigenous species richness with low abundance of invasive species. The limited connectivity with other grasslands decreases the present ecological status of the Grassland study unit.

Table 4 Species list for Grassland study unit.

Scientific name	Invasive category
<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	1b
<i>Aristida congesta</i> subsp. <i>congesta</i>	
<i>Asparagus larycinus</i>	
<i>Asparagus suaveolens</i>	
<i>Barleria</i> sp.	
<i>Bidens pilosa</i>	
<i>Bidens bipinnata</i>	
<i>Brachiaria nigropedata</i>	
<i>Celtis africana</i>	
<i>Celtis australis</i>	3
<i>Chamaecrista comosa</i>	
<i>Chlorophytum transvaalense</i>	

<i>Commelina africana</i>	
<i>Commelina benghalensis</i>	
<i>Crabbea acaulis</i>	
<i>Cucumis zeyheri</i>	
<i>Cyanotis speciosa</i>	
<i>Cymbopogon caesius</i>	
<i>Cynodon dactylon</i>	
<i>Delsoperma herbeum</i>	
<i>Dichrostachys cinerea</i> subsp. <i>africana</i> *	
<i>Dicoma anomala</i>	
<i>Diheteropogon amplexans</i> var. <i>amplexans</i>	
<i>Diospyros lycioides</i> subsp. <i>lycioides</i>	
<i>Elephantorrhiza elephantina</i> *	
<i>Eragrostis chloromelas</i>	
<i>Eragrostis curvula</i>	
<i>Eragrostis lehmanniana</i>	
<i>Eragrostis nindensis</i>	
<i>Eriosema salignum</i>	
<i>Eucalyptus camaldulensis</i>	1b
<i>Felicia muricata</i>	
<i>Gazania krebsiana</i>	
<i>Gladiolus crassifolius</i>	
<i>Gymnosporia buxifolia</i>	
<i>Helichrysum nudifolium</i> var. <i>nudifolium</i> *	
<i>Helichrysum rugulosum</i>	
<i>Hermannia depressa</i>	
<i>Heteropogon contortus</i>	
<i>Hibiscus trionum</i>	
<i>Hilliardiella oligocephala</i> *	
<i>Hyparrhenia hirta</i>	
<i>Hypoxis hemerocallidea</i> *	
<i>Hypoxis rigidula</i>	
<i>Ipomoea purpurea</i>	1b
<i>Kohautia caespitosa</i>	
<i>Ledebouria ovatifolia</i>	
<i>Ledebouria revoluta</i>	
<i>Macledium zeyheri</i>	
<i>Melia azedarach</i>	1b
<i>Melinis repens</i>	
<i>Mirabilis jalapa</i>	1b
<i>Nidorella</i> sp.	
<i>Panicum coloratum</i>	
<i>Panicum natalense</i>	
<i>Pentanisia angustifolia</i>	
<i>Pogonarthria squarrosa</i>	
<i>Pollichia campestris</i>	
<i>Polygala hottentotta</i>	
<i>Robinia pseudoacacia</i>	1b
<i>Scabiosa columbaria</i> *	
<i>Schizachyrium sanguineum</i>	
<i>Searsia pyroides</i>	

Seriphium plumosum
Setaria sphacelata var. *sphacelata*
Solanum panduriforme
Sphenostylis angustifolia
Striga asiatica
Tagetes minuta
Tephrosia capensis var. *capensis*
Tephrosia elongate var. *elongata*
Themeda triandra
Trichoneura grandiglumis
Triumfetta sonderi
Urochloa panicoides
Ziziphus zeyheriana



Figure 3 Grassland dominated by *Eragrostis* spp.

6.5 Drainage Line

6.5.1 Composition & Connectivity

The Drainage Line study unit is a tributary of the Jukskei River. The current ecological status of this unit is degraded and dominated by alien species such as *Acacia mearnsii*, *Arundo*

donax, *Melia azedarach*, *Morus alba*, *Salix babylonica*, *Sesbanania punicea* and *Verbena bonariensis* (**Table 6**). The majority of these alien species are Invasive Category 1b species. Several patches in the Drainage Line is dominated by indigenous species such as *Typha capensis* (**Figure 4**) and *Phragmites australis*. Connectivity of this Drainage Line system remains intact and forms part of the Jukskei River system. It is mandatory that the Drainage Line remain connected as it provides a passage for movement of flora species.

Table 5 Number of species recorded in each growth form

GROWTH FORM	TOTAL NUMBER OF SPECIES
Shrub/Tree	9
Grass/Sedge	12
Forb	22

6.5.2 Red & Orange List species

This study unit provides possible suitable habitats for the Red List species *Gunnera perpensa* (**Annexure A**). One Orange List species, *Hypoxis hemerocallidea* was found in abundance.

6.5.3. Medicinal & Alien species

Four medicinal species were observed in the Drainage Line study unit (**Table 6**). This area is degraded and dominated by approximately 12 alien invasive species, which were high in abundance (**Table 1**).

6.5.4 Sensitivity

The Drainage Line is deemed moderate ecological sensitive as it is dominated by alien invasive species. The connectivity with the Jukskei River remains good and needs to be maintained.

Table 6 Species list for the Drainage Line.

Scientific name	Invasive category
<i>Acacia mearnsii</i>	2
<i>Amaranthus spinosus</i>	
<i>Andropogon schirensis</i>	
<i>Arundo donax</i>	1b
<i>Asparagus larycinus</i>	
<i>Barleria</i> sp.	
<i>Berkheya radula</i>	

<i>Bidens pilosa</i>	
<i>Celtis africana</i>	
<i>Cleome maculata</i>	
<i>Cynodon dactylon</i>	
<i>Cyperus cf. eragrostis</i>	
<i>Diospyros lycioides</i> subsp. <i>lycioides</i>	
<i>Eragrostis curvula</i>	
<i>Helichrysum nudifolium</i> var. <i>nudifolium</i> *	
<i>Hilliardiella oligocephala</i> *	
<i>Hyparrhenia hirta</i>	
<i>Hypericum aethiopicum</i>	
<i>Hypoxis hemerocallidea</i> *	
<i>Hypoxis rigidula</i>	
<i>Ipomoea purpurea</i>	1b
<i>Melia azedarach</i>	1b
<i>Morus alba</i>	3
<i>Oxalis depressa</i>	
<i>Paspalum urvillei</i>	
<i>Persicaria decipiens</i>	
<i>Persicaria lapathifolia</i>	
<i>Phragmites australis</i>	
<i>Polygala hottentotta</i>	
<i>Salix babylonica</i>	
<i>Schoenoplectus</i> sp.	
<i>Searsia pyroides</i>	
<i>Seriphium plumosum</i>	
<i>Sesbania punicea</i>	1b
<i>Setaria sphacelata</i> var. <i>torta</i>	
<i>Setaria pumila</i>	
<i>Solanum mauritianum</i>	1b
<i>Solanum panduriforme</i>	
<i>Striga asiatica</i>	
<i>Themeda triandra</i>	
<i>Typha capensis</i> *	
<i>Verbena bonariensis</i>	1b
<i>Wahlenbergia undulata</i>	



Figure 4 Section of the Drainage Line dominated by the medicinal species *Typha capensis*.

7. FINDINGS AND POTENTIAL IMPLICATIONS

Two study units were identified on the study site which includes Grassland and a Drainage Line cutting through it. The Connectivity of the Grassland is limited as it is surrounded by urban development. The Drainage Line on the other hand remains connected with the Jukskei river system. The Orange List species *Hypoxis hemerocallidea* were recorded in abundance in the study site, therefore the current ecological status of the study site is deemed to be moderate sensitive (**Figure 5**). Possible relocation of this species needs to be implemented prior to construction.

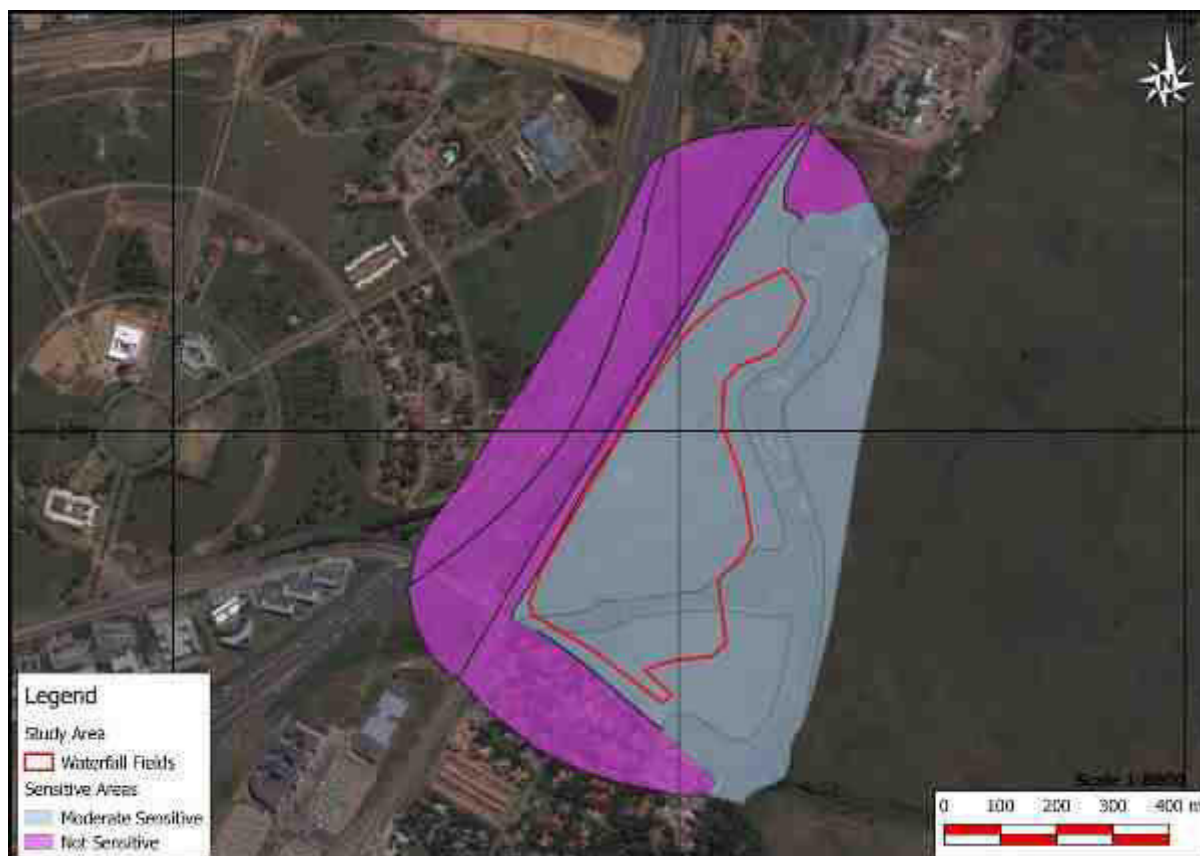


Figure 5 Sensitivity map of study site.

8. DISCUSSION, RECOMMENDATIONS AND MITIGATION IMPLICATIONS

Competent and appropriate management authority should be appointed to implement the Ecological Management Plan (EMP) and Environmental Impact Assessment (EIA) conditions throughout all phases of development, including the operational phase. The EMP should comply with the *Minimum Requirements for Ecological Management Plans* according to GDARD. The EMP and EIA should take into account all recommendations and mitigation measures as outlined by all Flora assessments conducted for the EIA process. The following recommendations and mitigation measures are proposed:

- The attached sensitivity map should be used as a decision tool to guide the layout design (**Figure 5**).
- A pre- and post-construction alien invasive control, monitoring and eradication programme must be implemented along with an on-going programme to ensure persistence of indigenous species. A qualified botanist/ecologist should compile and supervise the implementation of this programme.

- Construction activities at or close to wetlands, drainage lines and water bodies should be limited.
- Engineering measures are recommended to lower the risk of spillages into any wetlands located within 200m of the proposed development.
- A plan for the immediate rehabilitation of damage caused to wetlands should be compiled by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science. This rehabilitation plan should form part of the EMP and a record book should be maintained on site to monitor and report on the implementation of the plan.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Where active rehabilitation or restoration is mandatory, it should make use of indigenous plant species native to the study area. The species selected should strive to represent habitat types typical of the ecological landscape prior to construction. As far as possible, indigenous plants naturally growing within the vicinity of the study area, but would otherwise be destroyed during construction, should be used for re-vegetation/landscaping purposes.
- Only plant species that are indigenous to the natural vegetation of the study site should be used for landscaping in communal areas. As far as possible, plants naturally growing on the development site, but would otherwise be destroyed during clearing for development purposes, should be incorporated into landscaped areas. Forage and host plants required by pollinators should also be planted in landscaped areas.
- In order to minimize artificially generated surface storm-water runoff, total sealing of paved areas such as parking lots, driveways, pavements and walkways should be avoided. Permeable material should rather be utilized for these purposes.
- Competent hydrologist needs to delineate the Drainage Line Vegetation study unit and construct the necessary buffer zones around the water bodies.
- Engineering measures are recommended to lower the risk of spillages into any wetlands located within 200m of the pipeline on site.

9. CONCLUSIONS

The relevant buffer zones should be applied to the water bodies that might be affected by the development, which should be considered part of the sensitivity map. A rehabilitation

plan needs to be incorporated into the development plan for the whole study site as the Drainage Line is degraded and dominated by alien species and the Grassland is threatened by urban development. These areas should be properly managed throughout the lifespan of the project to ensure continuous biodiversity. All exotic species in the study site, especially in Category 1 and 2 must be eradicated as a matter of urgency to preclude their spreading during the construction phase.

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Annexure A: Red Data Flora (confidential)

The following Red Data floral species are listed for the QDC 2628AA. An indication is also provided if the species was recorded on site.

SPECIES	FLOWERING SEASON	SUITABLE HABITAT	CRITERIA	CATAGORY (¹ global; ² national)	OBSERVED
<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	September-January	Rock crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in shade of other vegetation.	A2	Near Threatened ¹	No suitable habitat
<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	September-April	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	B	Vulnerable ²	No suitable habitat
<i>Callilepis leptophylla</i>	August-January & May	Grassland or open woodland, often on rocky outcrops or rocky hillslopes.	N/A	Declining ²	No suitable habitat

<i>Cineraria austrotransvaalensis</i>	March-June	Amongst rocks on steep slopes of hills and ridges, as well as at the edge of thick bush or under trees; on all aspects and on a range of rock types: quartzite, dolomite and shale; 1400 – 1700 m.	A3	Near Threatened ¹	No suitable habitat
<i>Cineraria longipes</i>	March-May	Grassland, on koppies, amongst rocks and along seepage lines, exclusively on basalt on south-facing slopes.	A1	Vulnerable ¹	No suitable habitat
<i>Delosperma purpureum</i>	November-April	South facing slopes, grows in shallow soils among quartzitic rocks of crystalline or conglomerate type, in open or in broken shade, rarely in shade, in grassland with some trees.	A1	Endangered ¹	No suitable habitat
<i>Eucomis autumnalis</i>	November-April	Damp, open grassland and sheltered places.	N/A	Declining ²	No suitable habitat
<i>Gunnera perpensa</i>	October-March	In cold or cool, continually moist localities, mainly along upland streambanks.	N/A	Declining ²	Suitable habitat
<i>Habenaria bicolor</i>	January-April	Well-drained grasslands at around 1600m.	B	Near Threatened ²	No suitable habitat

<i>Habenaria mossii</i>	March-April	Open grassland on dolomite or in black sandy soil.	A1	Endangered ¹	No suitable habitat
<i>Holothrix micrantha</i>	October	Terrestrial on grassy cliffs, recorded from 1500 to 1800m.	A1	Endangered ¹	No suitable habitat
<i>Holothrix randii</i>	September-October	Grassy slopes and rock ledges, usually southern aspects.	B	Near Threatened ²	No suitable habitat
<i>Hypoxis hemerocallidea</i>	September-March	Occurs in a wide range of habitats, from sandy hills on the margins of dune forests to open rocky grassland, also grows on dry, stony, grassy slopes, mountain slopes and plateaux; appears to be drought and fire tolerant.	N/A	Declining ²	No suitable habitat
<i>Khadia beswickii</i>	July-April	Open areas on shallow surfaces over rocks in grassland.	A1	Vulnerable ¹	No suitable habitat
<i>Stenostelma umbelluliferum</i>	September-March	Deep black turf in open woodland mainly in the vicinity of drainage lines.	A3	Near Threatened ¹	No suitable habitat

APPENDIX G3: FAUNA ASSESSMENT

Fauna Habitat Assessment for the remainder of portion 1 of the farm Waterval 5- IR, Midrand, Gauteng Province



May 2016



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Declaration of independence:

The specialist investigators responsible for conducting this particular specialist vegetation study declare that:

- We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report we did not have any interest, hidden or otherwise, in the proposed development, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, we will not be affected in any manner by the outcome of any environmental process of which this report may form a part;
- We declare that there are no circumstances that may compromise our objectivity in performing this specialist investigation. We do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- We do not have any influence over decisions made by the governing authorities;
- We have the necessary qualifications and guidance from professional experts (registered Pr. Nat. Sci.) in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Bokamoso Environmental: Specialist Division. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- We will comply with the Act, regulations and all other applicable legislation;



S.E. van Rooyen



CW Vermeulen



MI Cooper

Review of

Fauna Habitat Assessment for the remaining extent of Portion 1 of the Farm Waterfall 5-IR, Gauteng Province of April 2016

Review: May 2016

Reviewer: Reinier F. Terblanche

(M.Sc, *Cum Laude*; Pr.Sci.Nat, Reg. No. 400244/05)

APPROACH OF REVIEWER TO ECOLOGICAL REVIEWS

Ecological studies and applied ecology comprise the consideration of a diversity of factors, even more so in South Africa with its exceptional high floral and faunal diversities, various soil types, geological formations and diversity of habitats in all its biomes. Therefore it would be easy to add onto or show gaps in any ecological impact assessment, rehabilitation actions or management plans stemming from ecological assessments. The approach followed here is to review the ecological study in a reasonable context and focus on the successful fulfillment of the aims of the study within the limits of cost and time.

**ECOLOGICAL REVIEW: FAUNA HABITAT ASSESSMENT FOR THE REMAINING
EXTENT OF PORTION 1 OF THE FARM WATERFALL 5-IR, GAUTENG PROVINCE
OF APRIL 2016**

Findings of the review

- The report contains details of the expertise of the persons who prepared the report and a declaration that the person who prepared the report is acting independently.
- The aims of the report are clear.
- The report provides references and descriptions of the principles and guidelines to be taken into account for fauna habitat assessment.
- Acceptable methods and limitations have been given in detail to reach the goal of the assessment.
- Relevant laws and guidelines have been mentioned and integrated.
- The report gives a clear assessment of the status fauna at the site and also added an extensive literature survey and existing knowledge survey.
- The recommendations and the conclusion are consistent with the aims of the report.
- It is to be commended that the report is economical and practical so that it adds value to the team effort of addressing the management and future of the habitats at the site..

Overall the report appears to be relevant, detailed enough for the purposes of this study and complete and finally addressing the key issues at stake.



Reinier F. Terblanche M.Sc. Ecology; Pr.Sci.Nat, Reg. No. 400244/05

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1. INTRODUCTION

Bokamoso Environmental Consultants CC: Specialist Division was appointed to conduct a Basic Faunal Assessment for the proposed residential development on the remaining extent of Portion 1 of the Farm Waterfall 5-IR, Gauteng Province, also known as Kikuyu (hereafter referred to as the study area).

This report is based on the faunal species present on the study area as well as species that could potentially occur. The report acts as an overview of the probable and/or known occurrence for following faunal groups; Mammals, Reptiles, Amphibians and Invertebrates. Avifauna is not included in this report, as a separate avifaunal assessment was conducted for the study area. The primary focus of this report falls on threatened species and other species with conservation importance occurring on or near the study area to ensure that, should any such species be using the study area as particular habitat, the appropriate actions are taken to guarantee the well-being of these species.

2. SCOPE AND OBJECTIVE OF ASSESSMENT

- To qualitatively and quantitatively assess the significance of the habitat components and current general conservation status of the property
- Comment on ecological sensitive areas within the study area
- Comment on connectivity with natural vegetation and homogeneous habitats surrounding the study area
- To provide a list of faunal species which occur or might occur, and to identify species of conservation importance
- To highlight potential impacts of the proposed development on the fauna judge to be present on the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

The study site lies within the Quarter Degree Square (QDS) 2628AA, which according to Mucina and Rutherford (2006) forms part of the Egoli Granite Grassland, declared as Endangered (Government Gazette no. 34809, 2011). Less than 3 % of the targeted 24 % of the Egoli Granite Grassland is conserved in several nature reserves. The authors described the landscape of the Egoli Granite Grassland as low hills and moderately undulating plains, which support tall grass species such as *Hyparrhenia hirta*, dominating the area. Scattered rocky outcrops and rock sheets form suitable habitats for several important fauna species (Mucina and Rutherford, 2006).

The site for the proposed development of a Megawatt generator on the remainder of Portion 1 of the Farm Waterval 5 IR and part of the remainder of the Farm Waterval 38 IR, Midrand is situated along the eastern section of Pretoria Main Road and north of Sandra Ave in Midrand (**Figure 1**). The study site is about 16 ha in size. This study site consist large grassland area with a drainage line cutting through it from west to east (**Figure 2**).

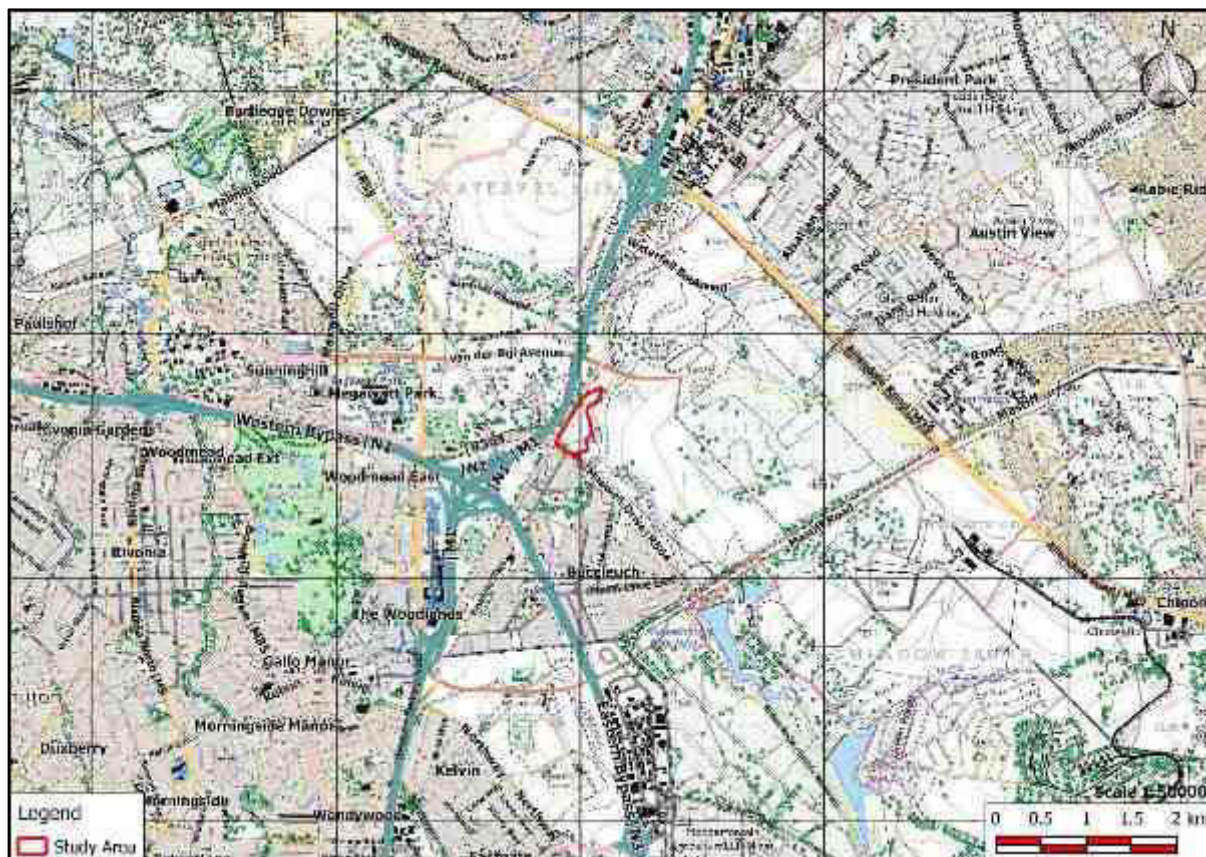


Figure 1: Locality Map



Figure 2: Aerial photo of study area

4. METHODS

Before conducting a field survey on the study area a desktop assessment was conducted to note the prevalent faunal species occurring on or near the site. A list of expected species was compiled and used as a reference during the field survey to ensure that species that should theoretically occur were not overlooked. All distinct faunal habitats were identified on site, after which each habitat was assessed to record the associated faunal species for each of the respective faunal group (Herpetofauna, Invertebrates and Mammals) present in that specific habitat.

5. RESULTS

During the habitat assessment two distinct habitats were identified in the study site. These habitats include: Grassland and Drainage Line (**Figure 3**).

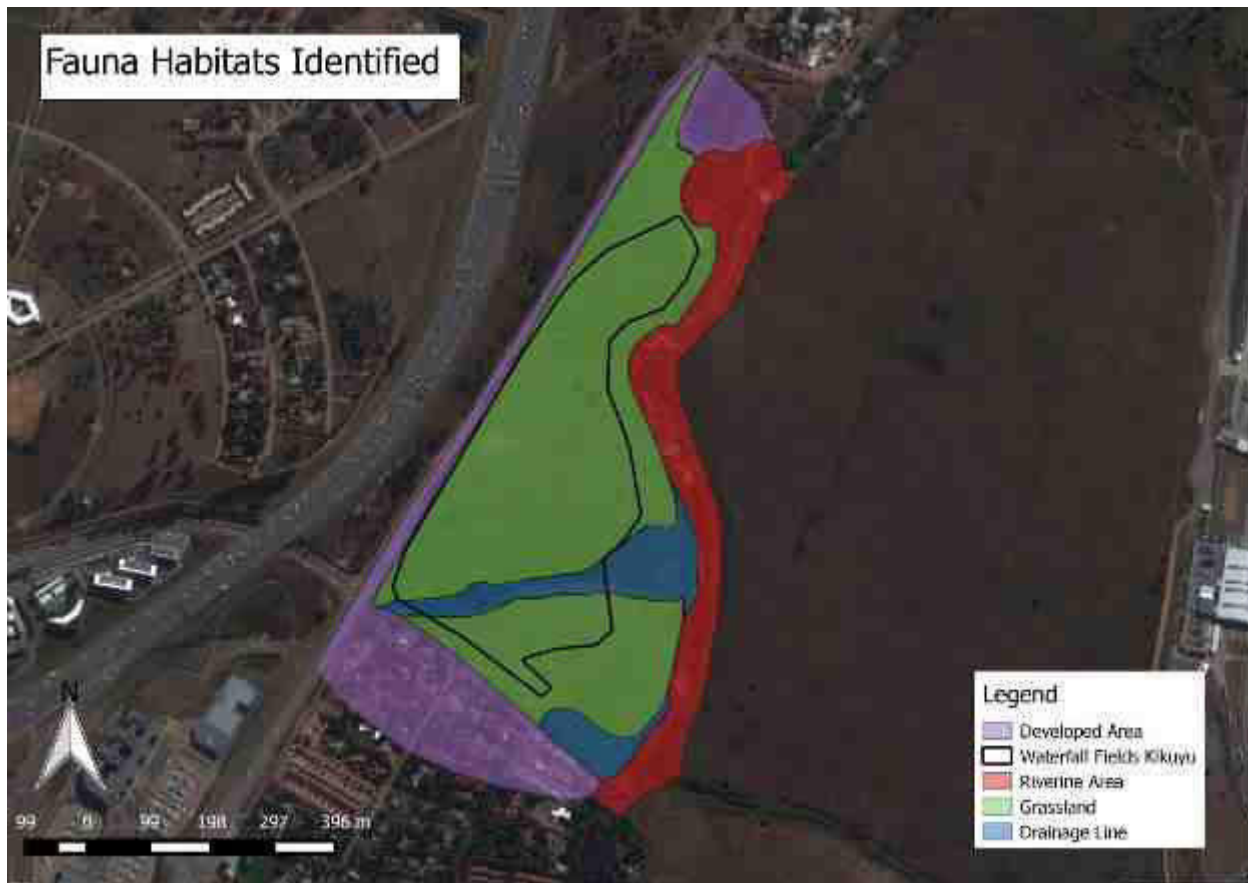


Figure 3: Different habitats in the study area

5.1 Grassland

The Grassland habitat contains several dominant Highveld graminoid species including *Eragrostis* spp., *Schizachyrium sanguineum*, *Heteropogon contortus* and *Hyparrhenia hirta* (**Figure 4**). Few scattered tree/shrub species were also observed in the grassland, which includes *Searsia pyroides* and the alien species *Robinia pseudoacacia* (**Figure 4**). The connective function between the aforementioned grassland and homogenous grasslands remains intact, providing a suitable passage for the movement of fauna species. As a result of the current, natural status of the aforementioned grassland habitat, it is deemed moderate sensitive from a faunal perspective, as it creates suitable habitats for several fauna species. Connectivity of the Grassland habitat unit with surrounding homogenous grassland habitats is mandatory to ensure sustainable demographic patterns of the fauna species relying on this habitat for survival.



Figure 4: Grassland habitat

5.2 Drainage Line

A drainage line cuts through the center of the study site from the west to the east as it joins the Jukskei River. The current ecological status of this unit is degraded and dominated by alien plant species such as *Acacia mearnsii*, *Arundo donax*, *Melia azedarach*, *Morus alba*, *Salix babylonica*, *Sesbania punicea* and *Verbena bonariensis*. Some indigenous wetland plant species such as *Typha capensis* and *Phragmites australis* (**Figure 5**) encompasses the ideal habitat for the majority of wetland-associated fauna species. Although this drainage line habitat is degraded, it remains connected to the Jukskei River, which increases the occurrence probability of locating Threatened or Red List fauna species utilizing this habitat.

On account of the aforementioned aspects involved with this drainage line, the majority of this habitat is deemed to be sensitive. Connectivity of the Drainage Line habitat unit with surrounding homogenous wetland habitats is mandatory to ensure sustainable demographic patterns of the fauna species relying on this habitat for survival.



Figure 5: Drainage Line

5.3 Riverine Area

The eastern part of the study area borders the Jukskei River (**Figure 6**). Due to large number of faunal species preferring this unique habitat type, the riverine area was expected to produce the highest species richness in comparison with the other habitats in the study area. The state of the riverine habitat is however degraded on account of the high amount of alien vegetation encroachment as well as some pollution of the water (both chemical and solid waste) (**Figure 6**). The low species richness of this habitat is a direct result of the polluted river. While the riverine area provides the optimal habitat for a few Red-Data faunal species, the polluted state of the river compromises the probable occurrence of these species. If this section of the river is to be properly rehabilitated it could potentially be a highly diverse habitat and would most probably support a number of sensitive fauna. Due to the afore mentioned reasons this habitat is deemed highly sensitive, not on account of faunal species present in the habitat, but rather as

a result of its connectivity functions with two wetland areas to the north, and the potential that this area holds if proper rehabilitation thereof is implemented.



Figure 6: Riverine Area

6. MAMMAL HABITAT ASSESSMENT

Special attention was paid to the evaluation of the quantitative and qualitative habitat conditions of Red Data species judged to have a probable occurrence on the site. Mitigation measures to lesser the impacts and effects of the proposed development were suggested where applicable. The secondary objective of this investigation was to gauge which mammals might still reside in the study area and to compile a complete list of mammal diversity.

6.1 Methods

A three and a half hour field survey was conducted on the 7th of April 2016 during which all observed mammal species as well as all the potential mammal habitats on the study site were

identified. Following the field survey a desktop assessment was conducted to add additional mammal species expected to occur on the study site on account of their individual habitat preferences in accordance with the habitats identified on the study area. Mammal occurrence probability can be attributed to the well recorded and known distributions of South African mammals as well as the quantitative and qualitative nature of the habitats present on site. Moreover the 500 meters surrounding the study area were scanned for any additional faunal habitats.

Field Survey

Before the commencement of the field survey a list of expected mammal species was compiled to use as a reference in the field. All the threatened and sensitive mammals with distribution ranges overlapping the study area were included in the aforementioned reference list. These species were prioritized and special attention was paid in terms of identifying their associated habitat preferences and noting signs of their occurrence. The field survey was conducted by means of random transect walks in each habitat. During the field survey mammal species were identified in accordance with individual habitat preferences as well as actual observations and signs such as; spoor, droppings, burrows and roosting sites indicating their presence (Stuart & Stuart, 2011).

Desktop Survey

Due to the fact that the majority of mammals are either nocturnal, hibernators, secretive and/or seasonal it is increasingly difficult to confirm their presence or absence by means of actual observations alone. Therefor a number of authoritative tomes such as field guides, databases and scientific literature were utilized to deduce the probable occurrence of mammal species. The Animal Demography Unit: Virtual Museum (<http://vmus.adu.org.za/>) was consulted to verify the records and occurrence of recorded mammal species in the QDS 2628AA. The Gauteng Conservation Plan (C-plan v3.3) was consulted to evaluate ecologically sensitive areas associated with mammals. A comprehensive list of probable mammalian occurrence with reference to the study area was compiled on account of the well-known and documented distributions of mammals in South Africa, especially in the Gauteng province.

The occurrence probability of mammal species was deduced in accordance with a species' distribution and habitat preferences. Where a species' distribution range was found to overlap with the study area and its preferred habitat was present, the applicable species was deemed to have a high occurrence probability on or near the study area.

In the case where the preferred habitat of a species' were found to be suboptimal on the study area however its distribution range still overlapped the study area, the applicable species' occurrence probability was deemed to be medium.

When the habitat preferences of a species were absent from the site, the applicable species were deemed to have a low occurrence probability regardless of its distribution range.

6.2 Specific Requirements

During the field survey attention was paid to note any signs of potential occurrence of threatened and sensitive species as well as species associated with wetlands (GDARD, 2014).

These species include:

Vlei rat (*Otomys irroratus*), Angoni vlei rat (*Otomys angoniensis*), African march rat (*Dasymys incomtus*), Water mongoose (*Atilax paludinosus*), Spotted-necked otter (*Hydrictis maculicollis*), southern African hedgehog (*Atelerix frontalis*), Woodland Dormouse (*Graphiurus murinus*), White-tailed rat (*Mystromys albicaudatus*), and several bat species including Blasius's/Peak-Saddle Horseshoe Bat (*Rhinolophus blasii*), Darling's Horseshoe Bat (*Rhinolophus darlingi*), Geffroy's Horseshoe Bat (*Rhinolophus clivosus*), Hildebrandt's Horseshoe Bat (*Rhinolophus hildebrandtii*), Scheiber's Long-Fingered Bat (*Miniopterus schreibersii*) and Temminck's Hairy Bat (*Myotis tricolor*).

Mammal species listed according to IUCN as Near Threatened: Southern African Hedgehog (*Atelerix frontalis*), Spotted-Necked Otter (*Hydrictis maculicollis*), Highveld Golden Mole (*Amblysomus septentrionalis*), Cape Clawless Otter (*Aonyx capensis*), Schreiber's Long-Fingered Bat (*Miniopterus schreibersii*), Temminck's Hairy Bat (*Myotis tricolor*), Horseshoe Bat (*Rhinolophus clivosus*), Darling's Horseshoe Bat (*Rhinolophus darlingi*) and Hildebrandt's Horseshoe Bat (*Rhinolophus hildebrandtii*).

6.3 Results

6.3.1 Mammal habitats identified

During the habitat assessment three distinct mammalian habitats were identified in the study area. These habitats include: Drainage Area, Riverine Area and Grassland (**Figure 3**).

The grassland habitat provides excellent habitat for smaller rodents and insectivorous mammals such as shrews, Slender Mongoose (*Galerella sanguineus*), Marsh Mongoose (*Atilax*

paludinosus), Scrub Hare (*Lepus saxatilis*), Four-striped grass mouse (*Rhabdomys pumilio*) and Common Genet (*Genetta genetta*). Although excellent connectivity is maintained to the east of the grassland few robust terrestrial mammals such as Common Duiker (*Sylvicapra grimmia*) or Steenbok (*Raphicerus campestris*) are expected to occur in the grassland habitat as urban activities threaten and disturb the mammal biodiversity that flourish in this grassland. The occurrence probability of nomadic mammal species such as the African Hedgehog is unlikely on account of the aforementioned factors disturbing this grassland habitat.

The Drainage Line habitat unit is degraded as it experiences some encroachment of alien species, but indigenous vegetation dominates some areas in this Drainage Line. Connectivity of this Drainage Line remains intact as it forms a tributary of the Jukskei River to the east. No major disturbances were observed which could alter or hinder mammal movement through this wet system. On account of the aforementioned habitat characteristics, a number of mammal species can be expected to occur such as Marsh Mongoose (*Atilax paludinosus*) and Vlei Rats (*Otomys* sp.). As a result of the seasonal nature of the Drainage Line and the fact that no perennial streams transect the study area, the occurrence probability of Otter species is fairly low. The entire Drainage Line area was scoured for signs of otter presence but no such signs were observed. The Drainage Line habitat was deemed to be moderately sensitive on account of the foraging opportunities that it provides for mammalian species with conservation concerns. Although The Drainage Line is judged to provide foraging opportunities for species with conservation concerns, none are anticipated to be resident in this habitat.

The riverine area was found to be polluted with both solid and chemical waste (**Figure 6**). The entire riverbank was scoured for signs of otter presence but no such signs were observed. This could be as a result of the lack of their primary food source (fish and crabs) on account of the polluted state of the Jukskei River (Sibali *et al.*, 2008). The associated riparian vegetation mainly consists of large alien trees with a dense undergrowth of invasive weeds. No threatened mammals can be expected to occur in this habitat. The riverine area was deemed to be highly sensitive in terms of a mammalian habitat due to its potential to provide the preferred habitat for threatened mammals, one of which is the Spotted-necked Otter. Although no Red Data species were found to be present in this habitat, the river still provides the necessary connectivity for species such as otters to move from one stretch of the river to another. As a result of the important connectivity function, the entire riverine habitat was deemed to be highly sensitive despite its polluted state.

6.3.2 Expected and observed Mammal species

Table 1: Mammals observed or expected to occur. Red List Category as defined by Friedmann and Daly (2004): S.A. Red Data Book of the mammals of South Africa.

	Scientific Name	Common Name	Red List Category	Occurrence Probability
1.	<i>Aethomys ineptus</i>	Tete Veld Rat	Least Concern	2
2.	<i>Aethomys namaquensis</i>	Namaqua rock mouse	Least Concern	3
3.	<i>Atilax paludinosus</i>	Marsh Mongoose	Least Concern	5
4.	<i>Civettictis civetta</i>	African Civet	Least Concern	1
5.	<i>Crocidura cyanea</i>	Reddish-grey musk shrew	Data Deficient	3
6.	<i>Crocidura hirta</i>	Lesser musk shrew	Data Deficient	3
7.	<i>Cryptomys hottentotus</i>	Common African Mole-rat	Not listed	5
8.	<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern	5
9.	<i>Dendromus melanotis</i>	Grey pygmy climbing mouse	Least Concern	3
10.	<i>Dendromus mystacalis</i>	Chestnut climbing mouse	Least Concern	3
11.	<i>Epomophorus wahlbergi</i>	Wahlberg's Epauletted Fruit-bat	Least Concern	2
12.	<i>Galago moholi</i>	Southern Lesser Bushbaby	Not listed	2
13.	<i>Galerella sanguineus</i>	Slender Mongoose	Least Concern	5
14.	<i>Genetta genetta</i>	Common Genet	Least Concern	3
15.	<i>Genetta tigrina</i>	Cape Genet	Least Concern	2
16.	<i>Gerbilliscus brantsii</i>	Highveld Gerbil	Least Concern	3
17.	<i>Hystrix africaeaustralis</i>	Cape Porcupine	Least Concern	3
18.	<i>Lepus saxatilis</i>	Scrub Hare	Least Concern	5
19.	<i>Mastomys coucha</i>	Southern Multimammate Mouse	Least Concern	3
20.	<i>Mastomys natalensis</i>	Natal multimammate mouse	Least Concern	3
21.	<i>Mus minutoides</i>	Pygmy mouse	Least Concern	3
22.	<i>Neoromicia capensis</i>	Cape serotine bat	Least Concern	4
23.	<i>Neoromicia capensis</i>	Cape Serotine	Least Concern	2
24.	<i>Otomys angoniensis</i>	Angoni vlei rat	Least Concern	3
25.	<i>Otomys auratus</i>	Southern African Vlei Rat	Not listed	3
26.	<i>Pipistrellus rusticus</i>	Rusty Pipistrelle	Near Threatened	2
27.	<i>Procavia capensis</i>	Rock Hyrax	Least Concern	1
28.	<i>Raphicerus campestris</i>	Steenbok	Least Concern	3
29.	<i>Rhabdomys pumilio</i>	Four-striped grass mouse	Least Concern	4
30.	<i>Scotophilus dinganii</i>	African Yellow house bat	Least Concern	4
31.	<i>Scotophilus viridis</i>	Greenish yellow house bat	Least Concern	3
32.	<i>Steatomys pratensis</i>	Common African Fat Mouse	Least Concern	3
33.	<i>Sylvicapra grimmia</i>	Common Duiker	Least Concern	2
34.	<i>Thryonomys swinderianus</i>	Greater Cane Rat	Least Concern	4

*The occurrence probability of the mammal species listed above is indicated as follows:

1 - Not likely to occur; 2 - Low occurrence probability; 3 - Medium occurrence probability; 4 - High occurrence probability; 5 - Confirmed occurrence.

6.3.3 Threatened and Red Listed Mammal species

The listed shrews (**Table 1**) are not necessarily threatened; they are listed as a precautionary measure as a result of their unknown status. Musk shrews are widespread and commonly found in residential gardens throughout Gauteng, as such they are generally assumed to be abundant. The conservation status of musk shrews are however still to be determined and as such they are listed as Data Deficient. Vlei Rats are considered to be sensitive due to their intolerance to drought and their association with wetlands. Their reliance on wetlands serves as the main reason for their sensitive status.

Suitable habitat for otters were found on the study area at the eastern boundary where the Jukskei River borders the property. Although the preferred habitat for otters is present in the study area, this specific stretch of the Jukskei River was found to be polluted with both solid and chemical waste. During the field survey no sign of otter activity was observed. As a result of the polluted state of the river, the otter's food source are thought to be scarce or possibly absent, thus its occurrence in this section of the river was deemed to be unlikely. Although the probable occurrence of otters is low, the river still provides a connectivity function and as such otters might move through this stretch of the river from time to time.

No suitable bat roosts were observed on the study site, thus it is not expected that any of the threatened bat species are resident, although the area might still be utilized by bats for foraging purposes.

No other threatened or sensitive mammal species are thought to be present within the study area due to various factors such as man-made disturbances, transformed habitats, suboptimal habitat and restricted distribution ranges.

6.4 Findings

The majority of the terrestrial habitats present on the study area have not been altered with minimal degradation, which could still be regarded as part of the Egoli Granite Grassland vegetation unit (Mucina and Rutherford, 2006). The current terrestrial habitats do however provide some habitat for the small mammals deduced to be present. On account of the assemblage of mammals as well as the present terrestrial habitats, no evidence exists to consider the study area to be highly sensitive for mammal species.

The Drainage Line and Riverine area have the potential to support sensitive species with conservation concerns (Vlei Rats and Otters). On the other hand, -none of these species are

thought to occur at present, on account of the polluted and degraded state of these habitats. No Roosting or nesting areas of mammalian species in The Drainage Line is expected to occur, thus this area will only be utilized as a foraging resource. On account of the aforementioned factors, this Drainage Line is deemed to have a moderate sensitivity status from a mammalian perspective. The Riverine area provides important ecological functions in terms of connectivity, as such it is considered to be highly sensitive from a mammalian point of view regardless of the current state.

7. HERPETOFAUNA HABITAT ASESMENT

7.1 Methods

The study site was visited on 7th of April 2016. Adequate amount of random transect walks in the study site was attempted to identify herpetofauna species. Habitat types identified within the study site was recorded, and a combined species list was compiled of the possible presence of herpetofauna species, considering the knowledge of their preferred habitats. Species were identified using the following field guides: for amphibians (Du Preez & Carruthers, 2009) and for reptilia (Marais, 2004; Alexander & Marais, 2007).

A desktop study was conducted to identify suitable habitats for the Red List herpetofauna species known to occur in the QDS 2628AA. The Animal Demography Unit: Virtual Museum (<http://vmus.adu.org.za/>) was consulted to verify the record of occurrence of herpetofauna species recorded within the QDS. The Gauteng Conservation Plan (C-plan v3.3) was consulted to evaluate ecologically sensitive areas.

The majority of herpetofauna species are nocturnal, poikilothermic secretive and seasonal, which makes it difficult to observe them during field surveys. In this case the presence of herpetofauna species was examined on account of habitat preferences of selected species and respective documented ranges.

7.2 Specific Requirements

During the survey the site was surveyed and assessed for the potential occurrence of Red List and/or and wetland associated herpetofauna species. No amphibians are listed according to GDARD (2014). Reptilia species listed (Bates *et al.*, 2014; GDARD, 2014): Striped Harlequin Snake (*Homoroselaps dorsalis*) and Coppery Grass Lizard (*Chaemaesaura aenea*) as 'Near Threatened'.

7.3 Results

7.3.1 Herpetofauna habitats identified

The grassland, with no conspicuous standing or flowing water bodies in the study site, forms part of the terrestrial systems with ecological niche for both amphibians and reptiles (Du preez & Carruthers, 2009). The Riverine and Wetland and drainage line systems provide a permanent flow of water in a natural channel, which forms a micro-habitat for various amphibians (**Table 2**).

7.3.2 Expected and observed Herpetofauna species

Based on the impressions gathered during the site visit and records from the “*Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland*” (Minter *et al.*, 2004), “*Ensuring a future for South Africa’s frogs: a strategy for conservation research*” (Measey 2011), “*Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland*” (Bates *et al.*, 2014) and the databases *FrogMAP* (continuation of the Southern African Frog Atlas Project) and *ReptileMAP* (the continuation of the Southern African Reptile Conservation Assessment), the following list of species which may occur on this site was compiled. No amphibians or reptiles were observed during the survey. Eleven amphibian species and 26 reptile species are expected to occur in and around the study area (**Tables 2 and 3**).

Table 2: Amphibian species expected to occur in and around the study area. The conservation status of each species was obtained from Minter *et al.* (2004).

Family name	Species name	Common name	Conservation status	Occurrence
BUFONIDAE	<i>Schismaderma carens</i>	Red Toad	Least Concern	4
BUFONIDAE	<i>Sclerophrys capensis</i>	Raucous Toad	Least Concern	3
BUFONIDAE	<i>Sclerophrys gutturalis</i>	Guttural Toad	Least Concern	4
HYPEROLIIDAE	<i>Kassina senegalensis</i>	Bubbling Kassina	Least Concern	4
HYPEROLIIDAE	<i>Hyperolius marmoratus</i>	Painted Reed Frog	Least Concern	4
PIPIDAE	<i>Xenopus laevis</i>	Common Platanna	Least Concern	4
PYXICEPHALIDAE	<i>Amietia fuscigula</i>	Cape River Frog	Least Concern	3
PYXICEPHALIDAE	<i>Amietia queketti</i>	Quekett's River Frog	Least Concern	4
PYXICEPHALIDAE	<i>Cacosternum boettgeri</i>	Common Caco	Least Concern	4
PYXICEPHALIDAE	<i>Pyxicephalus adspersus</i>	Giant Bull Frog	Least Concern	1
PYXICEPHALIDAE	<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	Least Concern	4
PYXICEPHALIDAE	<i>Tomopterna natalensis</i>	Natal Sand Frog	Least Concern	3

*The occurrence probability of the amphibian species listed above is indicated as follows:

1 - Not likely to occur; 2 - Low occurrence probability; 3 - Medium occurrence probability; 4 - High occurrence probability; 5 - Confirmed occurrence.

Table 3: Reptile species observed and/or deducted to occur in QDS 2628AA. Bates et al. (2014) was used for the conservation status of each species.

Family name	Species name	Common name	Conservation status	Occurrence
AGAMIDAE	<i>Agama aculeata</i> subsp. <i>distanti</i>	Distant's Ground Agama	Least Concern	4
AGAMIDAE	<i>Agama atra</i>	Southern Rock Agama	Least Concern	2
CHAMAELEONIDAE	<i>Bradypodion ventrale</i>	Eastern Cape Dwarf Chameleon	Least Concern	2
COLUBRIDAE	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	Least Concern	4
COLUBRIDAE	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	Least Concern	4
CORDYLIDAE	<i>Cordylus vittifer</i>	Common Girdled Lizard	Least Concern	3
ELAPIDAE	<i>Hemachatus haemachatus</i>	Rinkhals	Least Concern	4
GEKKONIDAE	<i>Hemidactylus mabouia</i>	Common Tropical House Gecko	Least Concern	2
GEKKONIDAE	<i>Lygodactylus capensis</i>	Common Dwarf Gecko	Least Concern	4
GEKKONIDAE	<i>Pachydactylus affinis</i>	Transvaal Gecko	Least Concern	4
GEKKONIDAE	<i>Pachydactylus capensis</i>	Cape Gecko	Least Concern	4
GERRHOSAURIDAE	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	Least Concern	3
LAMPROPHIIDAE	<i>Aparallactus capensis</i>	Black-headed Centipede-eater	Least Concern	3
LAMPROPHIIDAE	<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	Least Concern	2
LAMPROPHIIDAE	<i>Boaedon capensis</i>	Brown House Snake	Least Concern	4
LAMPROPHIIDAE	<i>Lamprophis aurora</i>	Aurora House Snake	Least Concern	3
LAMPROPHIIDAE	<i>Lycodonormorphus inornatus</i>	Olive House Snake	Least Concern	3
LAMPROPHIIDAE	<i>Lycodonormorphus rufulus</i>	Brown Water Snake	Least Concern	4
LAMPROPHIIDAE	<i>Lycophidion capense</i>	Cape Wolf Snake	Least Concern	3
LAMPROPHIIDAE	<i>Psammophis subtaeniatus</i>	Western Yellow-bellied Sand Snake	Least Concern	3
PELOMEDUSIDAE	<i>Pelomedusa subrufa</i>	Central Marsh Terrapin	Least Concern	1
SCINCIDAE	<i>Trachylepis capensis</i>	Cape Skink	Least Concern	3
SCINCIDAE	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	Least Concern	4
SCINCIDAE	<i>Trachylepis varia</i>	Variable Skink	Least Concern	3
TESTUDINIDAE	<i>Stigmochelys pardalis</i>	Leopard Tortoise	Least Concern	1
TYPHLOPIDAE	<i>Afrotrophlops bibronii</i>	Bibron's Blind Snake	Least Concern	2

*The occurrence probability of the reptile species listed above is indicated as follows:

1 - Not likely to occur; 2 - Low occurrence probability; 3 - Medium occurrence probability; 4 - High occurrence probability; 5 - Confirmed occurrence.

7.3.3 Threatened and Red Listed Herpetofauna species

No threatened herpetofauna species were observed or are expected to occur on the study area.

7.4 Findings

The study area is largely made up of grassland habitat with predominantly natural vegetation. The wetland and drainage line provides the optimal habitat for a number of frog species such as Painted Reed Frog (*Hyperolius marmoratus*), Common Platana (*Xenopus laevis*), Bubbling Kassina (*Kassina senegalensis*) and River Frogs (*Amietia* sp.). The tree species present on site are not particularly preferred by arboreal herpetofauna species as they are predominantly alien species. Logs and leaf litter is confined to the drainage line and riverine habitats were species such as Brown Water Snake (*Lycodonomorphus rufulus*), Red-lipped Snake (*Crotaphopeltis hotamboeia*), Gecko's (*Lygodactylus* sp.) and Toads (*Sclerophrys*) can be expected to occur. Minimal burrows and termite mounds suitable for shelter were observed on site. This site does not support any Red List or threatened herpetological species. It does however provide suitable habitat for a number of widespread herpetological species. The grassland habitat was deemed to have a medium ecological sensitivity whereas the drainage line and riverine area was judged to have a high ecological sensitivity on account of its connectivity function and optimal herpetological habitat it provides.

8. INVERTEBRATE HABITAT ASSESSMENT

8.1 Methods

A species survey was conducted on 7th of April 2016, which consisted of two random walked transects. The dominant invertebrate species and possible suitable habitats for Red List invertebrate species were noted and sampled if necessary. Habitat characteristics for species present were derived from a survey and descriptions given in the field guide by Picker *et al.* (2004). All insects were identified *sensu* Picker *et al.* (2004). Red Listed Butterflies were identified *sensu* Henning *et al.* (2009) and Mecenero *et al.* (2013). Other Red Listed Species were identified using the IUCN conservation status (IUCN, 2015).

A desktop study was done to identify suitable habitats for invertebrate species, especially Red List species known to occur in the QDS 2628AA. The Animal Demography Unit: Virtual Museum (<http://vmus.adu.org.za/>) was consulted to verify the record of occurrence of invertebrate species recorded within the QDS.

Invertebrate species are usually small, poikilothermic, and seasonal, which makes them difficult to observe during field surveys. In this case the presence of invertebrate species was examined on habitat preferred by selected species and respective documented ranges.

8.2 Specific Requirements

The survey took place during the end of the wet season, thus the probability of detecting identifiable life history stages was highest based on their biology.

During the survey the site was surveyed and assessed for the potential occurrence of Red List and/or ridge and wetland associated fauna species. Four invertebrate species, three butterflies and one beetle, are considered Vulnerable in Gauteng (GDARD, 2014): Highveld Blue Butterfly (*Lepidochrysops praeterita*), Heidelberg Copper Butterfly (*Chrysoritis aureus*), Roodepoort Copper Butterfly (*Aloeides dentatis dentatis*) and Stobbia's Fruit Chafer Beetle (*Ichnestoma stobbia*).

8.3 Results

8.3.1 Invertebrate habitats identified

The major habitats of concern in this area are the Drainage Line, Riverine Area and Grassland. Wetland areas provide suitable habitat for many hemi-metabolous invertebrates to complete their life-cycles as they rely on water for breeding and nymphs/juveniles are aquatic.

8.3.2 Expected Invertebrate species

Table 4: Invertebrate species deducted to occur within QDS 2628AA. Red Listed Butterflies were identified sensu. Henning et al. (2009) and Mecenero et al. (2013). Other Red Listed Species were identified using the IUCN conservation status (IUCN, 2015).

Family name	Species name	Common name	Conservation status	occurrence
AGANAIDAE	<i>Asota speciosa</i> subsp. <i>speciosa</i>	Specious Tiger Moth	Not Evaluated	3
ARCTIIDAE	<i>Utetheisa pulchella</i> subsp. <i>pulchella</i>	Crimson-speckled Footman	Not Evaluated	4
BUTHIDAE	<i>Parabuthus transvaalicus</i>		Not listed	4
BUTHIDAE	<i>Pseudolychas ochraceus</i>		Not listed	2
CHRYSOPIDAE	<i>Chrysemosa jeanneli</i>		Not listed	3
CHRYSOPIDAE	<i>Chrysoperla</i> sp.	Green Lacewings	Not listed	3
CHRYSOPIDAE	<i>Dysochrysa furcata</i>		Not listed	3
COENAGRIONIDAE	<i>Africallagma glaucum</i>	Swamp Bluet	Not listed	4

COENAGRIONIDAE	<i>Pseudagrion</i>		Not listed	3
COENAGRIONIDAE	<i>Pseudagrion salisburyense</i>	Slate Sprite	Not listed	3
COENAGRIONIDAE	<i>Pseudagrion spernatum</i>	Upland Sprite	Not listed	3
CRAMBIDAE	<i>Spoladea recurvalis recurvalis</i>		Not Evaluated	3
CULICIDAE	<i>Culex</i> sp.	Mosquito	Not listed	4
CYDNIDAE	<i>Geocnethus plagiata</i>	Burrowing Bug	Not listed	4
GEOMETRIDAE	<i>Acanthovalva inconspicuaris</i> subsp. <i>inconspicuaris</i>		Not Threatened	2
GEOMETRIDAE	<i>Pingasa abyssinaria</i> subsp. <i>abyssinaria</i>		Not Threatened	2
GEOMETRIDAE	<i>Rhodometra sacraria</i> subsp. <i>sacraria</i>	Vestal	Not Threatened	4
GERRIDAE	<i>Gerris</i> sp.	Waterskater	Not listed	4
HESPERIIDAE	<i>Coeliades forestan</i> subsp. <i>forestan</i>	Striped policeman	Least Concern	1
HESPERIIDAE	<i>Coeliades pisistratus</i>	Two-pip policeman	Least Concern	1
HESPERIIDAE	<i>Gegenes niso</i> subsp. <i>Niso</i>	Common hottentot	Least Concern	4
HESPERIIDAE	<i>Gegenes pumilio</i> subsp. <i>gambica</i>	Dark hottentot	Least Concern	3
HESPERIIDAE	<i>Kedestes lepenula</i>	Chequered ranger	Least Concern	3
HESPERIIDAE	<i>Kedestes nerva</i> subsp. <i>nerva</i>	Scarce ranger	Least Concern	3
HESPERIIDAE	<i>Kedestes wallengrenii</i> subsp. <i>wallengrenii</i>	Wallengren's ranger	Least Concern	3
HESPERIIDAE	<i>Metisella malgacha</i> subsp. <i>malgacha</i>	Grassveld sylph	Least Concern	4
HESPERIIDAE	<i>Metisella willemi</i>	Netted sylph	Least Concern	3
HESPERIIDAE	<i>Tsitana tsita</i>	Dismal sylph	Least Concern	3
HESPERIIDAE	<i>Spialia diomus</i>	Common Sandman	Least Concern	4
HODOTERMITIDAE	<i>Hodotermes mossambicus</i>	Harvester termite	Not listed	4
LIBELLULIDAE	<i>Brachythemis leucosticta</i>	Southern Banded Groundling	Not listed	3
LIBELLULIDAE	<i>Crocothemis erythraea</i>	Broad Scarlet	Not listed	4
LIBELLULIDAE	<i>Crocothemis sanguinolenta</i>	Small Scarlet	Least Concern	4
LIBELLULIDAE	<i>Diplacodes lefebvreii</i>	Black Percher	Not listed	3
LIBELLULIDAE	<i>Orthetrum</i>		Not listed	3
LIBELLULIDAE	<i>Orthetrum caffrum</i>	Two-striped Skimmer	Not listed	3
LIBELLULIDAE	<i>Orthetrum chrysostigma</i>	Epaulet Skimmer	Not listed	3
LIBELLULIDAE	<i>Orthetrum julia</i>	Julia Skimmer	Not listed	3
LIBELLULIDAE	<i>Orthetrum trinacria</i>	Long Skimmer	Not listed	3
LIBELLULIDAE	<i>Pantala flavescens</i>	Wandering Glider	Not listed	3
LIBELLULIDAE	<i>Tramea basilaris</i>	Keyhole Glider	Not listed	3
LIBELLULIDAE	<i>Trithemis</i>		Not listed	3
LIBELLULIDAE	<i>Trithemis dorsalis</i>	Highland Dropwing	Not listed	3
LIBELLULIDAE	<i>Trithemis kirbyi</i>	Orange-winged Dropwing	Not listed	3

LIBELLULIDAE	<i>Trithemis stictica</i>	Jaunty Dropwing	Not listed	3
LYCAENIDAE	<i>Actizera lucida</i>	Rayed blue	Least Concern	3
LYCAENIDAE	<i>Aloeides henningi</i>	Henning's copper	Least Concern	2
LYCAENIDAE	<i>Aloeides molomo</i> subsp. <i>molomo</i>	Molomo copper	Least Concern	2
LYCAENIDAE	<i>Aloeides taikosama</i>	Dusky copper	Least Concern	2
LYCAENIDAE	<i>Anthene amarah</i> subsp. <i>amarah</i>	Black striped hairtail	Least Concern	3
LYCAENIDAE	<i>Anthene definita</i> subsp. <i>definita</i>	Common hairtail	Least Concern	4
LYCAENIDAE	<i>Axiocerses tjoane</i> subsp. <i>tjoane</i>	Eastern scarlet	Least Concern	2
LYCAENIDAE	<i>Cacyreus fracta</i> subsp. <i>fracta</i>	Water geranium bronze	Least Concern	3
LYCAENIDAE	<i>Cacyreus marshalli</i>	Common geranium bronze	Least Concern	4
LYCAENIDAE	<i>Cacyreus virilis</i>	Mocker bronze	Least Concern	3
LYCAENIDAE	<i>Capys disjunctus</i>	Russet protea	Least Concern	3
LYCAENIDAE	<i>Chilades trochylus</i>	Grass jewel	Least Concern	4
LYCAENIDAE	<i>Cigaritis ella</i>	Ella's bar	Least Concern	2
LYCAENIDAE	<i>Cigaritis mozambica</i>	Mozambique bar	Least Concern	2
LYCAENIDAE	<i>Cigaritis natalensis</i>	Natal bar	Least Concern	2
LYCAENIDAE	<i>Cupidopsis cissus</i> subsp. <i>cissus</i>	Common meadow blue	Least Concern	3
LYCAENIDAE	<i>Euchrysops dolorosa</i>	Sabie smoky blue	Least Concern	2
LYCAENIDAE	<i>Euchrysops subpallida</i>	Ashen smoky blue	Least Concern	2
LYCAENIDAE	<i>Iolaus trimeni</i>	Trimen's sapphire	Least Concern	1
LYCAENIDAE	<i>Lachnocnema durbani</i>	D'Urban's woolly legs	Least Concern	2
LYCAENIDAE	<i>Lampides boeticus</i>	Pea blue	Least Concern	4
LYCAENIDAE	<i>Leptomyrina henningi</i> subsp. <i>henningi</i>	Henning's black-eye	Least Concern	2
LYCAENIDAE	<i>Leptotes species</i>		Not listed	4
LYCAENIDAE	<i>Myrina silenus</i> subsp. <i>ficedula</i>	Common fig tree blue	Least Concern	2
LYCAENIDAE	<i>Oraidium barberae</i>	Dwarf blue	Least Concern	2
LYCAENIDAE	<i>Tarucus sybaris</i> subsp. <i>sybaris</i>	Dotted blue	Least Concern	4
LYCAENIDAE	<i>Tuxentius melaena</i> subsp. <i>melaena</i>	Black pie	Least Concern	2
LYCAENIDAE	<i>Uranotauma nubifer</i> subsp. <i>nubifer</i>	Black heart	Least Concern	2
LYCAENIDAE	<i>Zizeeria knysna</i> subsp. <i>knysna</i>	African grass blue	Least Concern	4
LYCAENIDAE	<i>Zizina otis</i> subsp. <i>antanossa</i>	Dark grass blue	Least Concern	2
LYCAENIDAE	<i>Zizula hylax</i>	Tiny grass blue	Least Concern	2
LYCOSIDAE		Wolf Spider	Not listed	4
LYNIPHIDAE	<i>Lyniphia</i> sp.	Sheet Orb Web Spider	Not listed	4
MYRMELEONTIDAE	<i>Creoleon mortifer</i>	Large Grassland Antlion	Not listed	3
MYRMELEONTIDAE	<i>Hagenomyia tristis</i>	Gregarious Antlion	Not listed	3

MYRMELEONTIDAE	<i>Macroleon quinquemaculatus</i>		Not listed	3
MYRMELEONTIDAE	<i>Palpares caffer</i>	Dotted Veld Antlion	Not listed	3
NOCTUIDAE	<i>Calloplistria yerburii</i> subsp. <i>yerburii</i>		Not Evaluated	2
NOCTUIDAE	<i>Sphingomorpha chlorea</i> subsp. <i>chlorea</i>		Not Evaluated	2
NYMPHALIDAE	<i>Acraea horta</i>	Garden acraea	Least Concern	4
NYMPHALIDAE	<i>Acraea neobule</i> subsp. <i>neobule</i>	Wandering donkey acraea	Least Concern	3
NYMPHALIDAE	<i>Byblia ilithyia</i>	Spotted joker	Least Concern	4
NYMPHALIDAE	<i>Charaxes jasius</i> subsp. <i>saturnus</i>	Foxy charaxes	Least Concern	3
NYMPHALIDAE	<i>Danaus chrysippus</i> subsp. <i>orientis</i>	African monarch, Plain tiger	Least Concern	4
NYMPHALIDAE	<i>Hypolimnas misippus</i>	Common diadem	Least Concern	4
NYMPHALIDAE	<i>Junonia hierta</i> subsp. <i>cebrene</i>	Yellow pansy	Least Concern	4
NYMPHALIDAE	<i>Junonia oenone</i> subsp. <i>oenone</i>	Blue pansy	Least Concern	4
NYMPHALIDAE	<i>Junonia orithya</i> subsp. <i>madagascariensis</i>	Eyed pansy	Least Concern	4
NYMPHALIDAE	<i>Melanitis leda</i>	Twilight Brown	Least Concern	2
NYMPHALIDAE	<i>Precis archesia</i> subsp. <i>archesia</i>	Garden commodore	Least Concern	3
NYMPHALIDAE	<i>Stygionympha wichgrafi</i> subsp. <i>wichgrafi</i>	Wichgraf's hillside brown	Least Concern	2
NYMPHALIDAE	<i>Telchinia rahira</i> subsp. <i>rahira</i>	Marsh acraea	Least Concern	3
NYMPHALIDAE	<i>Vanessa cardui</i>	Painted lady	Least Concern	4
PAPILIONIDAE	<i>Papilio demodocus</i> subsp. <i>demodocus</i>	Citrus swallowtail	Least Concern	4
PAPILIONIDAE	<i>Papilio nireus</i> subsp. <i>lyaeus</i>	Green-banded swallowtail	Least Concern	3
PIERIDAE	<i>Belenois aurota</i>	Brown-veined white	Least Concern	4
PIERIDAE	<i>Belenois creona</i> subsp. <i>severina</i>	African common white	Least Concern	4
PIERIDAE	<i>Belenois zochalia</i> subsp. <i>zochalia</i>	Forest white	Least Concern	2
PIERIDAE	<i>Catopsilia florella</i>	African migrant	Least Concern	4
PIERIDAE	<i>Colias electo</i> subsp. <i>electo</i>	African clouded yellow	Least Concern	4
PIERIDAE	<i>Colotis annae</i> subsp. <i>annae</i>	Scarlet tip	Least Concern	2
PIERIDAE	<i>Colotis evenina</i> subsp. <i>evenina</i>	Orange tip	Least Concern	2
PIERIDAE	<i>Eurema brigitta</i> subsp. <i>brigitta</i>	Broad-bordered grass yellow	Least Concern	4
PIERIDAE	<i>Mylothris agathina</i> subsp. <i>agathina</i>	Common dotted border	Least Concern	1
PIERIDAE	<i>Pontia helice</i> subsp. <i>helice</i>	Common meadow white	Least Concern	4

PILLBUG	<i>Armadillidium vulgare</i>		Not listed	4
POTOMONAUTIDAE	<i>Potomonautes warreni</i>	Warren's	Not listed	4
PYRGOMORPHIDAE	<i>Phymateus viridipes</i>	Green Milkweed Locust	Not listed	4
SALTICIDAE		Jumping Spider	Not listed	4
SCARABAEIDAE	<i>Catharsius sesostris</i>	Three-horned Dung Beetle	Not listed	4
SCARABAEIDAE	<i>Liatongus militaris</i>		Not listed	3
SCARABAEIDAE	<i>Onitis caffer</i>	Bronze Dung Beetle	Not listed	4
SCARABAEIDAE	<i>Onthophagus ebenus</i>		Not listed	3
SCARABAEIDAE	<i>Onthophagus pugionatus</i>		Not listed	3
SPARASSIDAE	<i>Palystes superciliosus</i>	Rain spiders	Not listed	4
SPHINGIDAE	<i>Basiothia</i>		Not Evaluated	2
SPIROSTREPTIDAE	<i>Doratogonus</i> sp.	Spirostreptidan Millipede	Not listed	4
THERAPHOSIDAE	<i>Harpactira hamiltoni</i>		Not listed	4

*The occurrence probability of the invertebrate species listed above is indicated as follows:

1 - Not likely to occur; 2 - Low occurrence probability; 3 - Medium occurrence probability; 4 - High occurrence probability; 5 - Confirmed occurrence.

8.3.3 Threatened and Red Listed Invertebrate species

No Red Listed invertebrate species were recorded or are expected to occur on the study area.

8.4 Findings

The presence of several wetland species such as *Crocothemis* provides immediate confirmation of the importance of the riverine area as a habitat for invertebrates that use aquatic systems. No Red Data invertebrate species were recorded or are expected to occur on or near the study site. The terrestrial habitat is not considered ecologically sensitive with respect to invertebrates; however the wetland area is considered important for the survival of wetland specific invertebrates. The wetland area is important for hemi-metabolic insects for breeding and for the survival of their nymphs, and is therefore necessary to preserve. The presence of grassland habitat is given as the reason for the relatively high percentage of butterfly species in the list (56.2%). This figure is significantly lower than the percentage taxa expected in a pristine grassland and the difference between the two figures is probably approaching the 43.3 % of total threatened taxa in grassland given by Edge et al. (2013). The loss and change in grassland habitat will include loss of dispersal corridors and the loss of niche' as causal factors for species loss (Henning et al. 2009).

9. OVERALL FINDINGS AND IMPLICATIONS

The majority of the terrestrial habitats present on the study area remain in its natural state (**Figure 7**), although alien plant species tend to invade some of the habitats. The current terrestrial habitats do however provide good habitat for a number of small mammals deduced to be present. The Grassland habitat is expected to support several small mammal species on account of the availability of their food source and maintained connectivity with homogenous habitats. The Riverine habitat is deemed to be highly sensitive from a faunal perspective as it produces suitable habitats for Otter and Vlei Rat species. The probability of Red List Otter or Vlei Rat species selecting this particular stretch of the Jukskei River suitable for their nesting area is unlikely, on account of some pollution and degradation of the habitat. Otter and Vlei Rat species is however expected to use this part of the Jukskei River as a corridor or passage way to areas suitable for nesting purposes. The Drainage Line is deemed to be moderate sensitive from a faunal perspective as it acts as a tributary to the Jukskei River. No Red Data faunal nesting areas were identified in the Drainage Line, however this habitat is expected to be utilized as a forage resource by these species.



Figure 7: Fauna Sensitivity Map

10. LIMITATIONS

Even though considerable care is taken to ensure accuracy and professionalism of this fauna report, environmental assessment studies are limited in scope, time and budget. Several years are needed to derive a 100% accurate report based on intensive field collecting and observations where all seasons are considered to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.

The desktop study made up the largest part of the data used to conclude the distribution of Red Data species which were sourced by making use of the Animal Demography Unit: Virtual Museum data basis. Any limitations in the above mentioned data basis will in effect have implications on the findings and conclusion of this assessment.

Therefore, Bokamoso Environmental: Specialist Division cannot accept responsibilities for conclusions and mitigation measures made in good faith with the limited available information at the time of the directive. This report should be viewed and acted upon considering these limitations.

11. RECOMMENDATIONS

Should the proposed development be approved:

- An appropriate management authority that must be contractually bound to implement the EMP and ROD during the constructional and operational phase of the development should be identified and informed of their responsibilities in terms of the EMP and ROD.
- Prior to any activities commencing on site, all construction staff should be briefed in an environmental induction regarding the environmental status and requirements of the site. This should include providing general guidelines for minimizing environmental damage during construction, as well as education with regards to basic environmental ethics, such as the prevention of littering, lighting of fires, etc.
- Induction should be done for all civil contractors and for each building contractor prior to them commencing on site.
- Construction should be restricted to areas deemed to have a low to medium ecological sensitivity (Please refer to **Figure 7**).

- Areas where construction is to take place should be clearly demarcated and fenced off, all areas outside that of the defined works should be deemed no-go areas.
- All construction activities must be restricted to the demarcated areas to ensure that no further disturbance into the surrounding vegetation or habitat takes place.
- It is recommended that prior to the commencement of construction activities' initial clearing of all alien vegetation should take place.
- No vehicles should be allowed to move in or through the drainage line. This will cause destruction of faunal habitat and will leave notable scares on site.
- The contractor must ensure that no faunal species are trapped, killed or in any way disturbed during the constructional phase.
- It is recommended that all concrete and cement works be restricted to areas of low ecological sensitivity and defined on site and clearly demarcated. Cement powder has a high alkalinity pH rating, which can contaminate and affect both soil and water pH dramatically. A shift in the pH can have serious consequences on the functioning of soil, vegetation and fauna.
- To ensure minimal disturbance of faunal habitat it is recommended that construction should take place during winter, outside the reproductive season of the species present on site.
- Construction, vegetation clearing and top soil clearing should commence from a predetermined location and gradually commence to ensure that fauna present on the site have enough time to relocate.
- When construction is completed, disturbed areas should be rehabilitated using vegetation cleared prior to construction to ensure that the habitat stays intact and that faunal species present on the site before construction took place, return to the area.
- It is recommended that the section of the Jukskei River bordering the study area on the Southern boundary should be rehabilitated and pollution prevention methods should be put in place to prevent further habitat degradation.
- It is recommended that no construction takes place within 32 meters of the Jukskei River.
- As a result of the artificial nature of the drainage line it was concluded that no additional buffers with respect to the upper section of the drainage line are necessary.

12. CONCLUSION

Due to the sensitive nature of the Riverine area induction with all the partaking contractors, workers, road engineers and landowners is necessary, in order to make them aware of the

areas deemed to be sensitive according to this report and act accordingly. Development should be restricted to areas deemed to have a low to medium ecological sensitivity (**Figure 7**).

Given the acceptance of the recommendations, the proposed development will not result in the destruction and/or loss of important or ecologically sensitive habitat units from a faunal perspective.

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APPENDIX G4: AVIFAUNA ASSESSMENT

AVIFAUNA ASSESSMENT OF PORTION 1 OF THE FARM WATERVAL 5 IR AND PART
OF THE REMAINDER OF THE FARM WATERVAL 38 IR



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20 June 2016

To whom it may concern,

REVIEW OF SPECIALIST AVIFAUNAL ASSESSMENT:

**AVIFAUNA ASSESSMENT OF PORTION 1 OF THE FARM WATERVAL 5 IR AND
PART OF THE REMAINDER OF THE FARM WATERVAL 38 IR**

I, Lukas Jurie Niemand, member and principal consultant of Pachnoda Consulting and registered professional scientist in the fields of Zoological and Ecological sciences, evaluated the avifaunal (bird) component of the abovementioned specialist assessment compiled by Mr CW Vermeulen of Bokamoso. The report was evaluated in accordance with the Gauteng Directorate of Nature Conservation (GDARD) Requirements for Biodiversity Assessments Version 3 and in terms of general content and avifaunal conservation.

In general, criticism lodged against avifaunal/ecological studies include: poor use of relevant scientific literature, lack of, or poor field surveys and associated data collection, poor use of regional information datasets, general poor knowledge of subject, failure to describe limitations or constraints on survey methodology, insufficient or inadequate data, vague generalisations with no indication of the relative importance of a particular component. With regards to the above criticism, none of it is relevant to the avifaunal assessment of the aforementioned report.

It is concluded that the report comply with the general provincial requirements, and the content as discussed in the report is relevant and concise.

Lukas Niemand
MSc Zoology - UP; Pr. Sci. Nat. Reg. no. 400095/06)
Pachnoda Consulting

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Specialist

Specialist investigator: Mr. C.W. Vermeulen (B.Sc. Biological and Environmental Science)

Declaration of independence:

I, the above mentioned specialist investigator responsible for conducting this particular specialist Avifauna study, declare that:

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part;
- I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience, and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I have the necessary qualifications and guidance from professional experts (registered Pr. Nat. Sci.) in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein are and will remain the intellectual property of Bokamoso Environmental: Specialist Division. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the respective specialist investigator.



CW Vermeulen

1. Introduction

Bokamoso Environmental Consultants CC; Specialist Division was appointed to conduct a Avifaunal Assessment for the proposed residential development on Portion 1 of the Farm Waterval 5 IR and part of the remainder of the Farm Waterval 38 IR.

This report is based on the avifaunal species present on the study area as well as species that could potentially occur. The report primarily focuses on species with conservation concerns (**NT** = Near Threatened, **VU** = Vulnerable, **EN** = Endangered, **CR** = Critically Endangered) and other species with conservation importance occurring on or near the study area to ensure that, should any such species exists, the appropriate actions are taken to guarantee the well-being of these species.

2. Scope of the study

- To identify the dominant bird species present on the study area.
- To identify all the distinct avifaunal habitats on the study area.
- To compare the species occurring in and around the study area with all the species that has been recorded in that area in recent history.
- To identify ecologically sensitive areas in terms of species occurrence and/ or habitat.
- To provide lists of all the bird species occurring on the study area as well as species possibly occurring in the area as a result of habitat preferences and previous records.
- To provide a list of species with conservation importance.
- To provide recommendations in the form of mitigation of negative impacts, should the development be approved.

3. Study Area

The study area is situated 1km north-west of the Eastern Bypass and Ben Schoeman intersection, and between the Old Pretoria Road and Jukskei River, 900m west of the Midrand Gautrain Depot (**Figure 1**). The size of the study area is approximately 17.2 hectares and is located within the 2628AA quarter degree square (QDS) (26°02'27.00"S; 28°06'28.59"E) and within the 2600_2805 pentad (a pentad is a 5 minute x 5 minute coordinate grid super-imposed over the continent for spatial reference, one QDS comprises of 9 pentads) (SABAP2). The Study area contains three discrete habitats: Wetland and drainage line, Grassland and Riverine habitats. The study area is situated within a single vegetation unit according to Mucina and Rutherford (2006) namely Egoli Granite Grassland.

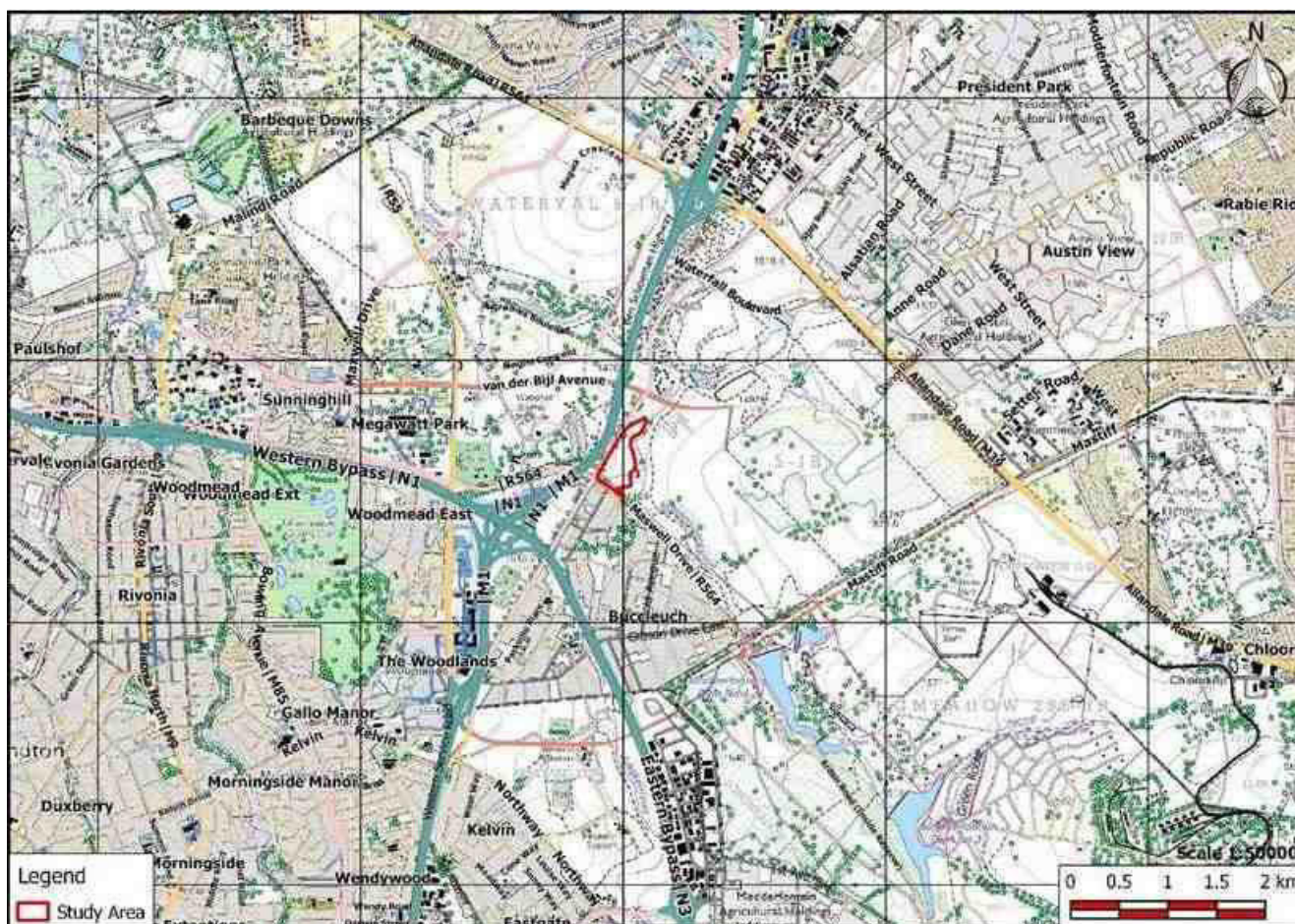


Figure 1: Locality Map

A locality map showing all the surrounding roads and open space within the surrounding area.

4. Methods

4.1 Field Survey

A field survey was conducted on the 7th of April 2016. A total of 2 hours was spent on the study area whilst conducting the field survey. Before conducting a field survey, a desktop assessment was conducted to document the prevalent avifaunal species occurring on or near the site. A list of expected species was compiled which was used as a reference guide during the field survey to ensure that bird species that should theoretically occur within the study area were not overlooked. All distinct avifaunal habitats were identified on site, after which each habitat was assessed to document the associated avifaunal species by means of random transect walks. Species were identified by actual sightings, calls as well as signs of presence in the form of eggshells, nests, droppings and feathers (Chris & Tilde Stuart., 2000). Where necessary, species were verified using Sasol Birds of Southern Africa (Sinclair *et al.*, 2011).

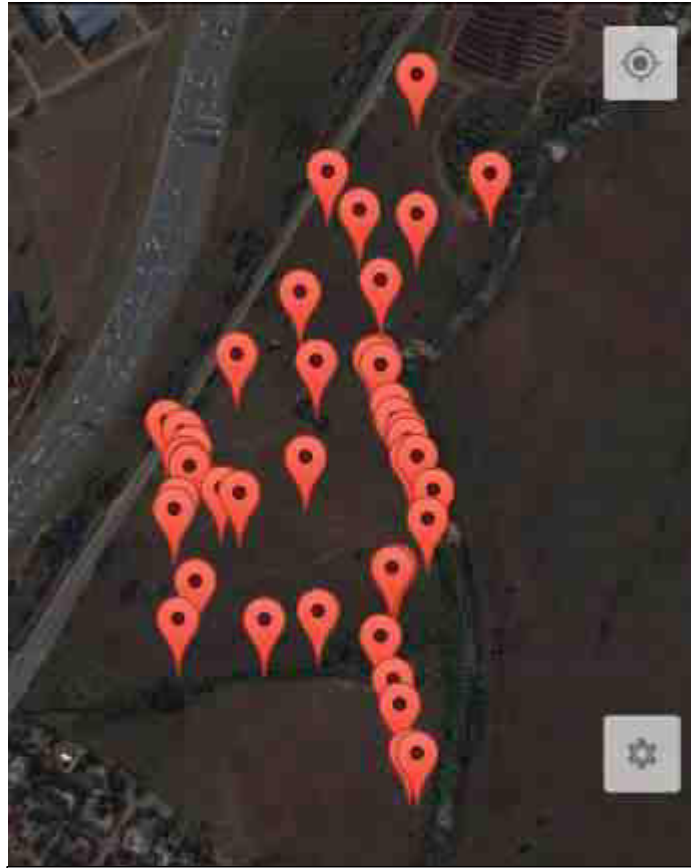


Figure 2: GPS waypoints for each bird species recorded

The geographical position of each bird species recorded within the study area, thereby illustrating the relative density of birds in the area. These observed species are colour coded and listed in **Table 1** (Recorded on site – 5)

4.2 Desktop Study

By using Southern Africa Bird Atlas Project 1 and 2 (SABAP2), a comprehensive species list could be compiled for the 2628AA QDS and the 2600_2805 pentads. SABAP2 is the follow-up project to the Southern African Bird Atlas Project (referred to as SABAP1). This first bird atlas project took place from 1987-1991. The second bird atlas project started on 1 July 2007 and plans to run indefinitely. The project aims to map the distribution and relative abundance of birds in Southern Africa. The field work for this project is done by more than one thousand nine hundred volunteers, known as citizen scientists. The unit of data collection is the pentad, five minutes of latitude by five minutes of longitude, squares with sides of roughly 9 km.

The expected species list for the QDS can however not be used as an accurate list in terms of the species actually occurring within the study area since it covers a larger area, as well as a variety of habitat types. In order to compile an accurate species list for the study area, all the species previously recorded in the 2628AA QDS were considered, and added or eliminated based on the habitat types present on the study area.

4.3 Threatened and Near Threatened bird species

By consulting the SABAP2 database, all the threatened and near threatened bird species previously recorded within the 2628AA QDS were added to the expected list of species that could potentially occur on or near the study area. All the threatened species occurring in or near the study area were reviewed (Roberts VII, Hockey *et al.* 2005; Taylor *et al.*, 2015) before conducting the field survey. During the field survey special attention was paid to identify any signs such as; actual sightings, suitable habitat, nest sites, suitable hunting/ foraging habitat or roosting spots indicating the presence of these species.

A list was compiled to indicate the presence and/or occurrence probability of bird species with conservation concerns based on the above mentioned indicators (**Table 2**).

4.4 Specific Requirements in terms of Red Data Avifaunal species

According to the Gauteng Department of Agriculture and Rural Development's (GDARD) requirements for Biodiversity Assessments, Version 3.3 (March 2014), as well as for any other Red Data species: Eleven threatened and near threatened bird species were prioritized for inclusion into the Gauteng C-Plan based on:

1. Threat status (2 Endangered (**EN**), 5 Vulnerable (**VU**) and 4 Near Threatened (**NT**)).
2. Whether the species was actually present, on a frequent basis, in the province. Vagrants, erratic visitors or erratic migrants to the province (Tarboton *et al.*, 1987) have been excluded from the conservation plan.
3. Whether the threat was due to issues related to land use planning. Species which are impacted on mostly by threats such as poisoning were excluded.

Important Threatened and Near Threatened Bird species regional conservation status (Taylor *et al.*, 2015):

- Half-Collared Kingfisher (*Alcedo semitorquata*) **NT**
- Blue Crane (*Anthropoides paradiseus*) **NT**

- African Marsh-Harrier (*Circus ranivorus*) **EN**
- White-bellied Korhaan (*Eupodotis senegalensis*) **VU**
- White-backed Night-Heron (*Gorsachius leuconotus*) **VU**
- Cape Vulture (*Gyps coprotheres*) **EN**
- African Finfoot (*Podica senegalensis*) **VU**
- Secretarybird (*Sagittarius serpentarius*) **VU**
- African Grass-Owl (*Tyto capensis*) **VU**
- Abdims Stork (*Ciconia abdimii*) **NT**
- Black-winged Pratincole (*Glareola nordmanni*) **NT**

5. Results

5.1 Avifaunal Habitat Assessment:

Three distinct avifaunal habitat types were identified within the study area. These habitat types include: Wetland and drainage line, Grassland and Riverine Area. (**Figure 4**). All the habitats identified on the study area are individually discussed hereafter.

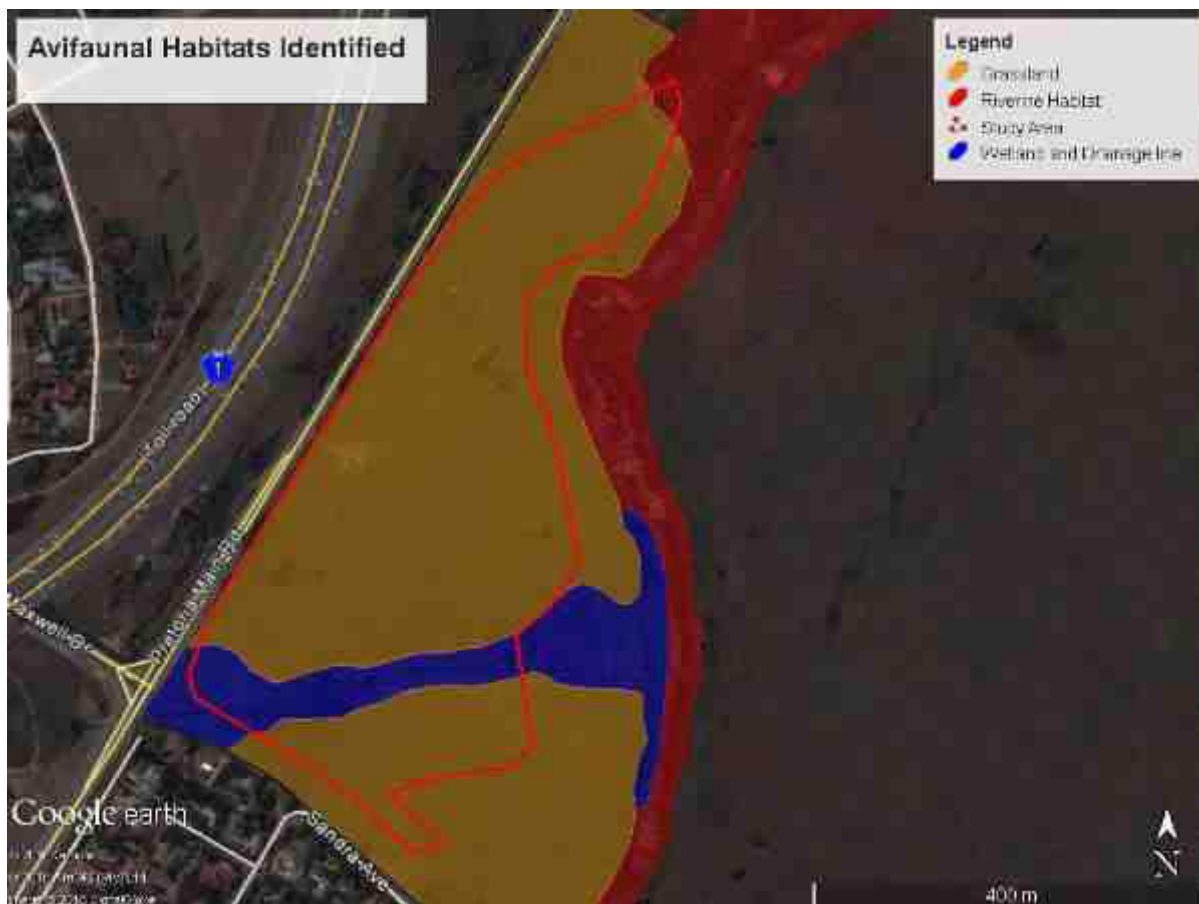


Figure 3: Habitats Identified

5.1.1 Grassland

The Grassland habitat unit contains mostly grass and forb vegetation with a few small scattered alien trees (**Figure 4**). The grassland habitat unit is dominated by a graminoid layer which includes species such as *Eragrostis spp.*, *Schizachyrium sanguineum*, *Heteropogon contortus* and *Hyparrhenia hirta*. Grassland habitats normally have low to medium avifaunal species richness as a result of the highly specialised environment. As a result of the unique environment a number of habitat specific species such as Desert Cisticola (*Cisticola aridulus*), Zitting Cisticola (*Cisticola juncidis*), Cape Longclaw (*Macronyx capensis*), African Quailfinch (*Ortygospiza atricollis*) and Rufous-naped Lark (*Mirafra africana*) are likely to be resident. All the bird species expected to occur or confirmed to be present within this habitat unit are common and/or widespread species. Connectivity of the grassland habitat unit with surrounding homogenous habitats is high towards the east on the opposite side of the Jukskei River. The Old Pretoria Road (directly adjacent) and the N1 (within 80 meters) are within close proximity of the study area and acts as a major barrier to the west as well as being a source of noise pollution which is a major disturbance from an avifaunal perspective. Most of the grassland-associated bird species rely on sound as their primary means of communication and during courtship displays. Noise pollution prevents certain species from communicating as well as having a negative effect on their reproductive success. The effect of noise pollution often results in a decline in species richness and species densities, consequently only species adapted to a disturbed environment remain resident within such an area.

The occurrence of threatened and/or near threatened bird species is highly unlikely due to the various developments and man-made activities in the surrounding area as well as the small surface area of this habitat unit (± 20 ha). No suitable breeding habitat was observed on site for any threatened or near threatened bird species, however the habitat might be periodically utilized as a hunting ground by threatened species such as Lanner Falcon (*Falco biarmicus*). No threatened or near threatened bird species are expected to be resident or rely on the grassland habitat for survival. The globally near threatened Melodious Lark could be present at low densities. However, this species was subsequently delisted during a recent national conservation assessment (sensu Taylor et al., 2015).

On account of the aforementioned connectivity, sub-optimal habitat for threatened bird species and the small surface area this habitat was deemed to have a low avifaunal sensitivity.



Figure 4: Grassland

5.1.2 Wetland and Drainage Line

The wetland and drainage line habitat unit is situated on the south-western section of the study area and contains one small densely vegetated shallow dam. The dam is dominated by *Typha capensis* and *Phragmites australis* which is connected to the Jukskei River towards the south. The Jukskei River is dominated by palustrine vegetation such as *Cyperus spp.*, *Schoenoplectus spp.*, *Arundo donax*, *Phragmites australis* and *Typha capensis*, as well as other wetland associated vegetation (**Figure 5**). This study unit contains scattered indigenous and alien trees, as well as some dense tree and shrub stands at the inflow of the drainage line with the Jukskei River. The wetland and drainage line habitat is approximately 3.4 ha in size and provides the habitat for a large number of bird species including; Rallids, Ducks, Herons, Waxbills, Widowbirds, Waders and Weavers. No threatened or near threatened bird species is expected to occur on or along the edge of the dam due to its small size (0.45 ha) and the lack of open water. The latter is an important foraging habitat for piscivorous bird species which were absent from the dam. Although no threatened or near threatened bird species are expected to occur within this section of the study unit, the shallow wetland dam does however fulfil an important pollution prevention function by way of filtering the storm water before it enters the Jukskei River. The drainage line itself relies on storm water as its main source of water resulting in

unpredictable water levels, minimal aquatic fauna as a food source and poor water quality., Therefore, no threatened or near threatened bird species are expected to be resident on this section of the study unit. In terms connectivity, the drainage line is directly connected to the Jukskei River to the east, which forms part of an extensive network of wetlands in the surrounding area.

It was identified as highly sensitive from an avifaunal perspective due to the intact and largely undisturbed nature of the wetland and drainage line habitat unit, along with the pollution prevention function and optimal habitat it provides for a number of widespread bird species, .



Figure 5: Wetland and Drainage Line

5.1.3 Riverine Area

The Riverine habitat unit is located directly outside the boundaries of the proposed development property where the Jukskei River flows in a northern direction, adjacent to the study area for approximately 1.2km (**Figure 6**). This habitat unit contains patches of densely vegetated overhanging reeds, trees and shrubs. The riverine area contains sections of vertical sand banks and scattered rocks and large boulders. This section of the river has relatively fast flowing, clear water containing small rapids every few meters. As a result of the vegetation diversity, as well as the dense nature of the riverine vegetation, the habitat supports a large avifaunal density and diversity. Species observed within this habitat unit include; Kingfisher,

Moorhen, Weavers, Bishops, Ibis, Herons, Warblers and Ducks. The riverine habitat also provides the optimal breeding habitat for the near threatened Half-collared Kingfisher in that it contains stretches of fast flowing water with vertical banks along with dense over-hanging vegetation (*Please refer to page 21 where the habitat requirements of the Half-collared Kingfisher are discussed*). No other threatened or near threatened bird species are expected to occur within the riverine habitat unit.

Connectivity with homogeneous habitat is relatively high, especially towards the north-east and west. Although the connectivity was judge to be high, the water quality of the Jukskei River is bad as a result of downstream pollution in the form of solid and chemical waste making its way into the river system. A single Malachite Kingfisher (*Alcedo cristata*) was however observed within the habitat unit, indicating that it is likely that a food source in the form of small fish, tadpoles and aquatic invertebrates are present.

Due to the connectivity function, high avifaunal diversity and optimal habitat for the near threatened Half-collared Kingfisher, this habitat unit was deemed to be highly sensitive.



Figure 6: Riverine Area

Table 1: Bird species observed within the study area during the field survey, as well as bird species potentially occurring on the study area as a result of habitat preferences and previous records.

The biodiversity index below indicates the probability of a species breeding (BR) within the study area as well as the occurrence probability of a species within the study area according to its specific habitat preferences (HP). Very Low – 1, Low – 2, Medium – 3, High – 4, Recorded on site – 5, Not likely to occur/breed – 0, Threatened Species

	Species name	Taxonomic name	Rep Rate %	OP	BR
1.	Apalis, Bar-throated	<i>Apalis thoracica</i>	2.44	3	3
2.	Barbet, Black-collared	<i>Lybius torquatus</i>	55.875	4	4
3.	Barbet, Crested	<i>Trachyphonus vaillantii</i>	75.355	4	4
4.	Bee-eater, European	<i>Merops apiaster</i>	26.935	5	0
5.	Bee-eater, White-fronted	<i>Merops bullockoides</i>	6.415	5	4
6.	Bishop, Southern Red	<i>Euplectes orix</i>	71.275	5	4
7.	Bishop, Yellow-crowned	<i>Euplectes afer</i>	10	5	4
8.	Bittern, Little	<i>Ixobrychus minutus</i>	4.025	3	0
9.	Bokmakierie,	<i>Telophorus zeylonus</i>	30.69	3	3
10.	Boubou, Southern	<i>Laniarius ferrugineus</i>	8.29	4	4
11.	Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>	90.555	5	4
12.	Buttonquail, Kurrichane	<i>Turnix sylvaticus</i>	0.355	2	2
13.	Buzzard, Lizard	<i>Kaupifalco monogrammicus</i>	1.39	2	2
14.	Buzzard, Steppe	<i>Buteo vulpinus</i>	15.45	4	0
15.	Canary, Black-throated	<i>Crithagra atrogularis</i>	49.005	5	4
16.	Canary, Yellow-fronted	<i>Crithagra mozambicus</i>	25.59	3	3
17.	Chat, Anteating	<i>Myrmecocichla formicivora</i>	0.175	3	3
18.	Chat, Familiar	<i>Cercomela familiaris</i>	13.935	3	3
19.	Cisticola, Cloud	<i>Cisticola textrix</i>	4.09	3	3
20.	Cisticola, Desert	<i>Cisticola aridulus</i>	2.67	4	4
21.	Cisticola, Levaillant's	<i>Cisticola tinniens</i>	38.17	5	4

22.	Cisticola, Zitting	<i>Cisticola juncidis</i>	23.02	5	4
23.	Cliff-swallow, South African	<i>Hirundo spilodera</i>	3.55	4	4
24.	Coot, Red-knobbed	<i>Fulica cristata</i>	63.605	3	3
25.	Cormorant, Reed	<i>Phalacrocorax africanus</i>	69.255	4	1
26.	Coucal, Burchell's	<i>Centropus burchellii</i>	21.125	4	4
27.	Crake, Black	<i>Amaurornis flavirostris</i>	5.06	4	4
28.	Crow, Pied	<i>Corvus albus</i>	78.545	5	4
29.	Cuckoo, Diderick	<i>Chrysococcyx caprius</i>	27.265	4	4
30.	Cuckoo, Red-chested	<i>Cuculus solitarius</i>	13.24	4	4
31.	Darter, African	<i>Anhinga rufa</i>	42.065	4	2
32.	Dove, Laughing	<i>Streptopelia senegalensis</i>	94.06	5	5
33.	Dove, Red-eyed	<i>Streptopelia semitorquata</i>	59.37	5	5
34.	Dove, Rock	<i>Columba livia</i>	60.155	5	4
35.	Drongo, Fork-tailed	<i>Dicrurus adsimilis</i>	6.735	3	3
36.	Duck, African Black	<i>Anas sparsa</i>	53.945	5	4
37.	Duck, White-faced	<i>Dendrocygna viduata</i>	22.335	3	3
38.	Duck, Yellow-billed	<i>Anas undulata</i>	57.405	4	4
39.	Eagle, Long-crested	<i>Lophaetus occipitalis</i>	16.65	4	2
40.	Eagle-owl, Spotted	<i>Bubo africanus</i>	14.11	3	3
41.	Egret, Cattle	<i>Bubulcus ibis</i>	64.535	5	1
42.	Egret, Little	<i>Egretta garzetta</i>	28.78	4	1
43.	Falcon, Amur	<i>Falco amurensis</i>	2.52	4	0
44.	Falcon, Lanner	<i>Falco biarmicus</i>	0.71	1	0
45.	Falcon, Peregrine	<i>Falco Peregrinus</i>	0.55	1	0
46.	Finch, Red-headed	<i>Amadina erythrocephala</i>	14.17	4	4
47.	Firefinch, Jameson's	<i>Lagonosticta rhodopareia</i>	7.51	3	3
48.	Fiscal, Common (Southern)	<i>Lanius collaris</i>	88.045	5	4
49.	Fish-eagle, African	<i>Haliaeetus vocifer</i>	17.6	3	2
50.	Flufftail, Red-chested	<i>Sarothrura rufa</i>	0.47	4	4

51.	Flycatcher, Fairy	<i>Stenostira scita</i>	2.095	2	2
52.	Flycatcher, Fiscal	<i>Sigelus silens</i>	45.775	4	4
53.	Flycatcher, Southern Black	<i>Melaenornis pammelaina</i>	6.72	2	2
54.	Flycatcher, Spotted	<i>Muscicapa striata</i>	13.44	4	0
55.	Francolin, Orange River	<i>Scleroptila levaillantoides</i>	14.83	3	3
56.	Go-away-bird, Grey	<i>Corythaixoides concolor</i>	58.055	4	4
57.	Goose, Egyptian	<i>Alopochen aegyptiacus</i>	79.06	4	4
58.	Goose, Spur-winged	<i>Plectropterus gambensis</i>	12.98	3	2
59.	Grebe, Little	<i>Tachybaptus ruficollis</i>	46.31	3	3
60.	Greenshank, Common	<i>Tringa nebularia</i>	4.02	3	0
61.	Guineafowl, Helmeted	<i>Numida meleagris</i>	61.345	5	4
62.	Gull, Grey-headed	<i>Larus cirrocephalus</i>	43.745	5	1
63.	Hamerkop, Hamerkop	<i>Scopus umbretta</i>	21.66	4	3
64.	Heron, Black	<i>Egretta ardesiaca</i>	3.25	3	1
65.	Heron, Black-headed	<i>Ardea melanocephala</i>	64.385	4	1
66.	Heron, Goliath	<i>Ardea goliath</i>	3.7	3	1
67.	Heron, Green-backed	<i>Butorides striata</i>	9.03	3	1
68.	Heron, Grey	<i>Ardea cinerea</i>	34.485	4	1
69.	Heron, Purple	<i>Ardea purpurea</i>	15.65	4	2
70.	Heron, Squacco	<i>Ardeola ralloides</i>	6.715	3	1
71.	Honeybird, Brown-backed	<i>Prodotiscus regulus</i>	4.72	2	2
72.	Honeyguide, Greater	<i>Indicator indicator</i>	7.25	3	3
73.	Honeyguide, Lesser	<i>Indicator minor</i>	14.795	3	3
74.	Hoopoe, African	<i>Upupa africana</i>	35.525	3	3
75.	Hornbill, African Grey	<i>Tockus nasutus</i>	7.37	2	2
76.	House-martin, Common	<i>Delichon urbicum</i>	5.815	5	0
77.	Ibis, African Sacred	<i>Threskiornis aethiopicus</i>	72.86	5	1
78.	Ibis, Glossy	<i>Plegadis falcinellus</i>	27.02	2	1
79.	Ibis, Hadedda	<i>Bostrychia hagedash</i>	91.06	5	4
80.	Kingfisher, Brown-hooded	<i>Halcyon albiventris</i>	9.05	4	4
81.	Kingfisher, Giant	<i>Megaceryle maximus</i>	19.34	3	3
82.	Kingfisher, Half-collared	<i>Alcedo semitorquata</i>	0.385	3	3
83.	Kingfisher, Malachite	<i>Alcedo cristata</i>	18.165	5	4

84.	Kingfisher, Pied	<i>Ceryle rudis</i>	23.945	3	3
85.	Kite, Black-shouldered	<i>Elanus caeruleus</i>	56.405	4	4
86.	Kite, Yellow-billed	<i>Milvus aegyptius</i>	9.675	2	0
87.	Korhaan, Northern Black	<i>Afrotis afraoides</i>	17.035	4	4
88.	Lapwing, African Wattled	<i>Vanellus senegallus</i>	50.95	4	4
89.	Lapwing, Blacksmith	<i>Vanellus armatus</i>	73.015	5	4
90.	Lapwing, Crowned	<i>Vanellus coronatus</i>	72.875	5	4
91.	Lark, Rufous-naped	<i>Mirafra africana</i>	20.83	4	4
92.	Lark, Spike-heeled	<i>Chersomanes albofasciata</i>	2.58	3	3
93.	Longclaw, Cape	<i>Macronyx capensis</i>	32.59	5	4
94.	Mannikin, Bronze	<i>Spermestes cucullatus</i>	23.035	4	4
95.	Martin, Banded	<i>Riparia cincta</i>	1.095	3	3
96.	Martin, Brown-throated	<i>Riparia paludicola</i>	33.56	5	4
97.	Martin, Rock	<i>Hirundo fuligula</i>	19.49	4	3
98.	Masked-weaver, Southern	<i>Ploceus velatus</i>	94.44	5	5
99.	Moorhen, Common	<i>Gallinula chloropus</i>	56.2	4	4
100.	Mousebird, Red-faced	<i>Urocolius indicus</i>	44.655	4	4
101.	Mousebird, Speckled	<i>Colius striatus</i>	67.225	4	4
102.	Myna, Common	<i>Acridotheres tristis</i>	92.77	5	4
103.	Neddicky, Neddicky	<i>Cisticola fulvicapilla</i>	33.73	5	4
104.	Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>	5.895	3	1
105.	Olive-pigeon, African	<i>Columba arquatrix</i>	17.315	3	3
106.	Oriole, Black-headed	<i>Oriolus larvatus</i>	4.675	4	4
107.	Owl, Barn	<i>Tyto alba</i>	4.675	3	3
108.	Owl, Marsh	<i>Asio capensis</i>	16.93	3	3
109.	Palm-swift, African	<i>Cypsiurus parvus</i>	46.79	5	1
110.	Paradise-flycatcher, African	<i>Terpsiphone viridis</i>	16.485	4	4

111.	Pigeon, Speckled	<i>Columba guinea</i>	50.785	5	3
112.	Pipit, African	<i>Anthus cinnamomeus</i>	30.49	4	4
113.	Plover, Three-banded	<i>Charadrius tricollaris</i>	35.455	5	4
114.	Prinia, Black-chested	<i>Prinia flavicans</i>	36.19	5	4
115.	Prinia, Tawny-flanked	<i>Prinia subflava</i>	57.035	5	4
116.	Quail, Common	<i>Coturnix coturnix</i>	0.39	3	3
117.	Quailfinch, African	<i>Ortygospiza atricollis</i>	3.68	3	3
118.	Quelea, Red-billed	<i>Quelea quelea</i>	10.525	4	4
119.	Rail, African	<i>Rallus caerulescens</i>	0.455	3	3
120.	Reed-warbler, African	<i>Acrocephalus baeticatus</i>	11.295	5	4
121.	Reed-warbler, Great	<i>Acrocephalus arundinaceus</i>	4.155	3	0
122.	Robin-chat, Cape	<i>Cossypha caffra</i>	76.065	4	4
123.	Ruff, Ruff	<i>Philomachus pugnax</i>	2.94	2	0
124.	Rush-warbler, Little	<i>Bradypterus baboecala</i>	9.345	4	4
125.	Sandpiper, Common	<i>Actitis hypoleucos</i>	11.425	4	0
126.	Sandpiper, Wood	<i>Tringa glareola</i>	10.805	4	0
127.	Seedeater, Streaky-headed	<i>Crithagra gularis</i>	10.915	4	3
128.	Shoveler, Cape	<i>Anas smithii</i>	5.165	2	2
129.	Shrike, Red-backed	<i>Lanius collurio</i>	4.125	3	0
130.	Snipe, African	<i>Gallinago nigripennis</i>	7.525	4	4
131.	Sparrow, Cape	<i>Passer melanurus</i>	83.145	5	4
132.	Sparrow, House	<i>Passer domesticus</i>	58.95	4	4
133.	Sparrow, Southern Grey-headed	<i>Passer diffusus</i>	34.55	4	4
134.	Sparrowhawk, Black	<i>Accipiter melanoleucus</i>	2.48	3	2
135.	Sparrowhawk, Little	<i>Accipiter minullus</i>	1.505	1	1
136.	Sparrowhawk, Ovambo	<i>Accipiter ovampensis</i>	9.035	3	3
137.	Spoonbill, African	<i>Platalea alba</i>	11.75	3	1
138.	Spurfowl, Swainson's	<i>Pternistis swainsonii</i>	41.76	5	4
139.	Starling, Cape Glossy	<i>Lamprotornis nitens</i>	62.21	4	4
140.	Starling, Pied	<i>Spreo bicolor</i>	24.985	3	3
141.	Starling, Red-winged	<i>Onychognathus morio</i>	15.185	3	3
142.	Stilt, Black-winged	<i>Himantopus himantopus</i>	10.86	3	2
143.	Stonechat, African	<i>Saxicola torquatus</i>	51.15	5	4
144.	Stork, White	<i>Ciconia ciconia</i>	4.66	3	0

145.	Sunbird, Amethyst	<i>Chalcomitra amethystina</i>	31.885	4	4
146.	Sunbird, White-bellied	<i>Cinnyris talatala</i>	14.795	4	4
147.	Swallow, Barn	<i>Hirundo rustica</i>	37.715	5	0
148.	Swallow, Greater Striped	<i>Hirundo cucullata</i>	42.07	5	4
149.	Swallow, Lesser Striped	<i>Hirundo abyssinica</i>	23.475	4	4
150.	Swallow, Red-breasted	<i>Hirundo semirufa</i>	1.675	3	3
151.	Swallow, White-throated	<i>Hirundo albigularis</i>	40.58	5	4
152.	Swamp-warbler, Lesser	<i>Acrocephalus gracilirostris</i>	36.995	5	4
153.	Swamphen, African Purple	<i>Porphyrio madagascariensis</i>	11.555	3	3
154.	Swift, Little	<i>Apus affinis</i>	37.66	5	1
155.	Swift, White-rumped	<i>Apus caffer</i>	40.76	5	1
156.	Teal, Red-billed	<i>Anas erythrorhyncha</i>	5.69	3	3
157.	Tern, Whiskered	<i>Chlidonias hybrida</i>	3.92	2	0
158.	Thick-knee, Spotted	<i>Burhinus capensis</i>	37.815	4	4
159.	Thrush, Karoo	<i>Turdus smithi</i>	72.445	5	4
160.	Thrush, Kurrichane	<i>Turdus libonyanus</i>	9.725	2	1
161.	Tit-babbler, Chestnut-vented	<i>Parisoma subcaeruleum</i>	14.03	4	3
162.	Turtle-dove, Cape	<i>Streptopelia capicola</i>	88.82	5	5
163.	Wagtail, Cape	<i>Motacilla capensis</i>	72.14	5	4
164.	Warbler, Willow	<i>Phylloscopus trochilus</i>	19.155	4	0
165.	Waxbill, Common	<i>Estrilda astrild</i>	26.225	5	4
166.	Waxbill, Orange-breasted	<i>Amandava subflava</i>	6.34	5	4
167.	Weaver, Cape	<i>Ploceus capensis</i>	17.56	4	4
168.	Weaver, Thick-billed	<i>Amblyospiza albifrons</i>	25.47	5	4
169.	Wheatear, Capped	<i>Oenanthe pileata</i>	4.36	4	4
170.	Wheatear, Mountain	<i>Oenanthe monticola</i>	16.78	2	2
171.	White-eye, Cape	<i>Zosterops virens</i>	78	5	4
172.	Whydah, Pin-tailed	<i>Vidua macroura</i>	27.825	5	4
173.	Widowbird, Long-tailed	<i>Euplectes progne</i>	26.105	5	4
174.	Widowbird, Red-collared	<i>Euplectes ardens</i>	11.945	4	4

175.	Widowbird, White-winged	<i>Euplectes albonotatus</i>	2.905	4	4
176.	Wood-hoopoe, Green	<i>Phoeniculus purpureus</i>	47.5	4	4
177.	Woodpecker, Cardinal	<i>Dendropicos fuscescens</i>	9.845	4	4
178.	Wryneck, Red-throated	<i>Jynx ruficollis</i>	16.175	3	3
Totals			0	0	18 (10.2%)
			1	2 (1.1%)	19 (10.7%)
			2	13 (7.4%)	15 (8.5%)
			3	49 (27.7%)	39 (22%)
			4	62 (35%)	82 (46.3%)
			5	51 (28.8%)	4 (2.3%)
Total Red Data Species expected to occur			2		

Of the 177 bird species listed in **Table 1**, 113 species (63.8%) were either confirmed or are highly likely to occur in or around the study area of which 86 species are likely to breed on or near the study area. Forty-nine of the 177 listed bird species have a medium occurrence probability and 15 a low to very low occurrence probability. One near threatened and one Vulnerable species, namely the Lanner Falcon (*Falco biarmicus*) **VU** and Half-collared Kingfisher (*Alcedo semitorquata*) **NT**, can be expected to occur in or around the study area. Of the aforementioned near threatened species only the Lanner Falcon is likely to occasionally utilize the study area as a hunting ground. This species cannot be regarded as resident or depend on the study area for its survival. The Half-collared Kingfisher was regarded as having a medium occurrence probability on account of the optimal riverine habitat directly adjacent to the study area, as well as the specific habitat requirements and preference of the species in question.

Twenty-three additional threatened and/or near threatened bird species have previously been recorded within the 2628AA QDS and are listed in **Table 2**.

Table 2: Threatened and near threatened bird species previously recorded within the 2628AA QDS.

Threatened and near threatened bird species previously recorded within the 2628AA QDS according to Taylor *et al.* (2015), Harrison *et al.* (1997), Tarboton *et al.* (1987), SABAP2 (Table2).

	Species name	Latest Date Record (Year)	Red Data: (Regional; Global)	Taxonomic name	Rep Rate (%)	HP	Br
1.	Crane, Blue	2016	NT, VU	<i>Anthropoides paradiseus</i>	0.5	0	0
2.	Duck, Maccoa	2015	NT, NT	<i>Oxyura maccoa</i>	1.08	0	0
3.	Eagle, Martial	Prior to 2007	EN, VU	<i>Polemaetus bellicosus</i>	0.02	0	0
4.	Eagle, Verreauxs'	Prior to 2007	VU, LC	<i>Aquila verreauxii</i>	0.02	0	0
5.	Falcon, Lanner	2016	VU, LC	<i>Falco biarmicus</i>	0.62	1	0
6.	Falcon, Red-footed	2016	NT, NT	<i>Falco vespertinus</i>	0.14	0	0
7.	Flamingo, Greater	2015	NT, LC	<i>Phoenicopterus ruber</i>	1.96	0	0
8.	Flamingo, Lesser	Prior to 2007	NT, NT	<i>Phoenicopterus minor</i>	0.065	0	0
9.	Grass-owl, African	2012	VU, LC	<i>Tyto capensis</i>	0.38	0	0
10.	Kingfisher, Half-collared	2016	NT, LC	<i>Alcedo semitorquata</i>	0.405	3	3
11.	Korhaan, White-bellied	Prior to 2007	VU, LC	<i>Eupodotis senegalensis</i>	1.195	0	0
12.	Lark, Melodious	Prior to 2007	LC, NT	<i>Mirafra cheniana</i>	0.15	0	0
13.	Marsh-harrier, African	Prior to 2007	EN, LC	<i>Circus ranivorus</i>	0.11	0	0
14.	Painted-snipe, Greater	Prior to 2007	NT, LC	<i>Rostratula benghalensis</i>	0.45	0	0
15.	Pratincole, Black-winged	Prior to 2007	NT, NT	<i>Glareola nordmanni</i>	0.02	0	0
16.	Roller, European	Prior to 2007	NT, LC	<i>Coracias garrulus</i>	0.15	0	0
17.	Secretarybird,	Prior to 2007	VU, VU	<i>Sagittarius serpentarius</i>	0.37	0	0
18.	Stork, Abdim's	Prior to 2007	NT, LC	<i>Ciconia abdimii</i>	0.435	0	0
19.	Stork, Black	Prior to 2007	VU, LC	<i>Ciconia nigra</i>	0.11	0	0
20.	Stork, Marabou	2015	NT, LC	<i>Leptoptilos</i>	0.14	0	0

				<i>crumeniferus</i>			
21.	Stork, Saddle-billed	Prior to 2007	EN, LC	<i>Ephippiorhynchus senegalensis</i>	0.02	0	0
22.	Stork, Yellow-billed	Prior to 2007	EN, LC	<i>Mycteria ibis</i>	0.02	0	0
23.	Vulture, Cape	Prior to 2007	EN, EN	<i>Gyps coprotheres</i>	0.02	0	0

Red data species Categories for the Birds of Southern Africa (Birdlife South Africa 2015)

LC = Least Concern, **NT** = Near Threatened, **VU** = Vulnerable, **EN** = Endangered, **CR** = Critically Endangered.

A total of 23 threatened and near threatened bird species have previously been recorded within the 2628AA QDS (**Table 2**). Fifteen of which have not yet been recorded within the 2600_2805 pentad since the commencement of the second South African Bird Atlas Project (SABAP2) in 2007. Therefore these species are highly unlikely to recur as they have not been recorded in the pentad within the past 9 years. Eight of the 23 species have been recorded within the 2628AA QDS during the past five years. With the exception of the Hal-collared Kingfisher, all the species listed in Table 2 are highly unlikely to be resident on or near the study area since they are predominantly recorded as vagrants and/or occasional visitors. In addition, most of these species were recorded in habitats not present within the study area, although present within the larger quarter degree square. On account of the habitats present within the study area, none of the species listed above, with the exception of the Half-collared Kingfisher, are likely to occur or be resident within the study area.

Half-collard Kingfisher habitat requirements according to the Gauteng Conservation Plan Version 3.3:

This species is internationally regarded as Least Concern and locally as Near Threatened (Ekstrom & Butchart 2004, Allan 2000). The Half-collared Kingfisher occurs along perennial rivers and streams where suitable cover in the form of wooded margins or over-hanging vegetation exists (Tarboton et al., 1987). It is widely, but patchily distributed in Gauteng. Suitable foraging habitat was mapped and a buffer zone was added to the riparian zone as delineated by the wetland specialist. A proportional allocation of the estimated national population resulted in the target being set at 240 breeding pairs. Pairs require at least 1 km of suitable riverine habitat for breeding (Clancey, 1992, in Allan, 2000), but densities may be as low as 1 bird/9km even in prime habitat (Allan, 2000). While densities are expected to vary among rivers, as a very rough estimate, approximately 240 - 2160 km of suitable riverine habitat would be required to support 240 pairs.

GDARD minimum requirements for Half-collared Kingfisher:

A buffer zone of 50m must be provided from the edge of the riparian zone.

Please refer to Figure 7 for the 50m Buffer Zone provided for the Half-collared Kingfisher

6. Findings:

The discrete habitats identified on the study area supports a moderate richness of bird species. Approximately 162 species have a high to medium occurrence probability, of which one near threatened bird species has a medium probability of occurring and/or being resident within the study area. The following findings were made for each of the associated habitat units within the larger study area.

- **Grassland:** No suitable breeding habitat for any threatened or near threatened bird species were observed on site. However, could provide potential foraging habitat for certain threatened species such the Lanner Falcon. On account of the lack of suitable breeding habitat for species with conservation concern, and the overall low avifaunal species composition, this study unit was identified with a low avifaunal sensitivity.
- **Wetland and drainage line:** The intact and largely undisturbed nature of the wetland and drainage line habitat unit, along with the pollution prevention function and high number of observed bird species, renders this study unit as highly sensitive from an avifaunal perspective.
- **Riverine:** The riverine area contains fast flowing, clear water with a number of small rapids, as well as vertical sandbanks and dense overhanging vegetation. Connectivity with neighbouring homogeneous habitat is relatively high, especially towards the north-east and west. Although the connectivity was judge to be high, the water quality of the Jukskei River is questionable as a result of downstream pollution in the form of solid and chemical waste making its way into the river system.

Apart from possible pollution, the riverine habitat unit provides optimal foraging habitat for the near threatened Half-collared Kingfisher, provided that a sustainable food source is available. A single Malachite Kingfisher was however observed within the riverine habitat unit, indicating that it is likely that a food source in the form of small fish, tadpoles and aquatic invertebrates is present.

Due to the connectivity function, high avifaunal diversity and optimal habitat for the near threatened Half-collared Kingfisher, this habitat unit was identified to be highly sensitive.

7. Limitations

The majority of the data used to conclude the distribution of Red Data species were sourced by making use of the SABAP 1 and 2 database. Any limitations in the above mentioned studies will in effect have implications on the findings and conclusion of this assessment. Furthermore this avifaunal assessment was conducted during April, hence the survey was done outside the main breeding period of the local bird species. Moreover, most of the Palearctic and intra-Africa migratory bird species have commenced their migration to the North by this time. With respect to this assessment the implications of not being able to record migratory bird species will be minimal, seeing as most are threatened in their Northern hemisphere distributions.

The limited time allocated to conduct the survey could potentially result in not recording all species within the study area. The study area was visited on the 7th of April 2016. A total of 2 hours was spent on-site while conducting this avifaunal assessment. As a result of the surface area of the study area, 2 hours was deemed sufficient to record most of the resident bird species on and around the study area.

8. Recommendations

- Prior to any activities commencing on site, all construction staff should be briefed in an environmental induction regarding the environmental status and requirements of the site. This should include providing general guidelines for minimizing environmental damage during construction, as well as education with regards to basic environmental ethics, such as the prevention of littering, lighting of fires, etc.
- Induction should be done for all civil contractors and for each building contractor prior to them commencing on site.
- Areas where construction is to take place should be clearly demarcated and fenced off, all areas outside that of the defined works should be deemed no-go areas.
- All construction activities must be restricted to the demarcated areas to ensure that no further disturbance into the surrounding vegetation or habitat takes place.
- It is recommended that prior to the commencement of construction activities' initial clearing of all alien vegetation should take place.
- The contractor must ensure that no avifaunal species are trapped, killed or in any way disturbed during construction. Collecting of eggs such as Guinea fowl and Ducks present on site should not be tolerated.
- It is recommended that all concrete and cement works be restricted to areas of low ecological sensitivity and defined on site and clearly demarcated. Cement powder has a high alkalinity pH rating, which can contaminate and affect both soil and water pH dramatically. A shift in the pH can have serious consequences on the functioning of soil, vegetation and fauna.

- To ensure minimal disturbance of avifaunal species it is recommended that construction should take place during winter, outside the breeding season of the species present on site.
- Construction, vegetation clearing and top soil clearing should commence from a predetermined location and gradually commence to ensure that birds and other fauna present on the site have enough time to relocate.
- When construction is completed, disturbed areas should be rehabilitated using vegetation cleared prior to construction to ensure that the habitat stays intact and that avifaunal species present on the site before construction took place, return to the area after construction is completed.
- The attached sensitivity map should be used as a decision tool to guide the layout design (**Figure 7**).
- All areas labelled as sensitive in the sensitivity map (**Figure 7**) should be incorporated into an open space system. Development should be located on areas low sensitivity.
- The open space system should be managed in accordance with the EMP that complies with the Minimum Requirements for Ecological Management Plans and forms part of the EMP.
- The section of the Jukskei River adjacent to the study area should be rehabilitated and pollution prevention strategies should be investigated and implemented.
- Should the proposed development layout overlap with the 50m buffer provided for the possible occurrence of the Half-collared kingfisher, an additional avifauna assessment should be conducted to confirm or refute the presence of this species.

9. Conclusion

The study area contains a total of three distinct habitats of which the Grassland habitat unit was deemed to have a low avifaunal sensitivity. The Wetland and Drainage line and Riverine habitat units were deemed to be highly sensitive on account of various factors as discussed under the respective sub-headings. Development within the habitat units deemed to have a high avifaunal sensitivity should not be permitted (**Figure 7**). A 50m buffer around the Riverine habitat unit was provided for the possible occurrence of the Near threatened Half-collared Kingfisher. This area should also be interpreted as highly sensitive.

Although 23 threatened and/or near threatened bird species were previously recorded within the larger 2628AA QDS, only one of these species were judged to be present within the study area. The remaining 22 species are unlikely to occur based on various factors as stipulated in this report.



Figure 7: Avifaunal Sensitivity Map

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APPENDIX G5: WETLAND ASSESSMENT

Hydropedology assessment

Farm Waterval 5 IR and part of the remainder of the Farm Waterval 38 IR



April 2016



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Declaration of independence:

The specialist investigators responsible for conducting this particular specialist study declare that:

- We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report we did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, we will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;
- We declare that there are no circumstances that may compromise our objectivity in performing this specialist investigation. We do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- We do not have any influence over decisions made by the governing authorities;
- Should we, at any point, consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party;
- We undertake to disclose all material information in our possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant;
- We have the necessary qualifications and guidance from professional experts (registered Pr. Sci.Nat.) in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Bokamoso Environmental Consultants: Specialist Division. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- We will comply with the Act, regulations and all other applicable legislation;
- All the particulars furnished by us in this document are true and correct.



Mr G. van Rooyen

Verification statement

VERIFICATION STATEMENT

This communication serves to verify that the wetland assessment completed by G. van Rooyen was reviewed under my supervision, and I have verified the contents thereof. Overall the report achieves the stated aim of delineating the wetland primarily using soil characteristics. The principles, methods, and approach are scientifically valid.

ECOLOGICAL REVIEW: WATERFALL KIKUYU

Declaration of independence: I, Dr. J. Dabrowski (Pr.Sci.Nat, Reg. No. 115166) declare that I:

- Am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to learn through the processes of constructive criticism and debate, I reserve the right to form and hold our own opinions. Therefore will not willingly submit to the interests of other parties, be they the client or the relevant competent authorities, nor change my statements to appease them;
- Abide by the Code of Ethics of the S.A. Council for Natural Scientific Profession;
- Act as an independent specialist consultant in the fields of aquatic science and ecology
- Am contracted as a subconsultant by Bokamoso Environmental consultants for the proposed Waterfall Kikuyu wetland delineation as described in the report;
- Do not have or will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Have or will not have any vested interest in the proposed activity proceeding;
- Have no and will not engage in conflicting interests in the undertaking of the activity;
- Undertake to disclose to the client and the competent authority any material information that has or may have the potential to influence the decision of the competent authority, as required in terms of the Environmental Impact Assessment Regulations 2014;

Overall the report appears to be relevant, detailed enough for the purposes of this study and complete and finally addressing the key issues at stake.

Dr. Jackie Dabrowski, *Pr.Sci.Nat (Aquatic Science)*



9 June 2016

(Pr.Sci.Nat, Reg. No. 115166)

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1. INTRODUCTION

South Africa is classified as an arid country, receiving an average annual rainfall of about 464 mm. The world annual average is 860 mm, which emphasises South Africa's status as an arid country (South Africa info, 2015). Furthermore, current model projections of climate change indicate that southern Africa may become generally drier in the future, with lower rainfall, and a higher incidence of extreme events such as heat-waves and drought (Engelbrecht et al., 2015). Given the relatively low rainfall, wetlands in South Africa are very important resources. The value of wetlands is underpinned by their ability to provide numerous ecosystem services. They regulate surface water runoff, and store scarce water resources. Wetlands act like sponges, in the sense that they retain water during flood events and release stored water during dry periods (droughts). Through processes such as precipitation and bio-accumulation, wetlands have the ability to remove pollutants from water such as heavy metals, nutrients and organisms which may cause disease (DWAF, 2005). Wetlands also provide habitats for many species, for which the wellbeing of the wetland is critical to their survival. Wetlands in South Africa are under threat due to anthropogenic activities such as hydrological modifications, mining, agriculture, and development. Studies suggest that over half of all wetlands in South Africa have already been destroyed, emphasizing the urgent need to ensure the protection and effective management of our remaining wetlands (DWAF, 2005).

1.1 Terms of reference

A wetland soil assessment (hydropedology) was required for the proposed development located on Farm Waterval 5 IR and part of the remainder of the Farm Waterval 38 IR, Midrand, Gauteng. The proposed development site and therefore study site is located at the following coordinates: 26°2'27.36"S, 28°6'27.13"E. The assessment focused on the delineation of the wetland according to soil forms and wetness indicators, as well as the use of vegetation indicators for confirmation of wetland zones. The site is currently vacant and displays no sign of current development. In order for the proposed site to be fully understood, this report should be understood along with other specialist reports.

1.2 Methods

The wetland assessment was based on the Department of Water Affairs and Forestry "A practical field procedure for identification and delineation of wetlands and riparian areas"(DWAF, 2005). In brief, the method uses a combination of indicators to delineate the wetland:

- Terrain unit and topographical maps to determine where wetlands are most likely to occur using GIS software
- Identification of hydromorphic (wetland) soils
- Soil form and wetness indicators to establish permanent, seasonal, and temporary wetland zones. Assessed with the use of an auger, GPS, soil classification manual, and information available about the area.
- Identification of hydrophytes (wetland plants)
- Historic and current satellite imagery (e.g. Google Earth)

A more detailed description of the methods used in the identification of soils are provided below.

1.3 Definition of wetlands

Wetlands as described by the National Water Act:

“Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

According to DWAF (2005), Wetlands must have one or more of the following attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation.
- The presence, at least occasionally, of water loving plants (hydrophytes).
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.

1.4 Wetland definition according to soil

According to DWAF (2005), the soil form indicator states that:

The permanent zone will always have either Champagne, Katspruit, Willowbrook or Rensburg soil forms present, as defined by the Soil Classification Working Group (1991).

The seasonal and temporary zones will have one or more of the following soil forms present (signs of wetness incorporated at the form level): Kroonstad, Longlands, Wasbank, Lamotte, Estcourt, Klipmuts,

Vilafontes, Kinkelbos, Cartref, Fernwood, Westleigh, Dresden, Avalon, Glencoe, Pinedene, Bainsvlei, Bloemdal, Witfontein, Sepane, Tukulu, Montagu.

OR

The seasonal and temporary zones will have one or more of the following soil forms present (signs of wetness incorporated at the family level): Inhoek, Tsitsikamma, Houwhoek, Molopo, Kimberley, Jonkersberg, Groenkop, Etosha, Addo, Brandvlei, Glenrosa, Dundee.

1.5 Hydromorphic soils

The following is extracted from DWAF (2005) and is an explanation of hydromorphic soils:

“A hydromorphic soil displays unique characteristics resulting from its prolonged and repeated saturation. Once a soil becomes saturated for an extended time, roots and microorganisms gradually consume the oxygen present in pore spaces in the soil. In an unsaturated soil, oxygen consumed in this way would be replenished by diffusion from the air at the soil surface. However, since oxygen diffuses 10 000 times more slowly through water than through air, the process of replenishing depleted soil oxygen in a saturated soil is significantly slower. Thus, once the oxygen in a saturated soil has been depleted, the soil effectively remains anaerobic. These anaerobic conditions make wetlands highly efficient in removing many pollutants from water, since the chemical mechanisms by which this is done need to take place in the absence of oxygen.

Prolonged anaerobic soil conditions result in a change in the chemical characteristics of the soil. Certain soil components, such as iron and manganese, which are insoluble under aerobic conditions, become soluble when the soil becomes anaerobic, and can thus be leached out of the soil profile.

Iron is one of the most abundant elements in soils, and is responsible for the red and brown colours of many soils. Once most of the iron has been dissolved out of a soil as a result of prolonged anaerobic conditions, the soil matrix is left a greyish, greenish or bluish colour, and is said to be gleyed.

A fluctuating water table, common in wetlands that are seasonally or temporarily saturated, results in alternation between aerobic and anaerobic conditions in the soil. Lowering of the water table results in a switch from anaerobic to aerobic soil conditions, causing dissolved iron to return to an insoluble state and be deposited in the form of patches, or mottles, in the soil. Recurrence of this cycle of wetting and drying over many decades concentrates these bright, insoluble iron compounds. Thus, soil that is gleyed

but has many mottles may be interpreted as indicating a zone that is seasonally or temporarily saturated.”

1.6 Field study limitations

Ideally, any study of a natural system should account for intra- and inter-seasonal variation. However, inherent budget and time constraints restricted the scope of work that could be conducted. The site assessment was conducted during one season and the data obtained should be considered in conjunction with conservation authorities as well as other professional studies. This constraint is partially compensated for by evaluation of historic imagery and maps. It must be noted that the study was conducted during a severe drought year, and that any wetlands present are most likely to be much drier than usual.

1.7 Site location and description

The site is located in Midrand, to the east of the old Pretoria road, and to the immediate north east of the Buccleuch interchange. Figure 1 illustrates the locality of the site. Figure 2 illustrates the *status quo* of the land in 2001. The latest satellite imagery of 2016 illustrates that the condition of the land and adjacent river has not changed drastically. The river adjacent to the east, is the Jukskei River.

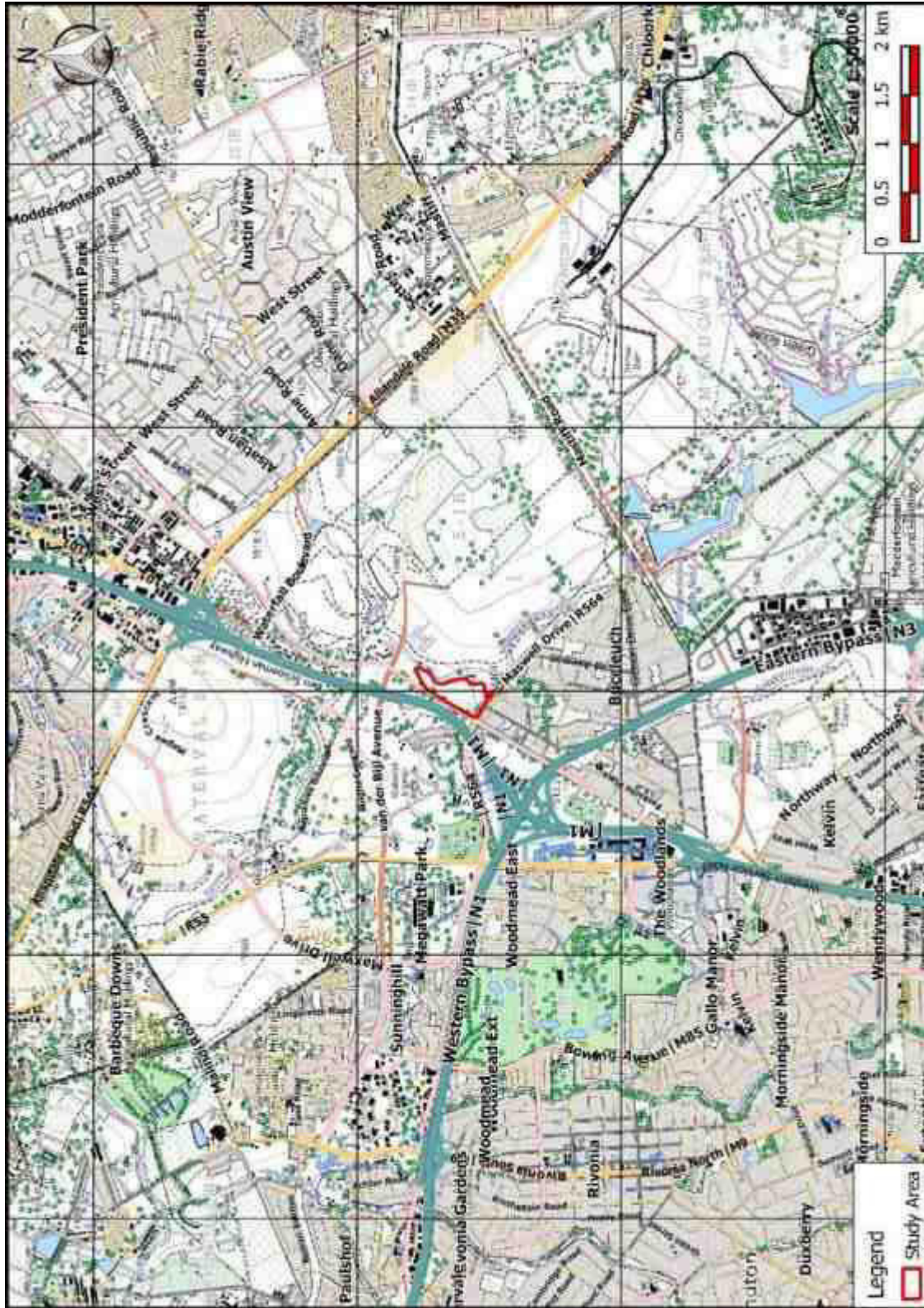


Figure 1: Locality



Figure 2: Satellite imagery from 2001

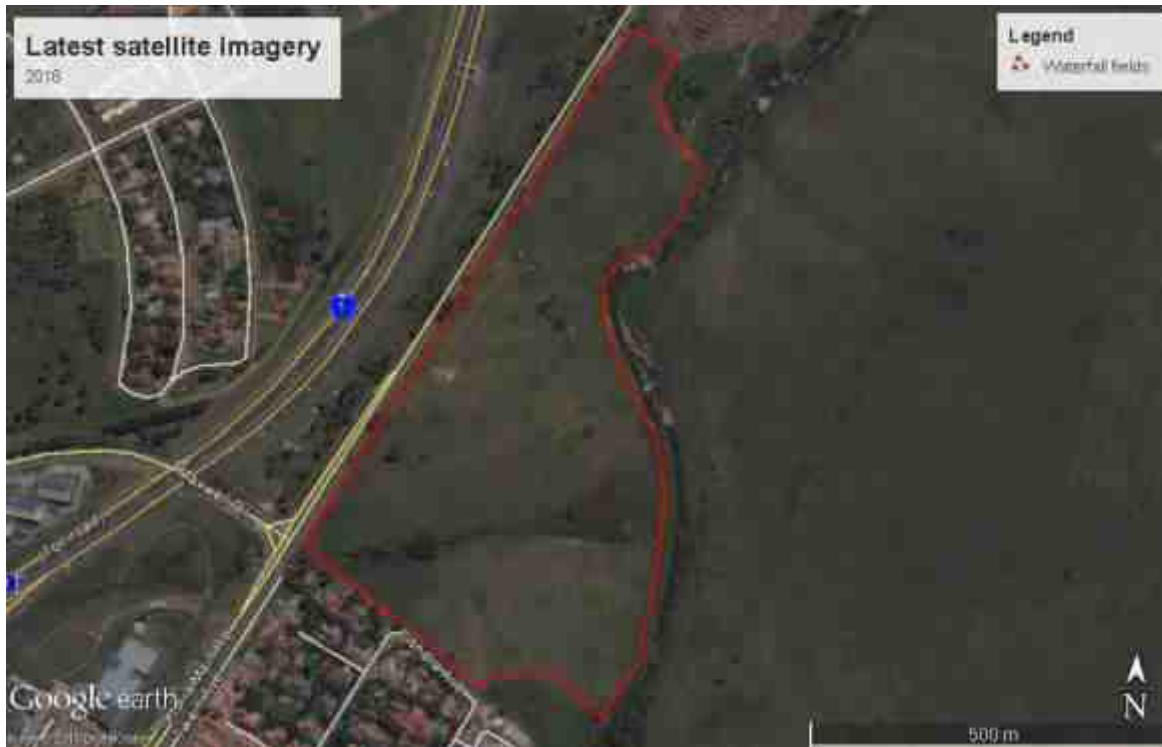


Figure 3: Latest satellite imagery (2006)

2. DESKTOP STUDY RESULTS

2.1 Terrain unit indicator

A wetland usually qualifies as a valley bottom unit (as depicted in figure 4) as defined by McVicar *et al* (1977, page 141). Unit 5 may also occur as a depression on a crest (1), midslope (3), or footslope (4), as depicted in Figure 4, and can then be described as 1(5), 3(5), or 4(5) respectively (DWAF, 2005). The valley bottom (unit 5) typically occurs in depression areas. Based on the contour data (figure 5), the wetland occurs in the valley bottom of unit 4 (unit 4(5)), and flows into unit 5.

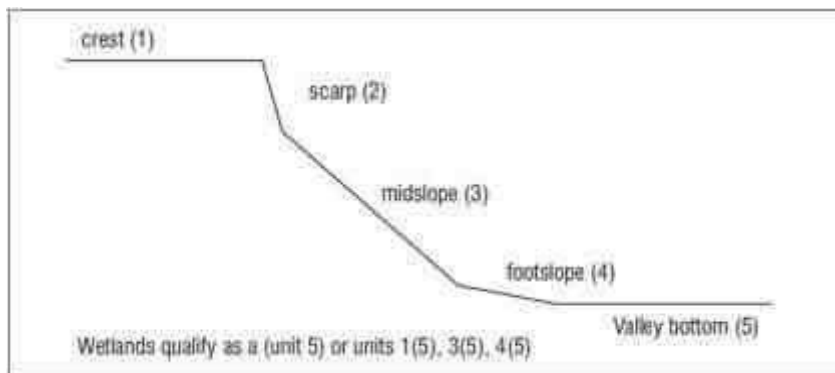


Figure 4: Terrain unit indicator

2.2 Elevation and contours

The site slopes west to east, and therefore the stream that is present within the study site flows west to east into the Jukskei River. The type of hydrogeomorphic wetland is described in table 1.

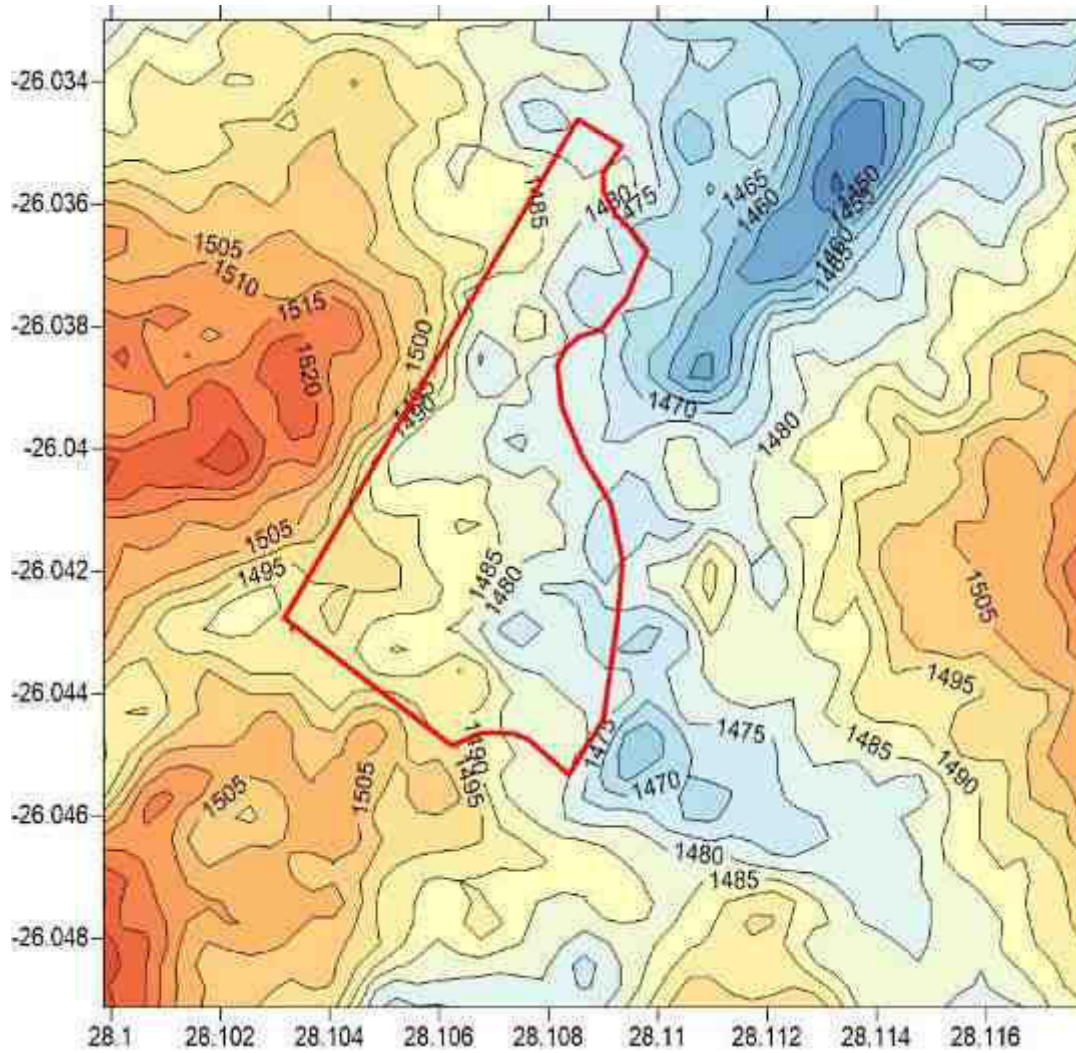



Figure 5: Contour data

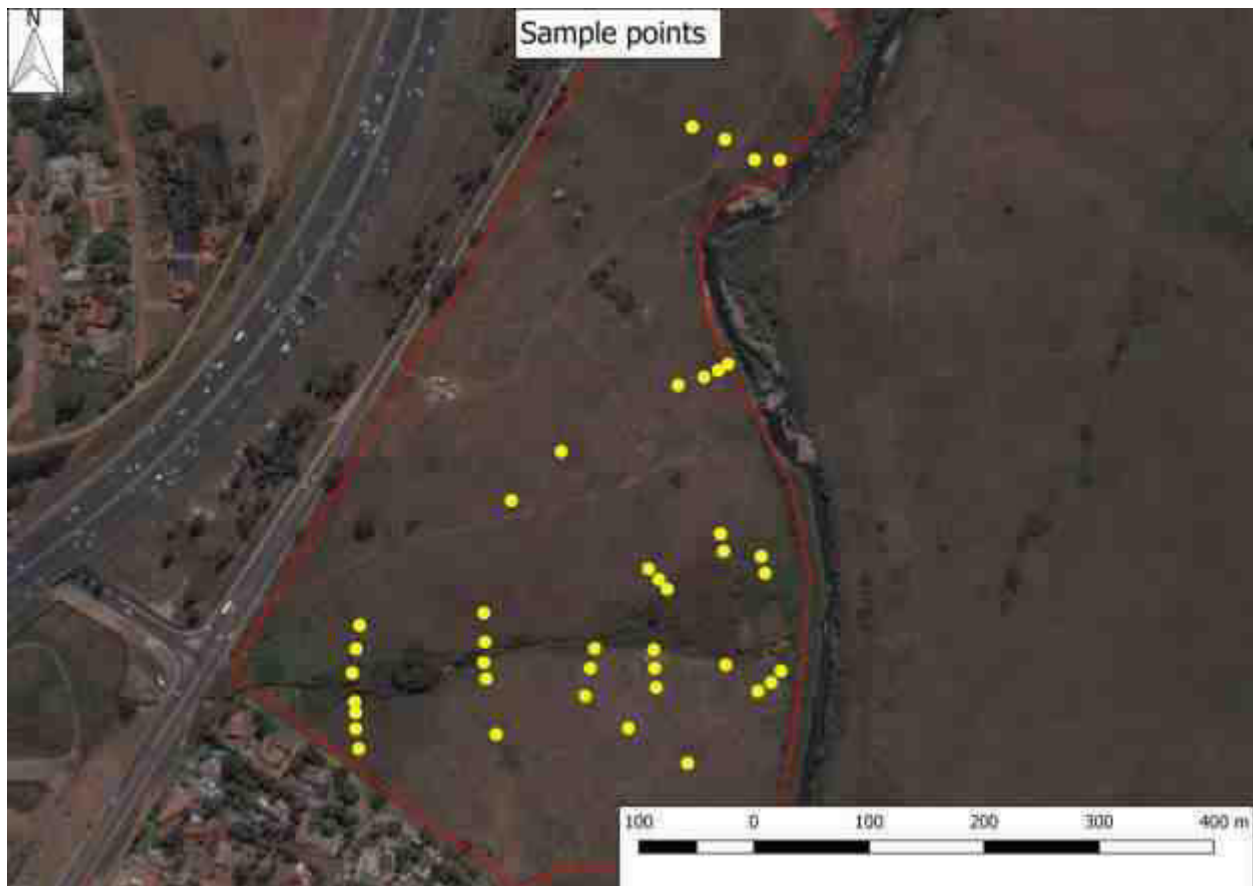
Table 1: Hydrogeomorphic type (Kotze *et al.* 2005)

Hydrogeomorphic type	Code	Illustration	Description
Valley bottom with a channel	VBC		Valley bottom area with a well defined stream but lacking characteristic floodplain features. Water inputs is from stream channel and adjacent slopes (runoff)

The site is located within the urban edge, therefore a 32m buffer zone from the edge of the riparian zone is required.

3. FIELD STUDY RESULTS

A field study was conducted on 5 April 2016. The sample points (auger points) are illustrated below.



3.1 Soil results

Soil forms that were encountered:

- Longlands (seasonal and temporary zone)
- Wasbank (terrestrial zone approaching temporary zone)
- Glenrosa (terrestrial zone)
- Permanent zone consisted of a flowing stream



Figure 6: Lithocutanic horizon of the Glenrosa soil form



Figure 7: Soft plinthic horizon B of the Longlands soil form



Figure 8: Transition between Longlands (seasonal) and Kroonstad (permanent)



Figure 9: Terrestrial zone, Glenrosa soil form

3.2 Vegetation

According to the National Water Act, the definition of a wetland states that the vegetation is the primary indicator of a wetland, which must be present under normal circumstances. In the field, however, the soil wetness indicators are the most important, and the other three indicators (soil form, terrain unit and vegetation unit) are used in a confirmatory role. The reason is because vegetation responds very quickly to changes in the moisture regime in the soil. The morphological indicators in the soil are far more permanent than the vegetation (disturbed sites may lead to inaccurate vegetation indicators). The soil can display signs of wetness long after a wetland has been drained.

The flora identified in the field was used as a confirmatory indicator of a wetland, and is not considered a full species list for the wetland plants occurring in the study area.

Table 3: Floral species identified in wetland areas within the study area

<u>Permanent zone</u>	<u>Seasonal/temporary zone</u>
<i>Schoenoplectus sp.</i> <i>Typha capensis*</i> <i>Arundo donax</i> <i>Phragmites australis</i>	<i>Verbena bonariensis</i> <i>Berkheya radula</i> <i>Chlorophytim transvaalense</i> <i>Persicaria lapathifolia</i> <i>Persicaria decipiens</i> <i>Wahlenbergia undulata</i>

Alien species indicated in bold; Medicinal species indicated with (*)



Figure 10: Drainage line vegetation

3.3 Proposed delineation

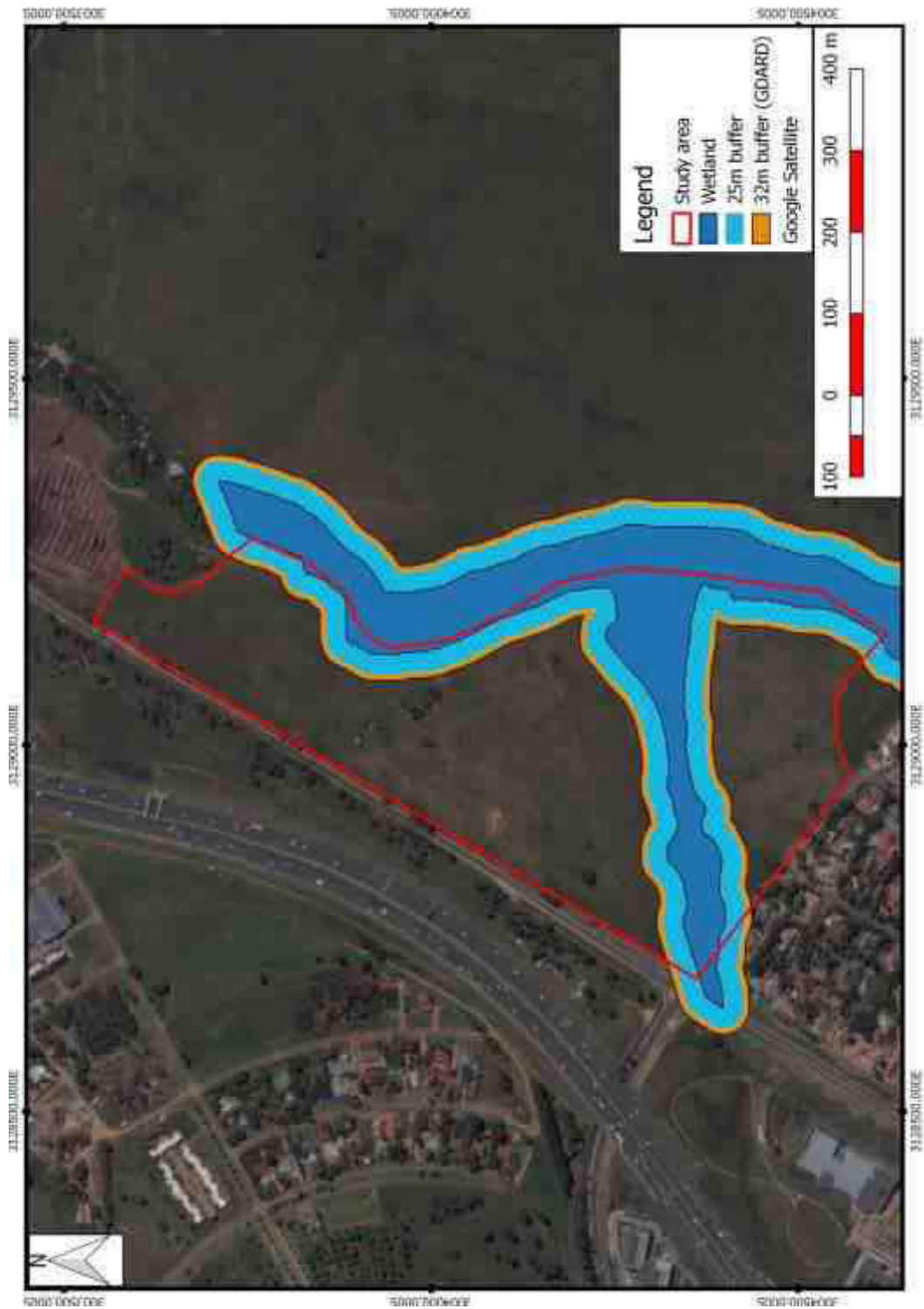


Figure 11: Wetland Delineation

4. PRESENT ECOLOGICAL STATE (PES)

The present ecological status refers to the current state or condition of a watercourse in terms of its combined characteristics and helps us to understand the change to the watercourse from its reference condition.

Overview of method (adapted from Kleynhans 1996 and 1999):

Table 3 contains criteria for assessing the status and habitat integrity wetlands and provides a guideline for allocating a score to attributes and rating the confidence level associated with each score. The criteria were selected on the assumption that anthropogenic alteration of the criteria and attributes listed under each criterion can usually be regarded as the primary causes of degradation of the ecological integrity of a wetland.

- Score each attribute according to the guidelines provided in the footnote.
- Calculate a mean score for Table 3 using the individual scores for all attributes.
- Provide a confidence rating for each score according to the guidelines provided in the footnote to indicate the areas of uncertainty in the determination.

The PES methodology comprises the following tasks:

- Literature review
- Type of development and land use
- Hydrology
- Water quality
- Erosion and sedimentation
- Exotic species (flora and fauna)
- Aerial photography assessment
- Site visit
- Use of local knowledge
- Reporting

Table 3: Scoresheet with criteria for assessing Habitat Integrity of watercourses (adapted from Kleynhans 1996)

Scoring guidelines per attribute:

natural, unmodified = 5; Largely natural = 4, Moderately modified = 3; largely modified = 2; seriously modified = 1; Critically modified = 0.

Relative confidence of score:

Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1.

Criteria and attributes	Relevance	Score	Confidence
Hydrologic			
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.	2	3
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.	2	3
Water Quality			
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland	1	1
Sediment load modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.	2	2
Hydraulic/Geomorphic			
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	3	4
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railwaylines and other substrate disruptive activities which reduces or changes wetland habitat directly or through changes in inundation patterns.	2	3
Biota			
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.	3	3
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.	3	3
Invasive plant encroachment	Affect habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).	3	3
Alien fauna	Presence of alien fauna affecting faunal community structure.	3	4
Overutilisation of biota	Overgrazing, Over-fishing, etc	3	3
TOTAL MEAN		2.45	

Description of PES score relevant to the study area:

Table 4: Interpretation of scores for determining present ecological status (Kleynhans 1999)

Interpretation of Mean* of Scores for all Attributes: Rating of Present Ecological Status Category (PES Category)
WITHIN GENERALLY ACCEPTABLE RANGE
CATEGORY A
>4; Unmodified, or approximates natural condition.
CATEGORY B
>3 and <=4; Largely natural with few modifications, but with some loss of natural habitats.
CATEGORY C
>2 and <=3; moderately modified, but with some loss of natural habitats.
CATEGORY D
=2; largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
OUTSIDE GENERAL ACCEPTABLE RANGE
CATEGORY E
>0 and <2; seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
CATEGORY F
0; critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The wetland in the study area has a mean PES rating of C: moderately modified, but with some loss of natural habitats.

5. CONCLUSIONS AND RECOMMENDATIONS

It is not applicable to treat this assessment and the associated management recommendations as effective management practices. These mitigation measures should be designed by a suitably qualified engineer and respective parties

The site contains a channeled valley bottom wetland, with a PES rating of C. The channeled stream enters the Jukskei River, which is a known critically modified river in terms of water quality.

It is of my opinion that the delineated wetland be excluded from development. However, due to the state of the hydrology in the area, it would be recommended that the buffer be considered insignificant, where the focus should be placed on rehabilitation and upgrading of the watercourse. The buffer will contribute very little to the protection of the watercourse, it is for this reason that the buffer be removed, and development incorporate and rehabilitate the functionality of the wetland. It should be noted that the development should always be designed outside of the floodlines to reduce risk to flooding (as wetlands on the Halfway House granite dome cannot attenuate flooding).

The study was undertaken during a severe drought year (2016). The permanent zone had free flowing water even within the drought year. It would be expected that during a normal year or a year with extremely high rainfall, the wetland (riparian zone) may extend slightly.

In terms of the National Water Act (NWA) and the National Environmental Management Act (NEMA), landowners have a duty to protect water resources, watercourses and wetlands.

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